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(54) **SMOOTHING BELT**

GLÄTTENDES BAND

BANDE DE LISSAGE

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(74) Representative: **Henseler, Daniela**

Sparing Röhl Henseler

Patentanwälte

Postfach 14 04 43

40074 Düsseldorf (DE)

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(73) Proprietors:

• **Ichikawa Co., Ltd.**

Tokyo 113-0033 (JP)

• **Oji Paper Co., Ltd.**

Tokyo 104-0061 (JP)

(72) Inventor: **ODA, Hiroyuki**

Tokyo 113-0033 (JP)

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Description

Technical field:

[0001] The present invention relates to a smoothing belt for use in a closed-draw-type papermaking machine. More specifically, the present invention is concerned with a smoothing belt for transferring a wet paper web, while one surface thereof is being held by the smoothing belt, and for smoothing the surface of the wet paper web.

Background art:

[0002] Papermaking machines generally include a wire part, a press part and a drier part. The wire part, the press part and the drier part are arranged in the order named along the direction in which the wet paper web is transferred.

[0003] In the papermaking machines, the wet paper web is transferred by being delivered successively to papermaking transfer tools disposed respectively in the wire part, the press part and the drier part. The wet paper web is pressed to squeeze water out, and is finally dried in the drier part.

[0004] The press part includes a press apparatus comprising a plurality of press devices which are arranged in line along the direction in which the wet paper web is transferred.

[0005] Each of the press devices comprises a pair of paper transfer felts in the form of endless belts and a press. The press has parts disposed in vertically facing relation to each other with portions of the paper transfer felts being interposed therebetween. The press may comprise a pair of rolls (i.e., a roll press) or a roll and a shoe (i.e., a shoe press).

[0006] The wet paper web is transferred by the paper transfer felts which travel in the same direction at substantially the same speed. In each of the press devices, the roll and the roll (or the roll and the shoe) press therebetween the wet paper web and the paper transfer felts, and then squeeze water out of the wet paper web and cause the paper transfer felts to absorb the water.

[0007] The press apparatus disposed in the press part includes a smoothing press apparatus in its final stage. The smoothing press apparatus presses the wet paper web transferred by a smoothing belt and also presses the smoothing belt, thereby smoothing the surface of the wet paper web.

[0008] A closed-draw-type papermaking machine incorporating a smoothing press is proposed in International Publication WO 2004/101885. According to the proposed papermaking machine, wet paper web is transferred while one surface thereof is being held by an elastic member, and the wet paper web and the elastic member are pressed by a pair of press rolls to smooth the surface of the wet paper web.

[0009] The smoothing press of the papermaking machine disclosed in International Publication WO

2004/101885 employs the elastic member which holds one surface of the wet paper web and which is pressed, together with the wet paper web, by a pair of press rolls.

[0010] The elastic member comprises a paper feeding belt, which does not have air permeability, or a surface property improving felt which is permeable to air. A rubber belt is illustrated as an example of the paper feeding belt which does not have air permeability. A felt which is slightly permeable to air with a permeability of less than 10 cm³/(Sec·cm²) is illustrated as an example of the surface property improving felt.

[0011] From EP 1 688 536 A1 a paper transporting felt is known that includes a base layer, a first batt layer formed on a wet paper side surface of the base layer, a second batt layer formed on a press side surface of the base layer, a polymeric elastic material impregnated in the base layer, the first batt layer and the second batt layer and a wet paper contacting layer which is formed on a wet paper side surface of the first batt layer so as to come into direct contact with a wet paper, and includes a flexible resin material.

[0012] EP 1 674 612 A1 discloses a paper transporting felt that includes a base layer, a first batt layer formed on a wet paper side surface of the base layer, a second batt layer formed on a roll side surface or a shoe side surface of the base layer and a wet paper contacting layer formed on a wet paper side surface of the first batt layer so as to come into direct contact with a wet paper. The wet paper contacting material is formed of a flexible resin material.

[0013] WO 2003 091498 A1 pertains to a method of manufacturing a press felt that comprises a base structure, a batt fiber layer being attached to a first web-side surface of the base structure. The structure of the press felt is compacted by treating it with a polymer material at least on the side of the first felt surface.

[0014] In recent years, there have been growing demands for papermaking processes at higher speeds and smoother wet paper web surfaces. Papermaking machines according to the background art are not necessarily good enough to meet the above demands, and remain to be improved.

[0015] The present invention has been made in view of the above problems. It is an object of the present invention to provide a smoothing belt, for use in a closed-draw-type papermaking machine, which is capable of smoothing wet paper web surfaces and of producing paper at high speeds.

Disclosure of the invention:

[0016] The above object is achieved by a smoothing belt according to claim 1. The smoothing belt according to the invention is adapted to be used in a smoothing press apparatus disposed in a press part of a closed-draw-type papermaking machine, comprising a first press roll having a smooth surface, a second press roll having a smooth surface and disposed in facing relation

to the first press roll, the smoothing belt for smoothing a surface of a wet paper web being pressed, together with the wet paper web, by the first press roll and the second press roll, and a paper transfer felt for transferring the wet paper web and for delivering same to the smoothing belt.

[0017] The smoothing belt comprises a base body, a first batt layer disposed on a wet paper web side surface of the base body, a second batt layer disposed on a roll side surface of the base body, and a porous thin film layer, disposed on a wet paper web side surface of the first batt layer, for direct contact with the wet paper web. The porous thin film layer of the smoothing belt comprises a foamed resin layer. The foamed resin layer is formed by mixing a polyurethane resin, a plurality of types of surfactants having different hydrophilic degrees, and a powder of inorganic compound with a solvent, and forming a mixture, and impregnating the first batt layer from the wet paper web side surface with the mixture to form an impregnated layer, and holding the impregnated layer in contact with water. The foamed resin layer is applied in an amount ranging from 50 g/m² to 150 g/m², and the smoothing belt has an air permeability ranging from 1 cm³/cm²/sec. to 5 cm³/cm²/sec. The foamed resin layer has preferably a wet paper web side surface polished to open air bubbles therein and make itself smooth. The surfactants preferably comprise a plurality of types of surfactants selected from anionic surfactants including carboxylate, sulfuric ester salt, sulfonate, phosphoric ester salt, etc. and polyethylene glycol-based and multiple alcohol-based nonionic surfactants, and have hydrophilic degrees by way of HLB (Hydrophile Lyophile Balance) which are different by at least 1 or greater. The powder of inorganic compound preferably comprises a mixture of one or a plurality of materials selected from sodium bicarbonate, sodium carbonate, sodium chloride and sodium nitrate.

[0018] With the smoothing press apparatus according to the above, the wet paper web is transferred by the permeable paper transfer felt, and is delivered to the smoothing belt which has the foamed resin layer on the wet paper web side surface of the first batt layer. The smoothing belt and the wet paper web are pressed by the pair of press rolls to smooth the surface of the wet paper web.

[0019] A nip pressure is applied to the wet paper web when the wet paper web is held between the paper transfer felt and the smoothing belt. The wet paper web which is transferred generally has such a characteristic that it sticks to a smoother surface and a harder surface. Therefore, the wet paper web which is transferred by the paper transfer felt is reliably delivered to the smoothing belt which has a high hardness and a smooth surface. Since the wet paper web is pressed, together with the smoothing belt, by the pair of press rolls and is held in contact with the smooth surface of the smoothing belt, the surfaces of the wet paper web are smoothed.

[0020] The smoothing belt has the foamed resin layer

on the wet paper web side surface of the first batt layer. Therefore, a bulky and smooth wet paper web surface can be obtained even in high-speed papermaking processes by the shock absorbing capability (cushioning capability) of the first batt layer and the denseness of the foamed resin layer. The foamed resin layer has uniform, dense, minute, and continuous open pores. Therefore, the foamed resin layer is effective to provide a capability for attracting the wet paper web through the minute pores and also to provide a surface smoothness.

[0021] As a result, since the wet paper web can reliably be received from the paper transfer felt, the wet paper web which is obtained is bulky and has a good surface smoothness. At the same time, the foamed resin layer is highly durable even in high-speed papermaking processes.

[0022] Details of the present invention will be further clarified by referring to best modes for carrying out the present invention with reference to the accompanying drawings.

Brief description of the drawings:

[0023]

Fig. 1 is a schematic view of a closed-draw-type papermaking machine which incorporates a smoothing press apparatus and a smoothing belt according to the present invention;

Fig. 2 is a vertical cross-sectional view of a paper transfer felt;

Fig. 3 is a vertical cross-sectional view of the smoothing belt;

Fig. 4 is a view showing a surface of a foamed resin layer according to the present invention;

Fig. 5 is a cross-sectional view of the smoothing belt according to the present invention;

Best mode for carrying out the invention:

[0024] Preferred embodiments of the present invention will be described in detail below with reference to the drawings.

[0025] Fig. 1 is a schematic view of a closed-draw-type papermaking machine which incorporates a smoothing press apparatus and a smoothing belt according to the present invention,

Fig. 2 is a vertical cross-sectional view of a paper transfer felt, and Fig. 3 is a vertical cross-sectional view of the smoothing belt.

[0026] As shown in Fig. 1, the closed-draw-type papermaking machine includes a press part 11 and a drier part 13 which are arranged in line in the order named along the direction in which a wet paper web W is transferred. The press part 11 has a smoothing press apparatus 100 disposed therein.

[0027] The smoothing press apparatus 100 comprises a smoothing press 17 which is disposed as a press in a

final stage in the press part 11 downstream of final water-squeezing press rolls 15A, 15B of the press part 11.

[0028] The water-squeezing press rolls 15A, 15B are disposed in facing relation to each other across a transfer path for the wet paper web W. A transfer felt 19 and a paper transfer felt 21 hold the wet paper web W between the transfer felt 19 and a paper transfer felt 21 and transfer the wet paper web W. The water-squeezing press rolls 15A, 15B hold and press the transfer felt 19 and the paper transfer felt 21, together with the wet paper web W, thereby squeezing water out of the wet paper web W.

[0029] The smoothing press 17 serves to smooth the surfaces of the wet paper web W, from which water has been squeezed, and to transfer the wet paper web W to the drier part 13. The smoothing press 17 comprises a first press roll 23 and a second press roll 25 which are disposed in facing relation to each other across the transfer path for the wet paper web W. Both the first press roll 23 and the second press roll 25 have a high surface hardness and smooth surfaces.

[0030] The paper transfer felt 21 transfers the wet paper web W and delivers the wet paper web W to a smoothing belt 27. The smoothing belt 27 runs while holding one surface of the wet paper web W. The first press roll 23 and the second press roll 25 hold and press the smoothing belt 27 and the wet paper web W between the roll 23 and the roll 25 for thereby smoothing the surfaces (both surfaces) of the wet paper web W.

[0031] A pair of transfer rolls 29A, 29B is disposed between the water-squeezing press rolls 15A, 15B and the smoothing press 17. The transfer rolls 29A, 29B generate a nip pressure by pressing the wet paper web W, which is transferred by the paper transfer felt 21, while the wet paper web W is being held between the paper transfer felt 21 and the smoothing belt 27. The transfer rolls 29A, 29B deliver the wet paper web W to the smoothing belt 27.

[0032] As shown in Fig. 2, the paper transfer felt 21 includes batt layers 43, consisting of staple fibers 47, which are intertwiningly integrated with both surfaces of a base body 41 by needle punching. Specifically, the paper transfer felt 21 is made of a permeable felt including a first batt layer 43A disposed on a wet paper web side surface and a second batt layer 43B disposed on a roll side surface.

[0033] The smoothing belt 27 used in the smoothing press apparatus 100 according to the present embodiment will be described in detail below.

[0034] As shown in Fig. 3, the smoothing belt 27 includes batt layers 43, which consist of staple fibers 47, which are intertwiningly integrated with both surfaces of a base body 41 by needle punching. Specifically, the smoothing belt 27 comprises the base body 41, a first batt layer 43A disposed on a wet paper web side surface of the base body 41, and a second batt layer 43B disposed on a roll side surface of the base body 41. A porous thin film layer 45 is disposed on a wet paper web side surface of the first batt layer 43A for direct contact with the wet paper web W.

[0035] The base body 41 is made of a woven fabric of yarns in an MD (Machine Direction) direction (in other words, a direction in which the wet paper web W runs (flows)) and yarns in a CMD (Cross Machine Direction) direction (in other words, a widthwise direction).

[0036] The base body 41 may comprise both yarns superimposed, rather than woven, or a film or a knitted material, or a spirally wound narrow ribbon. If the base body 41 comprises the film or the knitted material, then the base body 41 is made of polyamide, polyester, aromatic polyamide, aromatic polyimide, high-polymer polyethylene, or the like.

[0037] The present invention employs a suitable method of forming the porous thin film layer 45. According to this method, a polyurethane resin and a plurality of types of surfactants, having different hydrophilic degrees (HLB: Hydrophile Lyophile Balance), and a powder of inorganic compound are mixed with a solvent, so that a mixture is formed. The first batt layer 43A is impregnated from the wet paper web side surface thereof with the mixture to form an impregnated layer, which is then held in contact with water to form a foamed resin layer.

[0038] Specifically, the first batt layer 43A is impregnated from the wet paper web side surface thereof with the mixture to form an impregnated layer, so that the mixture seeps in the first batt layer 43A. The mixture is also put on the first batt layer 43A, and the first batt layer 43A is then held in contact with water to extract the solvent and the powder of inorganic compound to convert the impregnated layer into a porous foamed resin layer.

[0039] The above method is generally called a wet-type film forming method. The foamed resin layer can be formed in and on the first batt layer 43A according to this method.

[0040] The resin of the foamed resin layer, which serves as the porous thin film layer 45 according to the present invention, comprises a polyurethane resin. Particularly suitable are polyurethanes such as polyester-based polyurethane which is of high mechanical strength, polyether-based polyurethane, polycarbonate-based polyurethane, etc.

[0041] The resin of the foamed resin layer according to the present invention should preferably comprise an aqueous resin or an emulsion resin having a solid content ranging from 20 weight % to 50 weight % and a viscosity ranging from 10 Pa s (10,000 cp) to 200 Pa s (200,000 cp) at 25°C.

[0042] The foamed resin layer according to the present invention can have closed pores opened and simultaneously increase the smoothness of the surface of the smoothing belt 27 when the wet paper web side surface of the formed resin layer is polished.

[0043] According to the present invention, the surfactants for forming the mixture comprise a plurality of types of surfactants selected from anionic surfactants including carboxylate, sulfuric ester salt, sulfonate, phosphoric ester salt, etc., and polyethylene glycol-based and multiple alcohol-based nonionic surfactants.

[0044] The plurality of types of surfactants have different HLB values where the hydrophilic degrees by way of HLBs (Hydrophile Lyophile Balances) are different by at least 1 or greater.

[0045] Hydrophilic surfactants with high HLB values have a property to promote the formation of a film according to the wet-type film forming method. Conversely, lyophilic (hydrophobic) surfactants with low HLB values have a property to suppress the formation of a film according to the wet-type film forming method.

[0046] As a result, pore diameters in a certain range are obtained by using together hydrophilic surfactants with high HLB values and lyophilic surfactants with low HLB values. Specifically, the diameters of the pores of the foamed resin layer are held to a range from 20 μm to 100 μm by using a plurality of types of surfactants.

[0047] The amount of the surfactant used according to the present invention should preferably be in a range from 1 weight % to 5 weight % with respect to the amount of the resin of the foamed resin layer. The reasons are that if the amount of the surfactant is 1 weight % smaller than the amount of the resin of the foamed resin layer, then its ability to form the foamed resin layer will become lowered, and if the amount of the surfactant is 5 weight % greater than the amount of the resin of the foamed resin layer, then the mixture will be foamed excessively and will poorly impregnate the wet paper web side surface of first batt layer 43A.

[0048] The powder of inorganic compound used according to the present invention should preferably be a mixture of one or a plurality of materials selected from sodium bicarbonate, sodium carbonate, sodium chloride and sodium nitrate. The mixture is easily dissolvable in water, hardly dissolvable in a solvent, and forms good pores according to the wet-type film forming method. In particular, sodium bicarbonate is preferable as the powder of inorganic compound.

[0049] According to the wet-type film forming method of the present invention, the first batt layer 43A is impregnated from the wet paper web side surface thereof with the mixture, and an impregnated layer and a stacked layer thereon are formed. Thereafter, the impregnated layer and the stacked layer thereon are brought into contact with water to extract the solvent and the powder of inorganic compound, thereby opening the pores.

[0050] Since the region including the impregnated layer and the stacked layer thereon is held in good contact with water, the minute and continuous pores are produced. As the impregnated layer in the first batt layer 43A is late in contacting water, part of the powder of inorganic compound may remain left therein. However, any powder of inorganic compound which may remain left will not impair the function of the smoothing belt 27.

[0051] The solvent used according to the present invention should preferably be of a material capable of uniformly dispersing the foamed resin layer, the plurality of surfactants of different HLBs, and the powder of inorganic compound, and the solvent should preferably be of the

material capable of keeping the mixture dispersed stably.

[0052] According to the present invention, the solvent should preferably comprise dimethylformamide (DMF) which keeps the mixture dispersed stably and which is of excellent extractability by water (i.e., miscibility with water, dissolvability into water) and which is easy to handle.

[0053] If the applied amount of foamed resin layer is smaller than 50 g/m², then the smoothing belt 27 will have high air permeability and a low hardness, so that lowering the smoothness of the wet paper web side surface of the smoothing belt 27. As a result, it will be difficult to receive the wet paper web W from the paper transfer felt, and the wet paper web W will not have a good surface smoothness.

[0054] Conversely, if the applied amount of foamed resin layer is greater than 150 g/m², then the shock absorbing capability (cushioning capability) of the first batt layer 43A of the smoothing belt 27 will be lowered, so that failing to produce a bulky wet paper web surface in high-speed papermaking processes.

[0055] Therefore, the foamed resin layer according to the present invention is applied in an amount ranging from 50 g/m² to 150 g/m². The smoothing belt 27 has an air permeability ranging from 1 cm³/cm²/sec. to 5 cm³/cm²/sec.

[0056] A sequence for forming the foamed resin layer according to the present invention will be described by way of example below. However, the present invention is not limited to the sequence described below.

[0057] For forming the foamed resin layer which is a porous thin film layer according to the present invention, 100 parts of an aqueous polyurethane resin (having an active ingredient concentration of 30 %), 120 parts of DMF as a solvent, 1 part of EMULGEN 105 (manufactured by KAO Corporation: HLB 9.7) and 1 part of EMULGEN 106 (manufactured by KAO Corporation: HLB 10.5) as nonionic surfactants (polyoxyethylene lauryl ether) are mixed together in the order named, and are stirred with 80 parts of a powder of sodium bicarbonate being added thereto, so that a mixture is produced.

[0058] Then, as shown in Fig. 3, the mixture is applied to impregnate the first batt layer 43A from its surface and to enter in the first batt layer 43A. Furthermore, the mixture is also stacked on the first batt layer 43A. The assembly is passed through a coagulating tank filled with water, so that the impregnated layer is converted into a foamed resin layer. The size of the coagulating tank and the time during which the assembly is kept in contact with water may be appropriately determined depending on the thickness of the impregnated layer.

[0059] After the foamed resin layer is dried, the wet paper web surface of the foamed resin layer is polished with a polishing paper, a grid brush, or the like. The denseness and smoothness of the wet paper web surface of the foamed resin layer are thus adjusted.

[0060] Fig. 4 shows the surface of the foamed resin

layer of the smoothing belt 27 according to the first embodiment. Fig. 5 shows a cross section of the smoothing belt 27 including the foamed resin layer. The foamed resin layer has a pore diameter ranging from 50 μm to 100 μm , and is applied in an amount of 100 g/m^2 , and has a thickness of 500 μm , and has an air permeability of 2.3 $\text{cm}^3/\text{cm}^2/\text{sec}$.

[0061] Identical reference characters denote identical parts throughout views.

Industrial applicability:

[0062] The smoothing press apparatus according to the present invention is applicable to closed-draw-type papermaking machines which are capable of performing papermaking processes at high speeds.

Claims

1. A smoothing belt (27, 127, 127A) adapted to be disposed in a smoothing press apparatus (100, 200), for smoothing a surface of a wet paper web (W) by being pressed, together with the wet paper web (W), by a pair of press rolls (23, 25), said smoothing belt (27, 127, 127A) comprising:

a base body (41);

a first batt layer (43A) disposed on a wet paper web side surface of said base body (41);

a second batt layer (43B) disposed on a roll side surface of said base body (41); and

a porous thin film layer (45), disposed on a wet paper web side surface of said first batt layer (43A), for direct contact with said wet paper web (W),

wherein said porous thin film layer (45) is a foamed resin layer being applied in an amount ranging from 50 g/m^2 to 150 g/m^2 ,

characterized in that the foamed resin layer is formed by mixing a polyurethane resin, a plurality of types of surfactants having different hydrophilic degrees, and a powder of inorganic compound to form a mixture, and impregnating said first batt layer (43A) from said wet paper web side surface with said mixture to form an impregnated layer, said mixture being also put on said first batt layer (43A), said first batt layer (43A) being then held in contact with water to extract said solvent and said powder of inorganic compound to convert said impregnated layer into a porous foamed resin layer, wherein said smoothing belt (27, 127, 127A) has an air permeability ranging from 1 $\text{cm}^3/\text{cm}^2/\text{sec}$ to 5 $\text{cm}^3/\text{cm}^2/\text{sec}$, and

wherein pore diameters in a certain range are obtained by using together hydrophilic surfactants with high HLB (Hydrophile Lyophile Bal-

ance) values and lyophilic surfactants with low HLB values, the diameters of the pores of the foamed resin layer being held to a range from 20 μm to 100 μm by using the plurality of types of surfactants.

2. A smoothing belt according to claim 1, wherein the resin of said foamed resin layer comprises an aqueous resin or an emulsion resin having a solid content ranging from 20 weight % to 50 weight % and a viscosity ranging from 10 Pa·s (10,000 cp) to 200 Pa·s (200,000 cp) at 25°C.
3. A smoothing belt according to claim 1, wherein said surfactants comprise a plurality of types of surfactants selected from anionic surfactants including carboxylate, sulfuric ester salt, sulfonate, phosphoric ester salt, and polyethylene glycol-based and multiple alcohol-based nonionic surfactants, and have hydrophilic degrees by way of HLB which are different by at least 1 or greater.
4. A smoothing belt according to claim 1, wherein said powder of inorganic compound comprises a mixture of one or a plurality of materials selected from sodium bicarbonate, sodium carbonate, sodium chloride and sodium nitrate.
5. A smoothing belt according to claim 1, wherein the solvent comprises dimethylformamide (DMF).

Patentansprüche

1. Glättungsband (27, 127, 127A), das zur Anordnung in einer Glättpressenvorrichtung (100, 200) geeignet ist, um eine Oberfläche einer nassen Papierbahn (W) zu glätten, die zusammen mit der nassen Papierbahn (W) durch ein Paar Presswalzen (23, 25) gepresst wird, wobei das Glättungsband (27, 127, 127A) umfasst:

einen Grundkörper (41);

eine erste Vlieslage (43A), die auf einer Oberfläche des Grundkörpers (41) auf Seiten der nassen Papierbahn angeordnet ist;

eine zweite Vlieslage (43B), die auf einer Oberfläche des Grundkörpers (41) auf Seiten der Walzen angeordnet ist; und

eine poröse Dünnschicht (45), die auf der Oberfläche der ersten Vlieslage (43A) auf Seiten der nassen Papierbahn für einen direkten Kontakt mit der nassen Papierbahn (W) angeordnet ist,

wobei die poröse Dünnschicht (45) eine geschäumte Harzschicht ist, die in einer Menge in einem Bereich von 50 g/m^2 bis 150 g/m^2 aufge-

bracht ist,

dadurch gekennzeichnet, dass die aufgeschäumte Harzschicht gebildet ist durch Mischen eines Polyurethanharzes, eine Mehrzahl von Typen von Tensiden mit unterschiedlichen hydrophilen Graden und eines Pulvers einer anorganischen Verbindung mit einem Lösungsmittel, um ein Gemisch zu bilden, und durch Imprägnieren der ersten Vlieslage (43A) von der Oberfläche auf Seiten der nassen Papierbahn mit dem Gemisch, um eine imprägnierte Schicht zu bilden, wobei das Gemisch auch auf die erste Vlieslage (43A) aufgebracht ist, wobei die erste Vlieslage (43A) dann in Kontakt mit Wasser gehalten wird, um das Lösungsmittel und das Pulver der anorganischen Verbindung zu extrahieren, um die imprägnierte Schicht in eine poröse aufgeschäumte Harzschicht umzuwandeln, wobei das Glättungsband (27, 127, 127A) eine Luftdurchlässigkeit im Bereich von $1 \text{ cm}^3/\text{cm}^2/\text{s}$ bis $5 \text{ cm}^3/\text{cm}^2/\text{s}$ aufweist und wobei die Porendurchmesser in einem bestimmten Bereich unter gemeinsamer Verwendung von hydrophilen Tensiden mit hohen HLB-Werten (Hydrophil/Lyophil-Gleichgewichtswerte) und von lyophilen Tensiden mit niedrigeren HLB-Werten erhalten werden, wobei die Durchmesser der Poren der geschäumten Harzschicht unter Verwendung der Mehrzahl von Typen von Tensiden in einem Bereich von $20 \text{ }\mu\text{m}$ bis $100 \text{ }\mu\text{m}$ gehalten werden.

2. Glättungsband nach Anspruch 1, wobei das Harz der aufgeschäumten Harzschicht ein wässriges Harz oder eine Harzemulsion mit einem Festkörperanteil im Bereich von 20 Gew.-% bis 50 Ges.-% und mit einer Viskosität im Bereich von $10 \text{ Pa}\cdot\text{s}$ (10.000 cp) bis $200 \text{ Pa}\cdot\text{s}$ (200.000 cp) bei 25°C enthält.
3. Glättungsband nach Anspruch 1, wobei die Tenside eine Mehrzahl von Typen von Tensiden enthalten, die ausgewählt sind aus anionischen Tensiden, die Carboxylat, Schwefelestersalz, Sulfonat und Phosphorestersalz enthalten, und aus nichtionischen Tensiden auf Polyethylenglykol-Basis und Mehrfachalkohol-Basis und hydrophile Grade nach HLB, die um mindestens 1 oder mehr voneinander verschieden sind, aufweisen.
4. Glättungsband nach Anspruch 1, wobei das Pulver der anorganischen Verbindung ein Gemisch aus einem oder einer Mehrzahl von Materialien enthält, die aus Natriumbicarbonat, Natriumcarbonat, Natriumchlorid und Natriumnitrat ausgewählt sind.
5. Glättungsband nach Anspruch 1, wobei das Lö-

sungsmittel Dimethylformamid (DMF) enthält.

Revendications

1. Courroie lisseuse (27, 127, 127A) adaptée pour être disposée dans un appareil de presse lisseuse (100, 200), pour lisser une surface de bande continue de papier humide (W) en étant pressée, conjointement avec la bande continue de papier humide (W), par une paire de rouleaux de presse (23, 25), ladite courroie lisseuse (27, 127, 127A) comprenant:

un corps de base (41);

une première couche de nappe (43A) disposée sur une surface côté bande continue de papier humide dudit corps de base (41);

une seconde couche de nappe (43B) disposée sur une surface côté rouleau dudit corps de base (41); et

une couche de film mince poreux (45), disposée sur une surface côté bande continue de papier humide de ladite première couche de nappe (43A), pour un contact direct avec ladite bande continue de papier humide (W), dans laquelle ladite couche de film mince poreux (45) est une couche de résine expansée appliquée dans une quantité allant de 50 g/m^2 à 150 g/m^2 ,

caractérisée en ce que la couche de résine expansée est formée par mélange d'une résine polyuréthane, d'une pluralité de types de tensioactifs ayant des degrés hydrophiles différents, et d'une poudre de composé inorganique avec un solvant pour former un mélange, et imprégnation de ladite première couche de nappe (43A) de ladite surface côté bande continue de papier humide avec ledit mélange pour former une couche imprégnée, ledit mélange étant également placé sur ladite première couche de nappe (43A), ladite première couche de nappe (43A) étant alors maintenue en contact avec l'eau pour extraire ledit solvant et ladite poudre de composé inorganique pour convertir ladite couche imprégnée en une couche de résine expansée poreuse,

dans laquelle ladite courroie lisseuse (27, 127, 127A) a une perméabilité à l'air allant de $1 \text{ cm}^3/\text{cm}^2/\text{s}$ à $5 \text{ cm}^3/\text{cm}^2/\text{s}$, et

dans laquelle des diamètres de pore dans une certaine plage sont obtenus par utilisation conjointe de tensioactifs hydrophiles avec des valeurs HLB (balance hydrophile-lyophile) élevées et des tensioactifs lyophiles avec des valeurs HLB faibles, les diamètres des pores de la couche de résine expansée étant maintenus dans une plage de $20 \text{ }\mu\text{m}$ à $100 \text{ }\mu\text{m}$ en utilisant la pluralité de types de tensioactifs.

2. Courroie lisseuse selon la revendication 1, dans laquelle la résine de ladite couche de résine expansée comprend une résine aqueuse ou une résine en émulsion ayant une teneur en matières sèches allant de 20 % en poids à 50 % en poids et une viscosité allant de 10 Pa·s (10.000 cp) à 200 Pa·s (200.000 cp) à 25°C. 5
3. Courroie lisseuse selon la revendication 1, dans laquelle lesdits tensioactifs comprennent une pluralité de types de tensioactifs choisis parmi des tensioactifs anioniques incluant le carboxylate, un sel d'ester sulfurique, le sulfonate, un sel d'ester phosphorique, et des tensioactifs non ioniques à base de polyéthylène glycol et à base d'alcools multiples, et ont des degrés hydrophiles à titre de HLB qui diffèrent d'au moins 1 ou plus. 10 15
4. Courroie lisseuse selon la revendication 1, dans laquelle ladite poudre de composé inorganique comprend un mélange d'un ou d'une pluralité de matériaux choisis parmi le bicarbonate de sodium, le carbonate de sodium, le chlorure de sodium et le nitrate de sodium. 20 25
5. Courroie lisseuse selon la revendication 1, dans laquelle le solvant comprend le diméthylformamide (DMF). 30 35 40 45 50 55

FIG.1

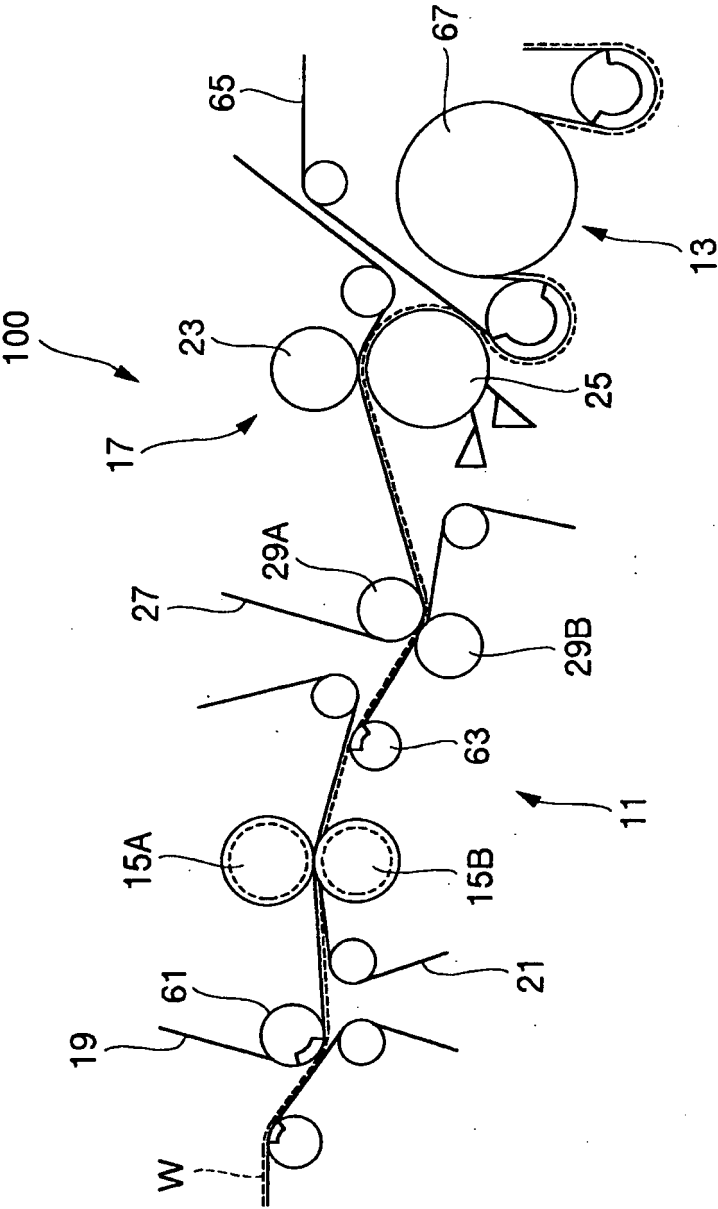


FIG.2

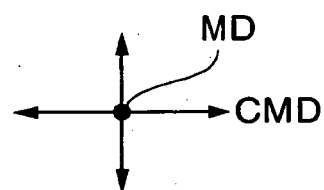
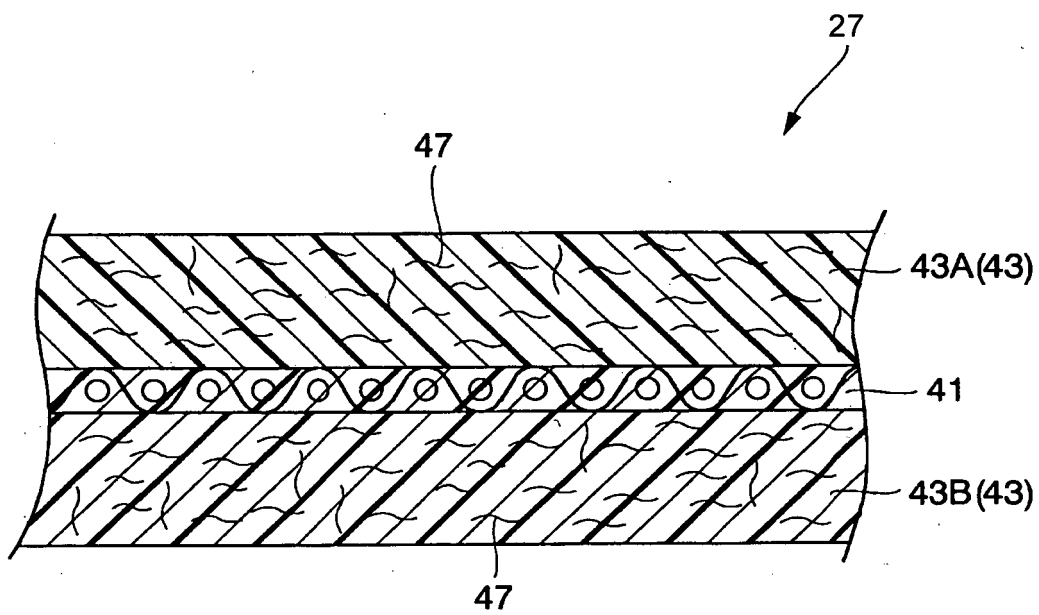


FIG.3

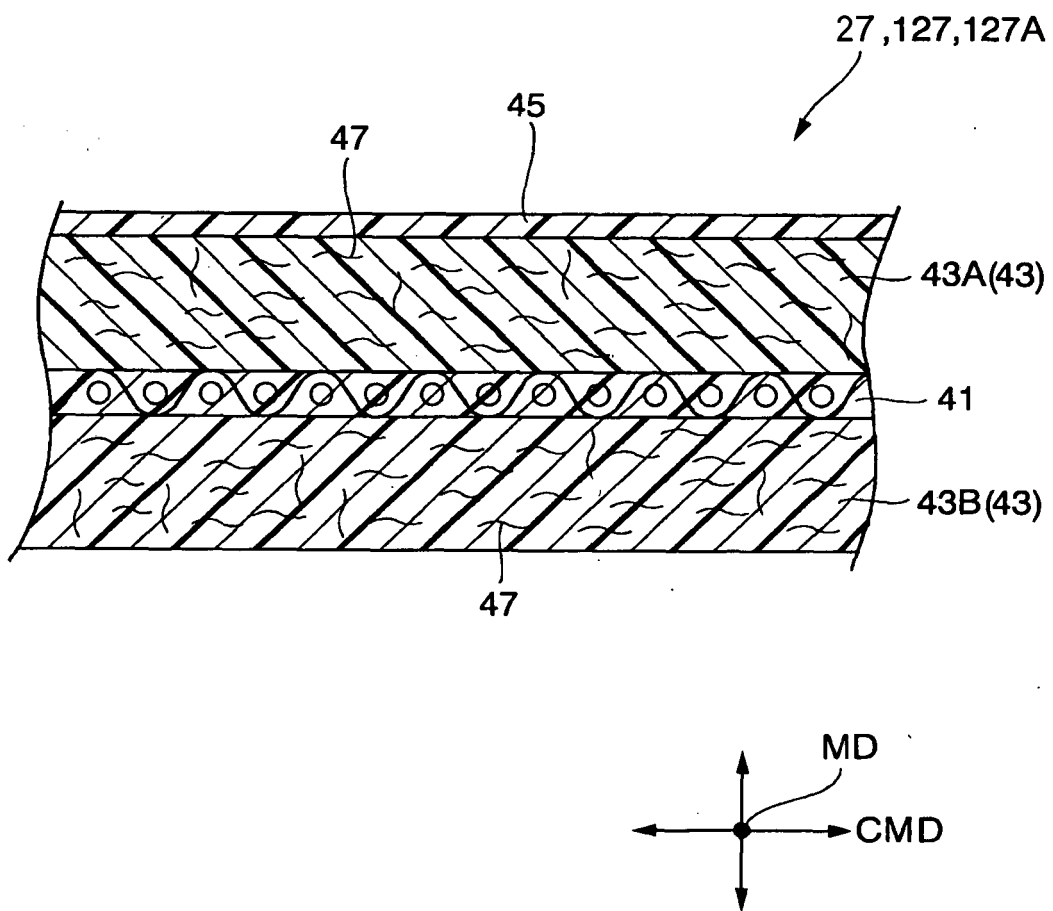


FIG.4

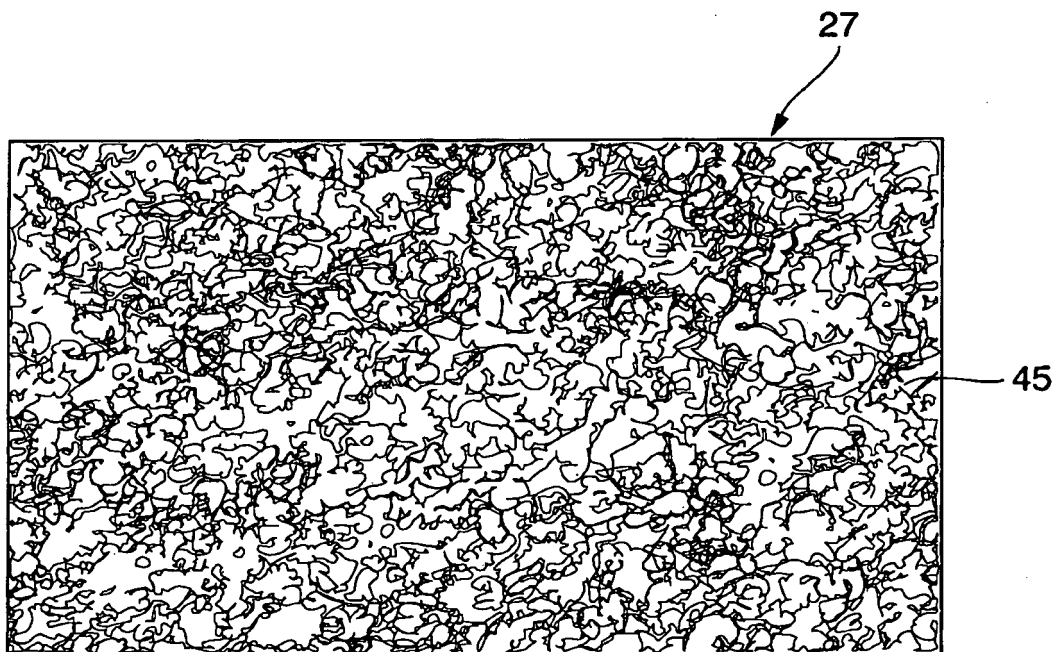
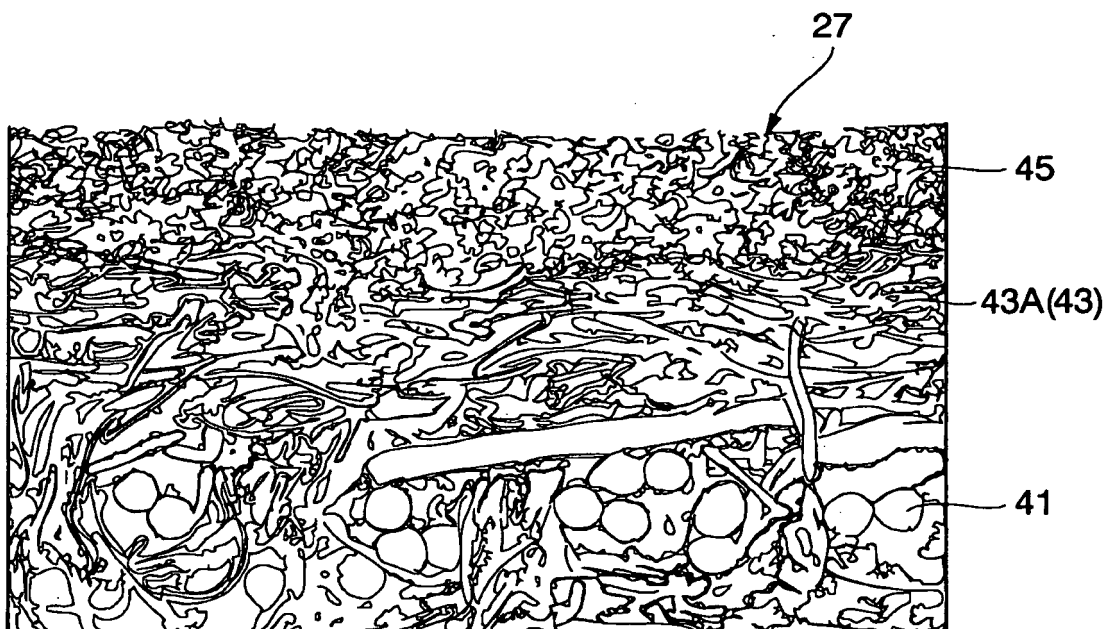


FIG.5



REFERENCES CITED IN THE DESCRIPTION

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