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(54) Method and arrangement for applying a substance layer onto a running fiber web by foam application

(57) The invention relates to a method for applying at least one substance layer (C) in form of foam onto a running fiber web by foam application by at least one foam application unit (12)- A boundary layer air flow carried by the fiber web (W) is removed by boundary layer air flow removing means (14) before applying the foam formed substance onto the fiber web (W) by the foam application unit (12) and the fiber web runs at speed, which is at least 250 m/min. The invention also relates to an arrangement for applying at least one substance layer (C) in form of foam onto a running fiber web by foam application comprising a foaming device (23), a pumping device (22) and at least one foam application unit (12). The arrangement comprises at least one boundary layer air flow removing means (14) and that the running speed of the fiber web (W) is at least 250 m/min.

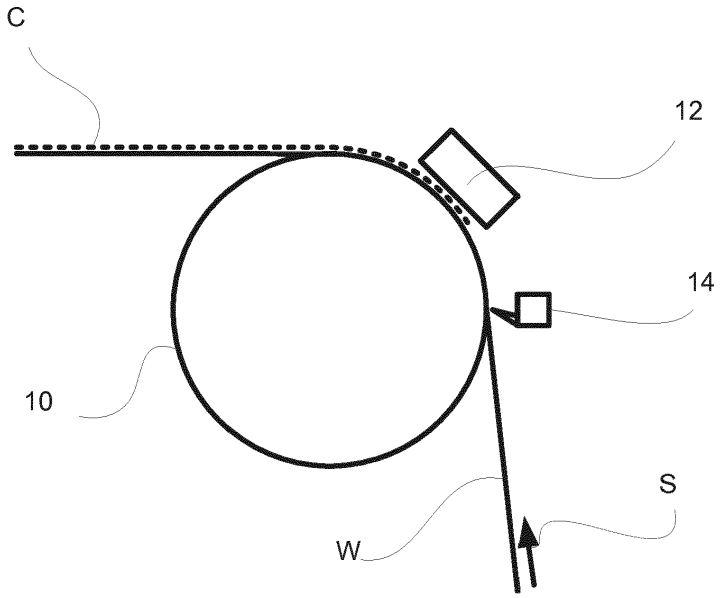

Fig. 1

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Description

[0001] The invention relates to a method and to an arrangement for applying a substance layer onto a running fiber web by foam application. More especially the invention relates to a method according to the preamble of claim 1 and to an arrangement according to the preamble of claim 10.

[0002] As known from the prior art fiber web making processes typically comprise an assembly formed by a number of apparatuses arranged consecutively in the process line. A typical production and treatment line comprises a head box, a wire section and a press section as well as a subsequent drying section and a reel-up. The production and treatment line can further comprise other devices and sections for finishing the fiber web, for example, a sizer, a calender, and a coating section. The production and treatment line also comprises at least one winder for forming customer rolls as well as a roll packaging apparatus. In this description and the following claims by fiber webs are meant for example paper and board webs.

[0003] In the production of fiber webs, for example of paper or board webs, various substances are added onto the fiber web in order to achieve the desired end-use properties of the fiber web. In particular, the strength and absorption properties of fiber webs can be improved by using surface sizing by applying sizing agents, such as starch or other glue chemicals, onto the web at the dry end of the web production line. In the pigmenting process a mixture of pigment and binder, usually starch, is applied onto the web usually as a single layer. In the pigment coating process one or more layers of coating color, i.e. mixture of pigments, binders and other additives is added on the top of the web surface. The main purpose of the coating treatment is to improve the appearance and printability of the web by providing a smooth, flat and opaque surface. In barrier coating a relatively closed and sealed surface layer is produced, that reduces or prevents in particular the migration of fluids through the coated surface layer.

[0004] In the coating of a fiber web typically a coating device - a coater - is used and in surface sizing a sizer is used. In connection with the coaters and the sizers different kinds of application technologies for application of the substance on the fiber web are employed, for example curtain coating technology or blade coating technology or film transfer technology or spray technology. The different application technologies and methods have different operating characteristics and operation windows. In particular, different application methods set different requirements both for the physical properties and application amounts of the applied substance.

[0005] Surface sizing is typically performed using water based binder dispersions at 5 -15 % consistency. While in the pond sizing the consistency is rather low, about 5 %, in the film transfer and in the spray sizing the consistency is about 10-15 %. Extremely high consistencies 20-25% can be used when modified binding agents are used. Typical sizing amounts are 1- 4 g/m^2 depending on the desired strength increase and penetration depth. When the target is just to prevent web from dusting and linting, very small size amounts, about 0.5 g/m^2, can be used.

[0006] In pigmenting, a pigmenting mixture, usually about 50% of pigment and 50% of binder, such as starch, is applied to the web using a size press. The solids content is about 20-40% and applied amount is about 2- 4 g/m^2.

[0007] In pigment coating a coating color, i.e. water based dispersion containing pigments, binders and additives, is applied to the web. Consistency of coating color is typically 45 - 75%, depending of the used coating method. Coating can be performed in one or several sequential phases, producing one or several coating layers, each layer being typically 5-15 g/m^2 and the total coating weight being about 5-40 g/m^2.It is clear, that substantial amount of water is transferred to the fiber web and drier units must be utilized after the coating stations.

[0008] In sizing and coating the application amount can be metered in number of ways. For example in blade coating the metering is done by controlling by the blade angle and blade load. A clear limitation is that the blade can be loaded up to the certain limit only, after which the coat weight cannot be reduced further by increasing the blade load. In practice, the minimum coat weight is in the blade coating is about 6 g/m^2 when reasonably high consistencies are used.

[0009] In the film transfer coating the minimum coat weight is limited to about 4 g/m^2 when using soft nip rolls and reasonably high consistencies to achieve reasonable cd- and md -profiles. Other limitations and restrictions of the film transfer coating are fogging and orange peel effect in the coating layer.

[0010] Spray coating is a contactless coating method, where the coating color is sprayed to the web typically at about 55-60% consistency using high pressure (about 100 bar) nozzles. Coating color must have low viscosity (50-100 mPas). Since the consistency is somewhat lower than with other coating methods, more drying capacity is needed. The coat weight can be well controlled well above the coat weight 2 g/m^2 to achieve reasonable spreading of the sprayed liquid, in the other words, reasonable cd- and md-profiles.

[0011] In curtain coating a continuous stream of falling coating color film or curtain is extruded to the fiber web from narrow nozzle slot. Since the process is based on gravity, the process is restricted to be one-sided in the upper side position. Curtain coating is particularly used for special papers, like thermal paper. In the typical curtain coating applications the used consistency is about 50-70 % and coat weight 5-30 g/m^2. Severe restriction in curtain coating results from maintaining strong and continuous curtain film, which requires about 0.1 l/s per meter volumetric flow from the slit nozzle. This requirement prevents from applying small coat weights at slow

speeds and at reasonable consistencies. For example, applying coating color at 60 % consistency at the running speed 300 m/min, the minimum achieved coat weight is about 20 g/m^2; in order to reach coat weight 5 g/m^2 one needs to dilute the consistency down to 20%, which means relatively much more water applied to the web. With the typical production speed of FBB (folding box board) or WLC (white line cup) board machine at 600 m/min the figures are: minimum coat weight 11 g/m^2 at 60% consistency and about 3 g/m^2 at 20% consistency. This example clearly shows the unsuitability of curtain coating to applications with small coat weight, low speed and high consistency.

[0012] Another difficulty with the spray and curtain coating is the boundary layer air trapping between the applied coating layer and fiber web. This is the case particularly in applications with small coat weights, light coating substance and high speeds. From the prior art, it is known to remove boundary layer air by various methods, like suction and vacuum devices, blowing devices, rolls, scraping by doctoring blades and even applying lighter density gas like steam that aims to displace the boundary air layer.

[0013] In general, both with contact and non-contact coating methods, there are limitations and restrictions to achieve small coating weights precisely and accurately by applying high consistency coating substances at reasonably small speeds, which are relevant in production of medium and heavy basis weight boards, in particular. Particularly in heavy basis weight board making lines, the production speed is limited mainly by drying capacity i.e. by dewatering capacity to about 300 - 800 m/min, depending on basis weight. Another drawback of the existing coating methods is the recirculation used in the coating color feed system. In contactless methods the recirculation ratio is low, for example in spray coating only about 2 - 3% coating color is recirculated, originating mainly from collected nozzle mist. Contact methods are generally designed to recirculate more, which makes the feed system complicated.

[0014] Barrier coated fiber web products typically have one or more layers with barrier function such as water barrier, water vapor barrier, grease/oil/solvent barrier, gas and aroma barrier. These barrier layers are aimed against the penetration of gases (odor, aroma, oxygen, nitrogen, carbon dioxide, water vapor etc.), against the penetration of liquids and solvents either polar (f. ex. water) or non-polar (f. ex. grease, oil), against the penetration of solids and contamination of particles (nano-particles, dust, fumes, dirt etc.) and of germs, bacteria, fungi etc., and against the penetration of radiation (electromagnetic, f. ex. visible light, IR (infra-red), US (ultra sound), X-ray, "electro smog" et.) and of radioactivity. Generally, barrier coatings in fiber products, such as packaging boards, refer to the use of extremely thin and tight layers of polymers on the base board. A barrier product may have one or more barrier layers with one or more different barrier functions. The most important requirements to the barrier coatings are: evenness of coating layer, free of pinholes and low coat weights (2-5 g/m^2, but even up to 10-15 g/m^2 with PE extrusion).

[0015] Barrier coatings are usually produced by extrusion coating process using as coating substance polymers like polyethylene (PE), polypropylene (PP), polyethylene terephthalate) PET or polyolefins. One disadvantage of extrusion coating is that it is a separate off-line process.

[0016] Another common production method for barrier coating layers is laminating. For example juice or beverage containers have a laminated aluminum foil, which provides good barrier properties. Further, the aluminum foil can be protected for example against corrosive or dissolving effect by coating it with a foil of for example polyethylene (PE). The method is an off-line method and logistically complicated but creates a good barrier layer.

[0017] Barrier coating can also be produced using common coating methods in an on-line or in an off-line process using above mentioned barrier polymers as water dispersions, but the limitation in common coating methods is the poor control of small coating amounts, as above is described in connection with curtain coating. Often it is desired to add on the barrier layer a wear-resistant surface layer, which is logistically easy in an on-line process. In general, the disadvantage of the commonly used barrier coating polymers is that the polymers, like PE, PP, PET, are oil-based and thus not biodegradable or recyclable. This problem has been recently tried to solve by using natural based biopolymers.

[0018] Typical applications and end uses of barrier coated products are food and liquid packages and wrappings. As barrier coatings are one of the most expensive coating substances, there is a need to reduce coat weight without compromising the barrier properties. On the other hand, reduction in coat weight leads easily uneven coating, poor coverage and appearance of pinholes, which are unacceptable in barrier coatings. In general, the best starting point for material saving barrier coating is a flat and smooth surface, preferably a calendered and precoated surface. Nevertheless, there is need for economical, environment-friendly and compact on-line coating method being able to apply also small coat weights precisely.

[0019] It is known from prior art to use foam application in a coating-like process to add substance on a web, especially in connection of production of nonwoven products. A foam coating system comprises typically a mixing device, a pumping device, a foaming device, a piping system and an application unit. The foaming is based on powerful mixing for adding air into the liquid-based substance with a surfactant additive, resulting substantial increase in the specific volume and thus making the handling and application of the coating substance much easier at small dry coat weights. The application device comprises an application head with a slot nozzle for extruding the foam onto the web. Very shortly after the application, the foamy structure disintegrates, absorbs and spreads

into the surface structure of the web, leaving a contour-like coat layer. The foam phase is utilized merely as a temporary carrier phase for the coated substance. Since the foam contains large volumetric fraction gas, typically air, the density of the foam is typically low, being typically in the range 50-500 kg/m^3. Since usually so called dry foam is used, of which typically about 85-95 % of the volume is air, the water amount is low. The foaming concepts known in practice operate at the speeds below 500 m/min, in critical applications even below 250 m/min; apply substance only on one side of the web that is supported on a support roll during the application; use small substance amounts of about 1 - 2 g/m^2 dry substance.

[0020] In DE patent application publication 19941194 is disclosed a method for coating a moving web of paper or cardboard with substance, which is applied as a foam and retains its foam structure in the finished coating and which has a covering layer of non-foamed substance. The substance is foamed mechanically or chemically. The foam has up to 80 % gas and the solid content of the foamed substance is 5 - 70 weight-percent. The substance contains a stabilizing agent such as a tenside or stearate. The substance is glue and/or starch and/or a dispersion of pigments and/or offset coating inks and/or gravure coating inks. The application onto the moving web is done directly or indirectly for example by a transfer roll.

[0021] The fiber web production lines and their substance application devices typically operate in high running speeds of the fiber web. Very high basis weight board making lines, like heavy carrier board lines, operate at 300-600 m/min, medium basis weight board lines, like FBB, , LPB (liquid packaging board) and WLC board lines operate at 500-800 m/min, and lower weight board making lines, line liner and fluting lines operate at 800-1300 m/min. Paper and tissue making lines operate typically up to 2000 m/min speeds. Typically the production is limited by the dryer capacity. As a fiber web is running at high speed, it creates a boundary layer air flow, which is a layer of air carried along with the running web. The boundary layer air flow disturbs the application of the substance in most coating methods, but particularly in the foam coating since the foam substance is light-weight and therefore easily affected by the aero-dynamical forces.

[0022] An object of the invention is to provide a method and arrangement for applying a substance layer onto a running fiber web, in particular onto a paper or a board web, advantageously producing a barrier coated web, using foam application, in which the disadvantages of prior art are eliminated or at least minimized.

[0023] A particular object of the invention is to provide a method and arrangement for applying a substance layer onto a running fiber web, in particular onto a paper or a board web, using foam application, in which the disadvantages and problems of the boundary layer air are eliminated and which is applicable in running at higher speeds, the speeds being typically over 250 m/min.

[0024] Another object is to provide a method and arrangement for applying a substance layer onto a fiber web, in which the substance is applied in form of foam, and in which the final applied substance material layer evenness and material layer weight can be controlled precisely and in which the method is applicable with small applied dry solid substance amounts.

[0025] Another object is to provide a method and arrangement for applying a substance layer onto a fiber web, in which the substance is applied in form of foam, and in which the applied substance can be applied at high speeds, preferably in an on-line process.

[0026] Another object to provide a method and arrangement for applying one or more coating layer onto a fiber web, in which the coating substance is applied in form of foam and in which the coating substance forms at least one barrier layer.

[0027] One particular object is to provide a method and arrangement for applying at least one barrier coating layer onto a fiber web, particularly fiber webs used in packaging, which the barrier layer is aimed to prevent contamination of the packaged product from the migration of impurities contained in the fiber web, for example dirt, mineral oils, and similar and to prevent the contamination of food stuff from impurities contained in recycled fiber, like OCC (old corrugated containers) or deinked pulp, contained in boards, like WLC (white lined chip) boards.

[0028] Another object is to provide a method and arrangement for applying at least one coating layer onto a fiber web, in which coating layer can have functional properties, like specialty papers, such as thermal paper, carbonless papers, safety papers etc., or in which particularly thin application of expensive coating is desired, such as in chemical treatment, or in lacquering of fiber webs.

[0029] In order to achieve the above objects and those that will come apparent later the method according to the invention is mainly characterized by the features of claim 1. The arrangement according to the invention is mainly characterized by the features of claim 10. Advantageous aspects and features of the invention are presented in the dependent claims.

[0030] According to the invention in a method and to an arrangement for applying a substance layer in form of foam onto a running fiber web a boundary layer air flow removing means are used in order to achieve undisturbed application of the substance. The boundary layer air flow removing means is a mechanical device, like doctor blade or a roll or an air doctor and/or a corresponding means known as such for removing boundary layer air flow carried along a running fiber web, for example suction means or steam application means. The fiber web running speed is at least 250 m/min.

[0031] According to the invention at least one layer of the substance in form of foam is applied onto the fiber web one-sidedly or two-sidedly.

[0032] According to an advantageous feature more than one layer of the substance in form of foam is applied at least on one side of the fiber web. When more than

one layer of the substance is applied in form of foam on one side of the fiber web, more than one consecutively located application devices or at least one device with a multilayer nozzle are/is used and before at least one application device, advantageously before the first application device in the running direction of the fiber web, a boundary layer air flow removal means is located. Most advantageously, boundary air removal means are located before each application device.

[0033] According to an advantageous feature the substance is applied two-sidedly simultaneously and symmetrically.

[0034] According to an advantageous feature of the invention total substance application amount per nozzle or applicator unit is 0.1 - 10 g/m^2, more advantageously 0.5 - 5 g/m^2.

[0035] According to an advantageous feature of the invention the density of the foam is 50-500 kg/m^3.

[0036] According to an advantageous feature of the invention in one-sided application, a support surface is used on the other side of the fiber web. The support surface may be advantageously a roll or a cylinder or a sliding surface. The support surface may also be a belt or a wire or a moving support surface or a non-moving surface.

[0037] According to an advantageous feature of the invention, the substance is applied in the finishing section of the fiber web production line as an on-line process, where the web dryness is over 70%.

[0038] According to an advantageous feature of the invention, the applied substance is foam formed from liquid-based composition forming a barrier coating, preferably applied in on-line fiber web making process.

[0039] According to an advantageous feature of the invention, the substance is applied onto a fiber web comprising recycled fiber to form a barrier layer, in particular to form a barrier layer for preventing for example residues of printing color mineral oils, or other impurities contained in the recycled fiber to contact the product inside a package produced from recycled fiber containing paper or board.

[0040] The from liquid-based composition foam formed applied substance can be used as pigment coating color, sizing or binding agent such as starch or latex or other natural or synthetic polymers providing a film layer.

[0041] The from liquid-based composition foam formed applied substance can be used as chemical additive, substance containing chemicals or particles having functional properties such as friction reducing agents, electrically conductive material, ink capsules, indicator elements, optical brighteners, UV-dyes, safety paper indicator etc.

[0042] The from liquid-based composition foam formed applied substance can be used for coating at least one layer in a thermal paper.

[0043] The from liquid-based composition foam formed applied substance can be used for coating at least one layer in a specialty paper, for example to provide a dense, thin surface layer. According to an advantageous feature of the invention on the opposite side of the fiber web in respect to the application device suction means are used to improve the transfer and the absorption of the substance onto the fiber web. The suction means are for example a suction roll, a suction box.

[0044] According to an advantageous feature of the invention the substance is heated to temperatures 20 - 90°C before, simultaneously or directly after the application of the foam substance in order to lower the surface tension, to improve the foaming properties of the substance and to improve the transfer and the absorption of the foam substance into the fiber web.

[0045] According to an advantageous feature of the invention the fiber web is at an elevated temperature, at about 40 - 100 °C when the foam substance is applied onto the fiber web. In particular, this improves the foam adsorption by lowering the surface tension of the substance. In addition, the thermal energy stored in the fiber web can be utilized in the drying of the water contained in the foam substance.

[0046] According to an advantageous feature of the invention the fiber web is moisturized before the application of the substance to improve the transfer and the absorption of the substance onto the fiber web.

[0047] The substance is advantageously coating color or sizing agent, more advantageously a substance providing a barrier layer comprising PVA(polyvinyl acetate) or PVOH (polyvinyl alcohol) and advantageously nano- or micro-fibrillated cellulose. More advantageously, the barrier coating is formed from materials allowing re-cycling, re-pulping or being environmentally friendly biodegradable materials.

[0048] The substance may also comprise fibrous material with short or long fibers, fiber originated fine fraction (nano-pulp, NFC (nano-fibrillated cellulose), MFC (micro-fibrillated cellulose), wood fiber), mineral based pigment or filler or solids, glue- and adhesion substances (starch, latex), solvent, water, synthetic or natural polymers (starch, PVA, PVOH, PE), chemicals and/or polymers providing a film layer, substance for providing a fiber structure layer.

[0049] According to an advantageous aspect the invention is utilized in production of a fiber web comprising at least one barrier layer, advantageously as the outermost or next outermost surface of the fiber web, which barrier layer provides an impermeable layer for fiber webs to be used for packages of foodstuffs, medicines etc. Especially advantageously the invention is utilized in production of a fiber web for package material, the fiber web comprising at least one barrier layer formed by foam coating and the fiber web consisting at least partially of recycled fiber, like OCC (old corrugated containers) or deinked pulp, the fiber web being for example WLC-board, the aim of the barrier being preventing contamination and contact of the packaged product with the impurities contained in the recycled fibers. The barrier layer

may also be in between of two fiber layers or under a protecting outer layer. The barrier layer may also be for example an oxygen barrier layer or water barrier layer or oil barrier layer or grease barrier layer.

[0050] The method and the arrangement according to the invention may also be utilized in connection of applying a coating color layer of a fiber web for printing products or in connection of sizing on top of a fiber web and in connection of providing a film, a membrane or a lacquer layer for example in converting products.

[0051] By the invention is achieved a smooth and good coverage providing substance layer with even thickness which has a small need for drying due to the low water amount. Recirculation of coating color in the coating process can be eliminated since the foam coating color feed system is designed open and the retention of the foam to the web is nearly 100 %. In the following the invention is described in more detail with reference to the accompanying drawing, in which

in figure 1 is a schematical example of one sided foam application of a fiber web according to an advantageous example of the invention,

in figure 2 is a schematical example of two sided foam application of a fiber web according to an advantageous example of the invention,

in figure 3 is a schematical example of two sided foam application of a fiber web according to another advantageous example of the invention and

in figure 4 is a schematical example of multilayer foam application of a fiber web according to an advantageous example of the invention.

[0052] During the course of this description like numbers and signs will be used to identify like elements according to the different views which illustrate the invention.

[0053] In the example of figure 1 the fiber web W is running in direction S and substance in form of foam is applied directly onto one side of the fiber web W by foam application unit 12 comprising at least one nozzle. During the application of the substance in form of foam the fiber web W runs supported on a roll 10. By the foam application unit a substance layer C is applied onto the fiber web W. Before the foam application unit 12 a boundary layer air flow removal means 14 is located on the same side of the fiber web W as the foam application unit 12 for removing the boundary layer air flow.

[0054] In the example of figure 2 the fiber web W is running in direction S and substance in form of foam is applied directly onto both sides of the fiber web W by foam application units 12 located on both sides of the fiber web, each application unit comprising at least one nozzle simultaneously and symmetrically. During the application of the substance in form of foam the fiber web W floats between the substance foam layers C applied onto both sides of the fiber web W. Before the foam application units 12 boundary layer air flow removal means 14 are located on both sides of the fiber web W for removing the boundary layer air flow. After application of the substance layers C by the foam application units 12 the fiber web W is directed to run over a roll 10.

[0055] In the example of figure 3 the fiber web W is running in direction S and substance in form of foam is applied indirectly onto both sides of the fiber web W by rolls 10 onto surfaces of which the substance is applied by the foam application units 12 comprising at least one nozzle to provide substance layers C on both sides of the fiber web. Before the application of the substance in form of foam onto the fiber web W in the nip N between the rolls 10 boundary layer air flow removal means 14 are located on both sides of the fiber web W for removing the boundary layer air flow. The substance is mixed in a mixing device 20 and pumped by a pumping device 22 to a foaming device 23 and then to the application devices 12 via regulator valves 24.

[0056] In the example of figure 4 the fiber web W is running in direction S and substance is applied directly onto both sides of the fiber web W by the foam application units 12 comprising at least one nozzle to provide substance layers C on both sides of the fiber web W. One side of the fiber web W, in the figure the top side, is coated by two layers C of substance and thus two successive foam application units are provided. Before the foam application units 12 onto the fiber web W boundary layer air flow removal means 14 are located on both sides of the fiber web W at least before the first foam application units 12 in the running direction S of the fiber web W for removing the boundary layer air flow.

Reference signs used in the drawing

[0057]

10	roll
12	foam application unit
14	boundary-layer air flow removal means
20	mixing device
22	pumping device
23	foaming device
24	regulator valve
C	substance layer in form of foam
W	fiber web
S	running direction of the fiber web
N	nip

Claims

1. Method for applying at least one substance layer (C) in form of foam onto a running fiber web by foam application by at least one foam application unit (12), **characterized in that** a boundary layer air flow carried by the fiber web (W) is removed by boundary layer air flow removing means (14) before applying the foam formed substance onto the fiber web (W) by the foam application unit (12) and that the fiber web runs at speed, which is at least 250 m/min.

2. Method according to claim 1, **characterized in that** in the method the foam formed substance applied onto the fiber web (W) is a substance creating a barrier layer onto the fiber web (W), which barrier layer has a barrier function such as water barrier and/or water vapor barrier and/or grease/oil/solvent barrier and/or gas barrier and/or aroma barrier and functions against the penetration of gases and/or against the penetration of liquids and/or solvents either polar or non-polar and/or against the penetration of solids and/or contamination particles and/or germs, bacteria, fungi etc., and/or against the penetration of radiation and/or radioactivity.

3. Method according to claim 1 or 2, **characterized in that** the substance is applied onto a fiber web comprising recycled fiber.

4. Method according to claim 1 or 2, **characterized in that** at least one layer (C) of the substance in form of foam is applied onto both sides of the fiber web (W).

5. Method according to claim 3, **characterized in that** at least one layer (C) of the substance in form of foam is applied onto both sides of the fiber web (W) simultaneously and symmetrically.

6. Method according to any of claims 1 - 5, **characterized in that** more than one layers (C) of the substance in form of foam is applied on at least one side of the fiber web (W).

7. Method according to any of claims 1 - 6, **characterized in that** total substance application amount per a nozzle of an application unit (12) is 0,1 - 10 g/m^2, more advantageously 0,5 - 5 g/m^2.

8. Method according to any of claims 1 - 7, **characterized in that** the density of the foam is 50 - 500 kg/m^3.

9. Method according to any of claims 1 - 3, **characterized in that** in the method the substance in form of foam is applied on only one side of the fiber web (W) and that the other side of the fiber web (W) is supported by a support surface.

10. Arrangement for applying at least one substance layer (C) in form of foam onto a running fiber web by foam application comprising a foaming device (23), a pumping device (22) and at least one foam application unit (12), **characterized in that** the arrangement comprises at least one boundary layer air flow removing means (14) and that the running speed of the fiber web (W) is at least 250 m/min.

11. Arrangement according to claim 10, **characterized in that** the boundary layer air flow removing means is a doctor blade or a roll or an air doctor or that the boundary layer air flow removing means are suction combined with a doctor blade or a roll or an air doctor.

12. Arrangement according to claim 10 or 11, **characterized in that** the boundary layer air flow removing means (14) is located before the foam application unit (12).

13. Arrangement according to any of claims 9 - 12, **characterized in that** the arrangement comprises more than one consecutively located application units (12) and before at least one, advantageously before the first application device in the running direction (S) of the fiber web (W) a boundary layer air flow removal means is located.

14. Arrangement according to any of claims 9 - 13, **characterized in that** the arrangement comprises a support surface is for supporting the fiber web (W) during application of the substance by the foam application unit (12) on the other side of the fiber web (W).

15. Arrangement according to any of claims 9 - 14, **characterized in that** the arrangement comprises suction means on the other side of the fiber web (W) in respect to the application device (12).

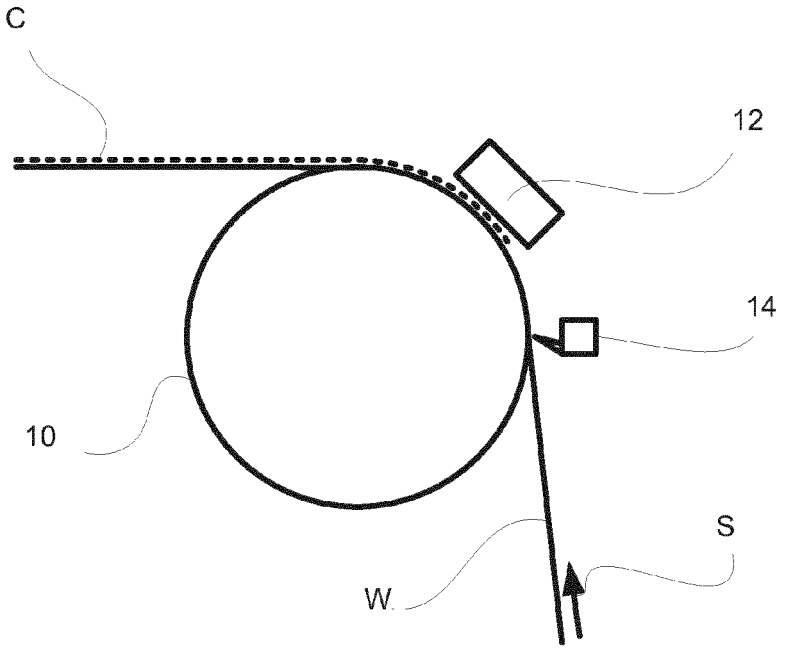

Fig. 1

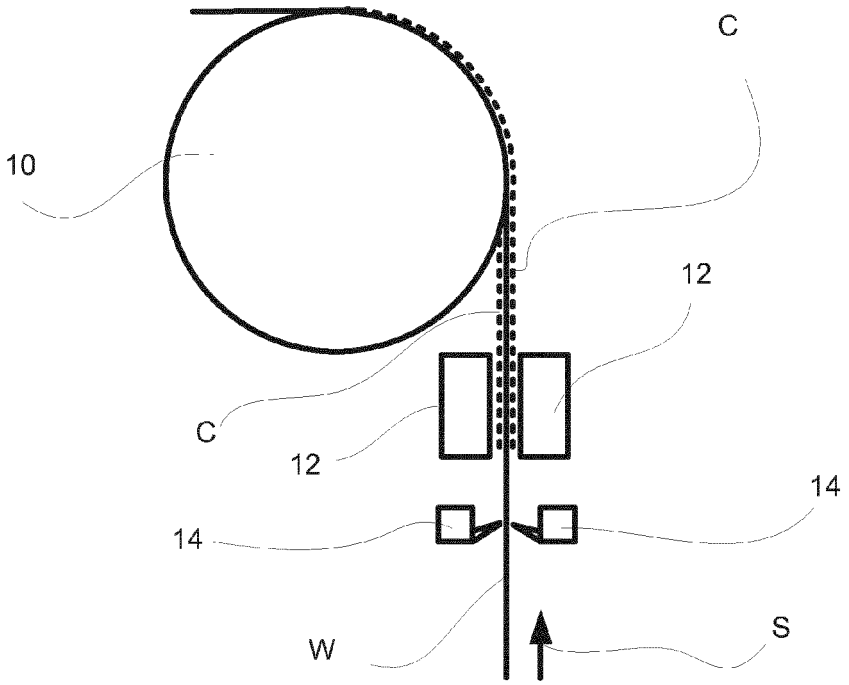

Fig. 2

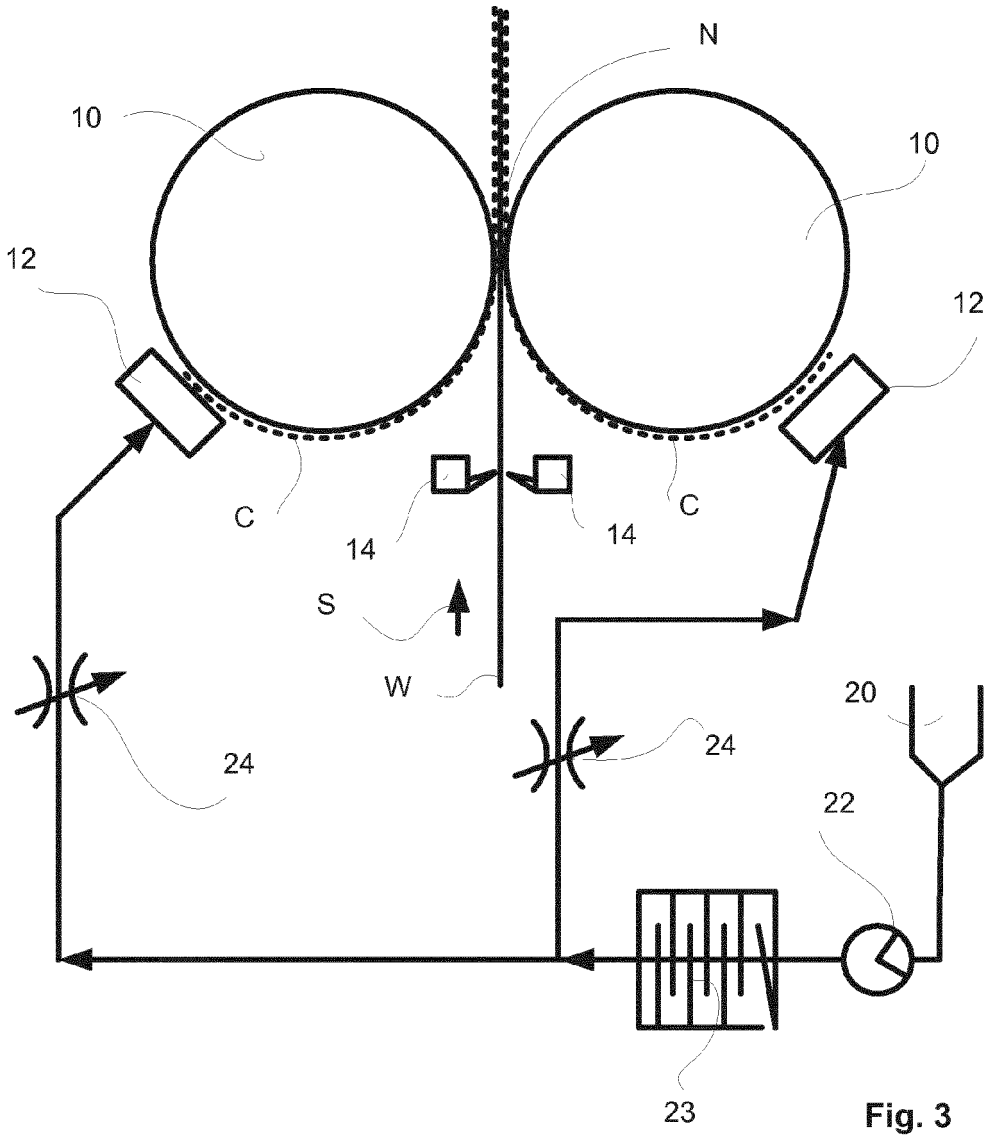

Fig. 3

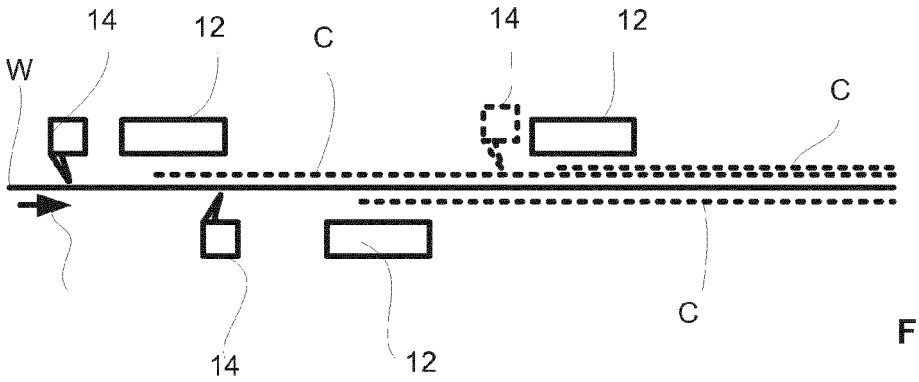

Fig. 4

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Place of search	Date of completion of the search	Examiner
Munich	3 December 2013	Karlsson, Lennart

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