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(54) METHOD FOR POST-PROCESSING OF A PRODUCT, ESPECIALLY PAPER OR PAPERBOARD, WHICH HAS BEEN FABRICATED FROM PULP CONTAINING LIGNIN

(57) The invention refers to a method for post-processing of a product, especially paper or paperboard, which has been fabricated at least partly from pulp containing lignin, comprising the following steps: introducing the product into a product gap of a belt press having at least one belt, heating up the product within the belt press to a temperature between 160 °C and 350 °C and submitting the product within the band press to a line pressure between 30 N/mm and 200 N/mm and/or a surface pressure between 50 kN/m^2 (0.5 bar) and 600 kN/m^2 (6 bar), especially between 200 kN/m^2 (2 bar) and 600 kN/m^2 (6 bar).

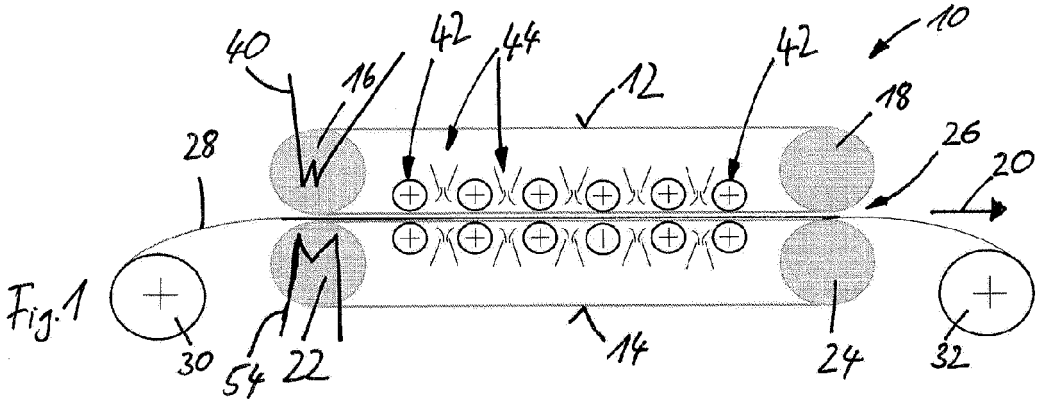

Fig.1

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Description

[0001] The invention refers to a method for post-processing of a product, especially paper or paperboard, which has been fabricated from pulp containing lignin.

[0002] By means of the invention a method for post-processing of a product, especially paper or paperboard, which has been fabricated from pulp containing lignin should be improved.

[0003] Such improvements are achieved by a method for post-processing of a product, especially paper or paperboard, which has been fabricated from pulp containing lignin according to claim 1. Advantageous further developments of the invention are disclosed in the subclaims.

[0004] A method for post-processing of a product, especially paper or paperboard, which has been fabricated at least partly from pulp containing lignin comprises the following steps: introducing the product into a product gap of a belt press having at least one belt, heating up the product within the belt press to a temperature between 160 °C and 350 °C and submitting the product within the band press to a line pressure between 30 N/mm and 200 N/mm and/or a surface pressure between 50 kN/m^2 (0.5 bar) and 600 kN/m^2 (6 bar), especially between 200 kN/m^2 (2 bar) and 600 kN/m^2 (6 bar).

[0005] By means of the inventive method the moisture resistance of a product, especially paper or paperboard, which has been fabricated from pulp containing lignin as well as the mechanical strength of the product can be improved. The product is at least partly fabricated from pulp containing lignin, which means that at least a component or at least a layer of the product is made from pulp containing lignin. The pulp contains lignin and usually also contains fibrous material. The pulp is preferably at least partly made from wood or from plants containing lignin. The product is especially a flat product, like paper or paperboard. Heating up the paper to a temperature within the boundaries indicated and submitting the product to a pressure within the boundaries is believed to have an effect on the lignin within the product, thereby making the product stronger and more resistant to moisture and water. It has been shown, that dry strength and wet strength can be increased. Dry strength can be measured by tensile index and SCT index (Short-Crush-Test). Wet strength can be measured by wet tensile index. Especially the wet strength of a product, especially paper or paperboard, is greatly increased by the inventive method, e.g. by a factor of 10, whereas dry strength is e.g. doubled. It should be noted that all the lignin is already contained in the product. Additional lignin can be added during the inventive method e.g. by applying a liquid or a powder containing lignin to the product. This can be done by spraying or scattering, respectively. By using a band press, the inventive method can be carried out in a very economical and fast way. However, the inventive method is not supposed to form an in-line solution, i.e. the inventive method is not intended to be carried out downstream of or within a paper machine. Rather, the inventive method is intended to be carried out off-line, e.g. in the form of a roll-to-roll-method. According to the invention, the product is heated up to a temperature between 160 °C and 350 °C. It is to be understood that the scope of the invention covers all temperatures within that range. The exact temperature or the exact temperature range which is to be used depends on the kind of paper and especially the pulp the product has been fabricated from. Simple tests with respect to an optimal temperature or temperature range can be carried out for a special given product. According to the invention the product within the band press is submitted to a line pressure between 30 N/mm and 200 N/mm and/or a surface pressure between 50 kN/m^2 and 600 kN/m^2. The scope of the invention covers all line pressures and surface pressures within the respective given range. The optimal line pressure and optimal surface pressure depends on the kind of product to be post-processed, especially from the kind of pulp the product has been fabricated from. Simple tests can be carried out to determine an optimal line pressure and/or an optimal surface pressure for the special product to be post-processed within the given boundaries for the line pressure and the surface pressure.

[0006] According to the development of the invention the step of moistening or drying the product in order that the product has a moisture content of 2% to 40%, especially 10% to 40% is carried out before introducing the product into the product gap.

[0007] According to a development of the invention the at least one belt is a steel belt or a plastic belt.

[0008] By means of a steel belt or a plastic belt the product to be post-processed can be reliably guided through the belt press and temperature as well as pressure can be applied to the product in a reproducible way. In the case of a plastic belt the belt can comprise Teflon, is made of Teflon or is coated with Teflon. In the case of a steel belt the belt can be polished or provided with a desired surface roughness.

[0009] In a development of the invention the belt press is a double belt press having at least an upper belt and a lower belt, wherein heating up the product and submitting the product to pressure takes place in the product gap between the at least one upper belt and the at least one lower belt of the double belt press.

[0010] Double belt presses are especially well suited for post-processing of flat products, especially paper. The product is safely guided within the product gap between the belts and pressure as well as temperature can be applied to the product.

[0011] The double belt press can comprise two or more steel belts forming at least a portion of the product gap in-between them, two or more plastic belts forming at least a portion of the product gap in-between them and/or at least one steel belt and at least one plastic belt forming at least a portion of the product gap in-between them. All upper belts and all lower belts are endless belts and are guided around at least two drums. The drums may be

driven or may rotate freely and the drums may be heated or cooled. Also the belts may be heated or cooled.

[0012] According to a development of the invention two plastic belts form at least a portion of the product gap in-between them and on the backside of at least one of the plastic belts a steel belt runs parallel to the plastic belt for at least a portion of the product gap.

[0013] By means of the use of two plastic belts and, in addition, at least one steel belt, the advantages of both plastic belts and steel belts can be combined. Plastic belts can be provided with a nonstick surface, e.g. Teflon. Further, plastic belts are in general cheaper and easier to manufacture compared to steel belts. Steel belts on the other hand can be used to apply a higher pressure compared to plastic belts as well as realizing higher heat flows into the paper to be post-processed. Further, the heat capacity of a steel belt is much higher compared to a plastic belt. Heat losses can, thereby, be minimized when a steel belt is used to introduce a heat flow into the paper to be post-processed. According to a development of the invention an upper belt of the double belt press is perforated.

[0014] By means of a perforated upper belt, vapour or steam can escape from the product gap. This may be important and advantageous, since the product is heated and moisture contained in the product evaporates within the product gap. A perforated belt gives the possibility for steam or vapour to leave the product gap without negatively influencing the product quality. Even so pressure can still be applied by means of the perforated belt. Thereby, a high and constant product quality can be ensured.

[0015] According to a development of the invention the double belt press comprises a first upper belt and a second upper belt, the first upper belt being arranged upstream of the second upper belt when seen in a transport direction of the double belt press in the product gap.

[0016] By means of a first upper belt and a second upper belt the product to be post-processed can be pressed and heated and, at the same time, vapour and steam which is produced within the product gap by heating the product, can escape through the gap between the first upper belt and the second upper belt. Also, the pressure is relieved in the gap between the first upper belt and the second upper belt and then applied again by the second upper belt, which can also be advantageous in the inventive method. Such vapor or steam arises from the moisture contained in the product and the following heating of the product within the product gap. By enabling the vapor or steam to escape, a very good and constant product quality can be ensured. Within the scope of the invention, two or more separate upper belts can be provided when seen in a transport direction of the paper through the product gap, between each pair of adjacent upper belts, a gap of the product gap being provided to enable vapor or steam to escape from the product gap.

[0017] According to a development of the invention the pressure is applied by means of at least one pressure roller, circulating rollers, at least one S-roller, at least one counterpressure roller and/or at least one counterpressure belt.

[0018] Pressure rollers, circulating rollers, S-rollers, counterpressure rollers and/or counterpressure belts can be advantageously combined with a belt press. Within the scope of the invention, combinations of pressure rollers, circulating rollers, S-rollers, counterpressure rollers and/or counterpressure belts are possible. The optimal combination is determined upon the pressure the product is to be submitted to, namely a line pressure or a surface pressure as well as the amount of pressure or the pressure range to which the product is to be submitted.

[0019] According to a development of the invention the pressure is applied by means of at least one pressure roller, circulating rollers, at least one S-roller, at least one counterpressure roller and/or at least one counterpressure belt directly to the product.

[0020] According to a development of the invention the at least one pressure roller, the circulating rollers, the at least one S-roller, the at least one counterpressure roller and/or the at least one counterpressure belt touches a backside of the at least one belt, the backside of the belt facing away from the product to be post-processed.

[0021] The pressure is, thereby, indirectly applied to the product. This can be advantageous.

[0022] According to a development of the invention the desired temperature of the product within the belt press is achieved by heating the at least one belt.

[0023] Among others, the product to be post-processed can at the same time be heated by the belt and pressure can be applied to the product by the belt.

[0024] According to a development of the invention the pressure is applied and again at least partly released within the belt press at least twice.

[0025] It has been shown that applying and again at least partly releasing the pressure at least twice leads to improved product qualities after post-processing, namely to an increased mechanical strength as well as an increased resistance against moisture and against water. The pressure can be applied to the product in the product gap e.g. by a first pair of pressure rollers facing each other and a second pair of pressure rollers facing each other, the first pair of pressure rollers and the second pair of pressure rollers being arranged one behind the other in a transport direction of the product through the belt press, wherein in-between the first pair of pressure rollers and the second pair of pressure rollers the pressure is at least partly released.

[0026] According to an embodiment, the pressure can also be applied to the product in the product gap by at least one pair of pressure rollers, said pair of pressure rollers having an upper roller and a lower roller, the upper roller and the lower roller being arranged at the same lengthwise portion when seen in transport direction, the upper roller touching a backside of a first belt, the backside of the first belt facing away from the product gap,

the lower roller touching a backside of a second belt, the backside of the second belt facing away from the product gap. According to a further embodiment the pressure can be applied to the product in the product gap by a first upper arrangement of circulating rollers and a second, lower arrangement of circulating rollers, the first arrangement of circulating rollers and the second arrangement of circulating rollers being arranged at the same lengthwise position when seen in transport direction, the first arrangement of circulating rollers touching a backside of a first belt, the backside of the first belt facing away from the product gap, the second arrangement of circulating rollers touching a backside of a second belt, the backside of the second belt facing away from the product gap. By means of circulating rollers, the pressure is applied and again partly released during the passing of the circulating rollers over the product or over a portion of the belt which the product touches.

[0027] According to a development of the invention the pulp has been generated by mechanical pulping.

[0028] Mechanical pulping means that wood in the form of chips or logs is mechanically separated into pulp fibers by grinding stones or refiners. This implies that most of the original wood components, such as cellulose, hemicellulose and lignin are kept intact, with some lesser degree of modification. The properties of such products can be significantly improved by the inventive method for post-processing such products. Especially, the mechanical strength of the product and the resistance of the product against moisture and water can be significantly increased. At least a component or a layer of the product, e.g. paper or paperboard, has to be fabricated from pulp containing lignin in order to achieve the advantages of the invention.

[0029] According to a development of the invention the product is unwound from a first product coil, then the product is introduced into the belt press and after leaving the belt press the product is coiled up on a second coil.

[0030] Thereby, a roll-to-roll-method is realized. Such a roll-to-roll-method is especially advantageous, since the inventive method is designed as an off-line solution, i.e. the inventive method is not intended to be carried out within a paper machine or downstream and on-line with a paper machine.

[0031] According to a development of the invention at least two layers of a product arranged on top of each other are introduced into the product gap.

[0032] Post-processing of a product can be performed at the same time with at least two layers of a product arranged on top of each other. Thereby, the production capacity of the inventive method is at least doubled. It has been found that no separating layer is needed between two layers of a product being post-processed at the same time.

[0033] Further advantages and embodiments of the invention can be derived from the following description of preferred embodiments of the invention in conjunction with the drawings. Individual features of the invention can be combined with other individual features described and/or shown in the figures within the scope of the invention. This is also true for the combination of individual features without other individual features being described or shown in conjunction with the individual features to be combined.

[0034] In the following, embodiments of the invention will be described in detail with reference to the drawings.

Fig. 1 shows schematically a first exemplary embodiment of a belt press for carrying out the inventive method,

Fig. 2 shows schematically a second exemplary embodiment of a belt press for carrying out the inventive method,

Fig. 3 shows schematically a third exemplary embodiment of a belt press for carrying out the inventive method and

Fig. 4 shows schematically a fourth exemplary embodiment of a belt press for carrying out the inventive method.

[0035] Fig. 1 shows a belt press 10 comprising an upper belt 12 and a lower belt 14. The upper belt 12 is guided by means of a first revolving drum 16 and a second revolving drum 18. The drums 16, 18 can both rotate counterclockwise. Thereby, the lower part of the upper belt 12 moves in a direction from the left to the right in fig. 1, namely in a transport direction 20 which is indicated in an arrow in fig. 1.

[0036] The lower belt 14 is guided by a third rotating drum 22 and a fourth rotating drum 24. Both drums 22, 24 can rotate in the clockwise direction. Thereby, the upper part of the lower belt 14 moves in the transport direction 20. Between the lower part of the upper belt 12 and the upper part of the lower belt 14, a product gap 26 is provided.

[0037] Paper 28 to be post-processed is guided into the product gap 26 and then transported through the product gap by means of the moving belts 12, 14 in the transport direction 20. Within the scope of the invention, a product, especially paper 28 or paperboard, which has been fabricated from pulp containing lignin, can be post-processed. Moistening or drying the paper to a moisture content between 2% and 40% can take place before introducing the paper into the product gap 26

[0038] The paper 28 is unwound from a first paper coil 30. After being post-processed within the product gap 26 by means of the belt press 10, the paper is coiled up on second coil 32. The inventive method, thereby, is carried out as a roll-to-roll-method. The inventive method is intended to form an off-line solution. I.e. the inventive method is not intended to be carried out on-line and downstream of a paper machine as a further processing step of fabricating paper.

[0039] The paper 28 is guided from the first coil 30 into the product gap 26. The drums 16, 22 can be heated.

[0040] The upper belt 12 and the lower belt 14 can be plastic belts or steel belts. E.g. the upper belt 12 can be a plastic belt and the lower belt 14 can be a steel belt or both belts 12, 14 can be plastic belts or steel belts. In the embodiment shown in fig. 1 both belts 12, 14 are steel belts and the drums 16, 22 may be heated to heat up the upper belt 12 and the lower belt 14 at the beginning of the product gap 26 to a desired temperature.

[0041] At the beginning of the product gap 26, the upper belt 12 is guided over approximately half the circumference of the first drum 16. The first drum 16 is heated by means of heated liquid guided through the interior of the first drum 16 through channels 40. As a consequence, the upper belt 12 is heated up while touching the circumference of the first drum 16. Therefore, at the very beginning of the product gap 26, i.e. between the first drum 16 and the upper part of the second belt 14, the upper belt 12 has a desired temperature. The lower belt 14 is guided over approximately half the circumference of the third drum 22, which is heated by channels 54. The lower belt 14, therefore, also has desired temperature at the beginning of the product gap 26.

[0042] Downstream of the first drum 16 six pairs of pressure rollers 42 are arranged. Each pair of pressure rollers 42 comprises an upper pressure roller and a lower pressure roller, each upper pressure roller being arranged above a respective lower pressure roller when seen in the vertical direction which is vertical to the transport direction 20. The respective upper pressure roller touches the backside of the lower part of the upper belt 12 and the respective lower pressure roller touches the backside of the upper part of the lower belt 14. In other words, the upper pressure rollers touch a backside of the upper belt which faces away from the product gap 26 and the lower pressure rollers touch a backside of the lower belt 14 which faces away from the product gap 26.

[0043] In between two pairs of pressure rollers 42 a pair of heating devices 44 is arranged. Each pair of heating devices 44 comprises an upper heating device for blowing hot air against the backside of the upper belt 12 in between two upper pressure rollers. Also, each pair of heating devices 44 comprises a lower heating device blowing hot air against the backside of the lower belt 14 in between two lower pressure rollers. Altogether, five pairs of heating devices 44 are arranged to keep the temperature within the product gap 26 at a desired value or within a desired range. By means of the pairs of heating devices 44, also the pressure rollers 42 are heated.

[0044] The pressure rollers 42 form a zone for applying pressure and heat. The temperature applied to the paper 28 within that zone amounts to 300 °C and a line pressure applied by the pressure rollers 42 amounts to 40 N/mm. It can be seen that a line pressure of 40 N/mm is applied by each pair of pressure rollers 42. Downstream of a pair of pressure rollers 42, the pressure is at least partly released and then again applied by the following pair of pressure rollers 42. By means of the pressure rollers 42, the pressure is, therefore, applied and released six times.

[0045] Downstream of the sixth pair of pressure rollers 42, the upper belt 12 is guided over the second drum 18 and the lower belt 14 is guided around the fourth drum 24. Between the second drum 18 and the fourth drum 24, the product gap 26 therefore ends. The paper 28 having been post-processed is then, downstream of the product gap 26, coiled up onto the second coil 32.

[0046] Fig. 2 schematically shows a second embodiment of a belt press by means of which the inventive method can be carried out.

[0047] It should be understood that the various means for applying heat and pressure explained in fig. 1, fig. 2, fig. 3 and fig. 4 can be combined with each other without it being necessary to combine all means for applying heat and pressure of fig. 1 with all means of applying heat and pressure in fig. 2. E.g., the pressure rollers 42 of fig. 1 can be combined in a belt press with the S-rollers and counterpressure belt shown and explained according to fig. 4 and/or the circulating rollers according to Fig. 3.

[0048] The belt press 100 shown in fig. 2 comprises a first upper belt 112 and a second upper belt 114. The first upper belt 112 is guided around two drums 118, 120. The drums 118, 120 may be heated. The second upper belt 114 is guided around two drums 122, 124. The drums 122, 124 may be heated or cooled. The drums 118, 120 for the first upper belt 112 and the drums 122, 124 for the second upper belt 114 are arranged at the same height and can all rotate in the counterclockwise direction. When seen in the transport direction 20, the second upper belt 114 is arranged downstream of the first upper belt 112. In between the first upper belt 112 and the second upper belt 114 a gap 140 is provided. This gap 140 is arranged between the drum 120 and the drum 122. This gap 140 interrupts the product gap 26, the product gap 26 being open to the upper side within the gap 114. This gap 140 can be used to guide off vapor or steam of the paper being post-processed within the product gap 26. The paper being post-processed within the product gap 26 by the double belt press 100 contains a moisture content of 30% to 70%. The paper is then heated within the product gap by means of the upper belts 112, 114 and the lower belt 116 as well as by means of the pressure rollers 42 and the heating devices 44. The paper within the product gap 26 is heated up to a temperature between 160 °C and 350 °C. Thereby, the moisture contained within the paper at least partly evaporates. Vapors or steam caused thereby can leave the product gap 26 at the gap 140. Vapor and steam produced within the product gap 26 can, thereby, be guided away much faster compared to the double belt press 10 of fig. 1. In the double belt press shown in fig. 1, vapor and steam can only escape from the product gap 26 to the sides, i.e. in fig. 1 in direction of a viewer and into the drawing plane.

[0049] The first upper belt 112 has the same length as the second upper belt 114. In the area of the first upper belt 112 two pairs of pressure rollers 42 are arranged

and one pair of heating devices 44 in between the two pairs of pressure rollers 42. In the area of the second upper belt 114, also two pairs of pressure rollers 42 are arranged and one pair of heating devices 44 within the two pairs of pressure rollers 42.

[0050] The lower belt 116 has approximately twice the length of the first upper belt 112 or the second upper belt 114. The first drum 126 guiding the lower belt 116 at the beginning of the product gap 26 is arranged underneath the drum 118 guiding the first upper belt 112 at the beginning of the product gap 26. The drum 128 guiding the lower belt 116 at the end of the product gap 26 is arranged underneath the drum 124 guiding the second upper belt 114 at the end of the product gap 26. In the area of the lower belt 116, two pairs of pressure rollers 42 and one pair of heating devices 44 are arranged across the first upper belt 112. In the area of the lower belt 116 two pairs of pressure rollers 42 and one pair of heating devices 44 are arranged across the second upper belt 114. Across the drum 120 for guiding the first upper belt 112, in the area of the gap 140 and across the drum 122 for guiding the second upper belt 114 additional pressure rollers 142 are arranged. The pressure rollers 142 abut against the backside of the lower belt 116 facing away from the product gap 26. Heating devices 144 are arranged across the drums 120, 122 and the gap 140 for heating the upper part of the lower belt 116.

[0051] A first layer of paper 28 is unwound from a first coil 130, guided through the product gap 26 and after the end of the product gap 26 is coiled up on a second coil 132. At the same time, a second layer of paper 128 is unwound from a first coil 134, guided through the product gap 26 and after the end of the product gap 26 is coiled up on a second coil 136. By means of the double belt press 100 of fig. 2, two layers of paper 28, 128 can be post-processed at the same time. No separating layer is necessary between the two layers of paper 28, 128. Within the scope of the invention, more than two layers of paper can be post-processed at the same time.

[0052] Fig. 3 shows a belt press 200 according to a third exemplary embodiment of the invention. The belt press 200 is a double belt press and has an upper belt 12 and a lower belt 14 forming a product gap 26 in-between them. The belt press 200 is very similar to the belt press 210 explained in conjunction with fig. 1 and only different features are explained.

[0053] Paper 28 is unwound from the first coil 30, guided through the product gap 26 and temperature as well as pressure is applied to the paper 28 within the product gap 26. After leaving the product gap 26 the paper is coiled up on the second coil 32.

[0054] Within the product gap 26, three pairs of pressure rollers 42 are arranged. In between two pairs of pressure rollers 42, a pair of heating devices 44 is arranged.

[0055] Downstream of the third pair of pressure rollers 42, two pairs of circulating rollers 210 are arranged. Each pair of circulating rollers 210 presents an upper circulating roller device 212 and a lower circulating roller device 214. The upper circulating roller device 212 presents a chain of rollers which is guided and moved counterclockwise around a guiding block. As can be seen in fig. 3, approximately eight rollers of the circulating roller device 212 contact at the same time a backside of the upper belt 12. By means of each roller of the circulating roller device 212, pressure is applied to the paper 28 within the product gap 26. After passing over of each roller, the pressure is shortly relieved and then again applied by the next roller. The lower circulating roller device 214 is designed in the same way as the upper circulating roller device 212 except that the chain of rollers is moved in the clockwise direction. The guiding blocks and/or the rollers of the upper circulating roller device 212 and of the lower circulating roller device 214 may be heated and/or cooled. The second pair of circulating rollers 210 is designed in the same way as the first pair of circulating rollers 210.

[0056] By means of the circulating rollers 210, a temperature of up to 350 °C can be applied to the paper 28 in the product gap 26 and, at the same time, a pressure of 200 kN/m^2 (2 bar) can be applied to the paper 28 within the product gap 26.

[0057] Fig. 4 schematically shows a fourth embodiment of a belt press for carrying out the inventive method. The belt press 300 is very similar to the belt press 10 of fig. 1 and only the different features are explained.

[0058] The belt press 300 comprises an upper belt 12 and a lower belt 14. The lower part of the upper belt 12 and the upper part of the lower belt 14 form the product gap 26 in between them. Paper 28 is unwound from the first coil 30, guided through the product gap 26 in the transport direction 20 and, after leaving the product gap 26, the paper 28 is coiled up on the second coil 32. The upper belt 12 is guided around the drums 16, 18 and the lower belt 14 is guided around the drums 22, 24.

[0059] Within the product gap an S-roller 310 is arranged. The S-roller 310 is arranged in a way to press the upper belt 12 downwards. At the same time, the lower belt 14 is also pressed downwards. This leads to the product gap 26 being first downwardly curved upstream of the S-roller 310 and then again upwardly curved downstream of the S-roller 310. The S-roller 310 can be prestressed in the direction towards the product gap 26, e.g. by a hydraulic cylinder. The S-roller 310 can also be heated or cooled.

[0060] Across the S-roller 310 a counterpressure roller 312 is arranged which abuts against the backside of the lower belt 14. The counterpressure roller 312 is fixed in his position and touches the backside of the lower belt 14 facing away from the product gap 26. The counterpressure roller 312 applies a counterpressure in the region of the S-roller 310. As a consequence, the paper 28 within the product gap 26 is first guided downwards by means of the S-roller 310, then submitted to a line pressure or pressure by means of the counterpressure roller 312 and the S-roller 310. Afterwards, the paper 28 within the product gap 26 is again guided upwards to the same

height as at the beginning of the product gap 26. Upstream of the S-roller 310, a pair of pressure rollers 42 is arranged. This pair of pressure rollers 42 is used to apply a pressure to the paper 28 within the product gap, but is also used to guide the upper belt 12 and the lower belt 14.

[0061] Downstream of the S-roller 310, a further pair of pressure rollers 42 is arranged. This pair of pressure rollers 42 is used to apply pressure to the paper 28 within the product gap, but also to guide the upper belt 12 and the lower belt 14. It can be seen that by means of the pair of pressure rollers 42 upstream of the S-roller 310, by means of the S-roller 310 and the counterpressure roller 312 and by the pair of pressure rollers 42 downstream of the S-roller 310 pressure is applied and again at least partly relieved from the paper 28 three times. By means of the pair of pressure rollers 42 upstream of the S-rollers 310, a first pressure is applied having a first value. By means of the S-roller 310 and the counterpressure roller 312 a second pressure is applied having a second value, the second value being higher than the first value. By means of the pair of pressure rollers 42 downstream of the S-roller 310 a third pressure having a third value is applied to the paper 28, the third value being lower than the second value and, e.g., having the same value as the first value.

[0062] Following the second pair of pressure rollers 42 downstream of the S-roller 310, three pairs of heating devices 44 are arranged. In other words, the paper 28 in this region of the product gap is only heated and only a smaller pressure, smaller than the third value of pressure applied by the pair of pressure rollers 42 downstream of the S-roller 310 is applied to the paper 28. The lower belt 14 is guided in this area of the product gap by supporting rollers 314.

[0063] After leaving the product gap 26, the paper 28 is coiled up onto the second coil 32.

Claims

1. Method for post-processing of a product, especially paper or paperboard, which has been fabricated at least partly from pulp containing lignin, comprising the following steps: Introducing the product (28) into a product gap (26) of a belt press (10; 100) having at least one belt, heating up the product within the belt press (10; 100) to a temperature between 160°C and 350°C and submitting the product (28) within the band press to a line pressure between 30N/mm and 200N/mm and/or a surface pressure between 50 kN/m^2 (0,5 bar) and 600 kN/m^2 (6 bar), especially between 200 kN/m^2 (2 bar) and 600 kN/m^2 (6bar).

2. Method according to claim 1, comprising moistening or drying the product, especially paper (28), in order that the product (28) has a moisture content of 2% to 40%,

3. Method according to claim 1 or 2, wherein the at least one belt is a steel belt or a plastic belt.

4. Method according to claim 1, 2 or 3, wherein the belt press is a double belt press (10; 100) having at least an upper belt and at least one lower belt, wherein heating up the product (28) and submitting the product (28) to pressure takes place in the product gap (26) between the at least one upper belt and the at least one lower belt of the double belt press.

5. Method according to claim 4, wherein the double belt press (10; 100) comprises two steel belts forming at least a portion of the product gap (26) in-between them, wherein the double belt press (10; 100) comprises two plastic belts forming at least a portion of the product gap (26) in-between them or wherein the double belt press (10; 100) comprises a steel belt and a plastic belt forming at least a portion of the product gap (26) in-between them.

6. Method according to claim 5, wherein two plastic belts form at least a portion of the product gap (26) in-between them and wherein on the back side of at least one of the plastic belts, a steel belt runs parallel to the plastic belt for at least a portion of the product gap (26).

7. Method according to claim 34, 5 or 6, wherein an upper belt of the double belt press is perforated.

8. Method according to claim 4, 5, 6 or 7, wherein the double belt press comprises a first upper belt and a second upper belt, the first upper belt being arranged upstream of the second upper belt when seen in a transport direction of the double belt press in the product gap.

9. Method according to at least one the preceding claims, wherein the pressure is applied by means of at least one pressure roller (42, 48), circulating rollers (44, 46, 50), at least one S-roller (124), at least one counter pressure roller (126) and/or at least one counter pressure belt (128).

10. Method according to claim 9, wherein the pressure is applied by means of at least one pressure roller (42, 48), circulating rollers (44, 46, 50), at least one S-roller (124), at least one counter pressure roller (126) and/or at least one counter pressure belt (128) directly to the product (28).

11. Method according to claim 9 or 10, wherein the at least one pressure roller (42, 48), the circulating rollers (44, 46, 50), the at least one S-roller (124), the at least one counter pressure roller (126) and/or the at least one counter pressure belt (128) touches a back side of the at least one belt, the backside of the

belt facing away from the product gap (26).

12. Method according to at least one of the preceding claims, wherein the desired temperature of the product (28) within the belt press (10; 100) is achieved by heating the at least one belt.

13. Method according to at least one of the preceding claims, wherein the pressure is applied and again at least partly released within the belt press (10; 100) at least twice.

14. Method to any of the preceding claims, wherein the pulp has been generated by mechanical pulping.

15. Method according to any of the preceding claims, wherein the product (28) is unwound from a first coil (30), then the product (28) is introduced into the belt press (10; 100) and after leaving the belt press (10; 100) the product is coiled up on a second coil (32).

16. Method according to at least one of the preceding claims, wherein at least two layers of product arranged on top of each other are introduced into the product gap.

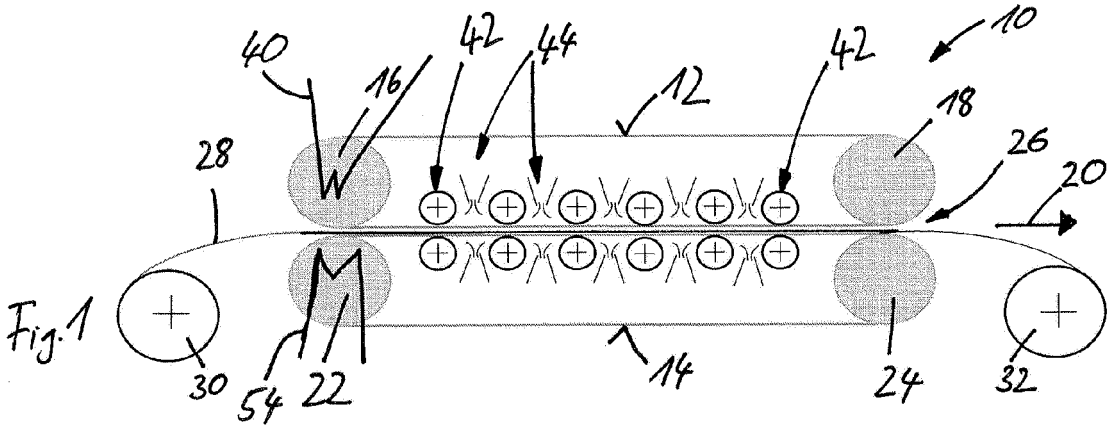

Fig.1

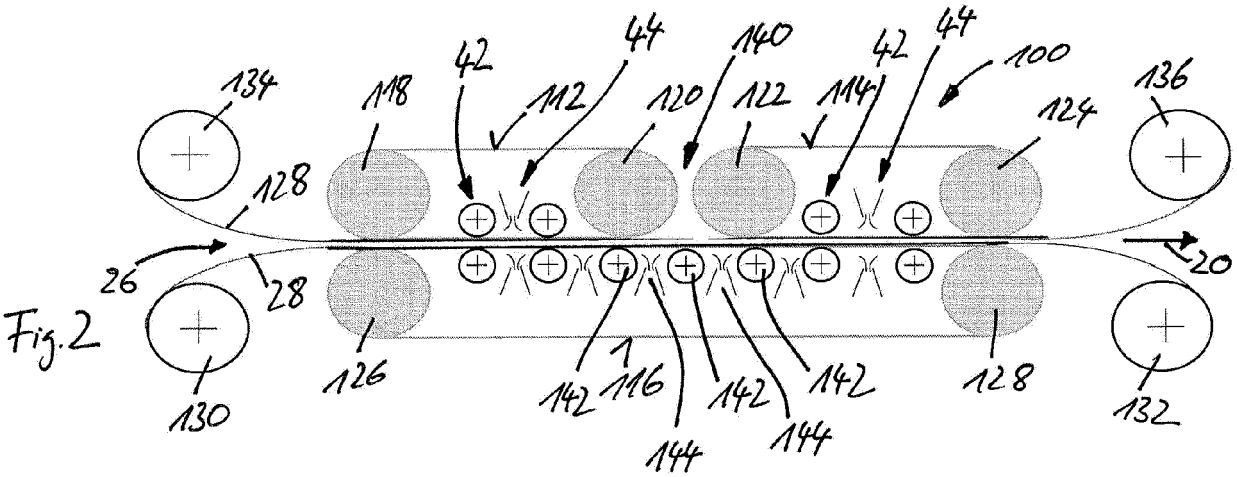

Fig.2

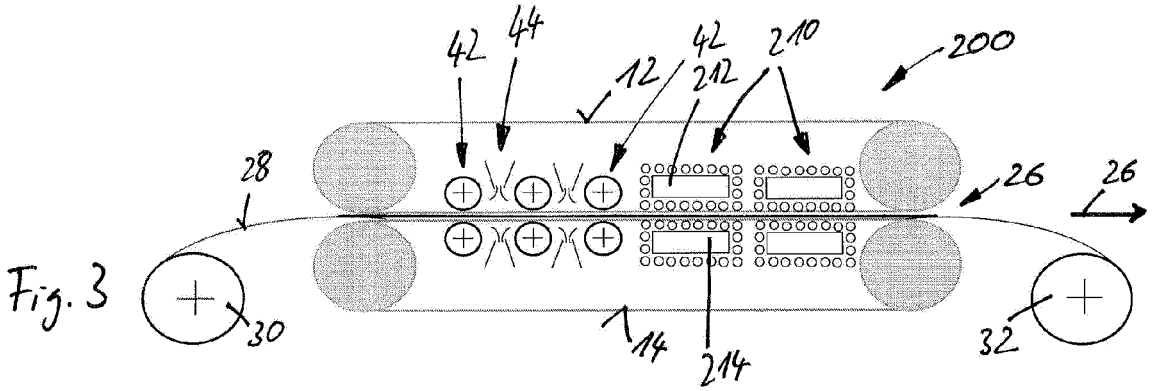

Fig.3

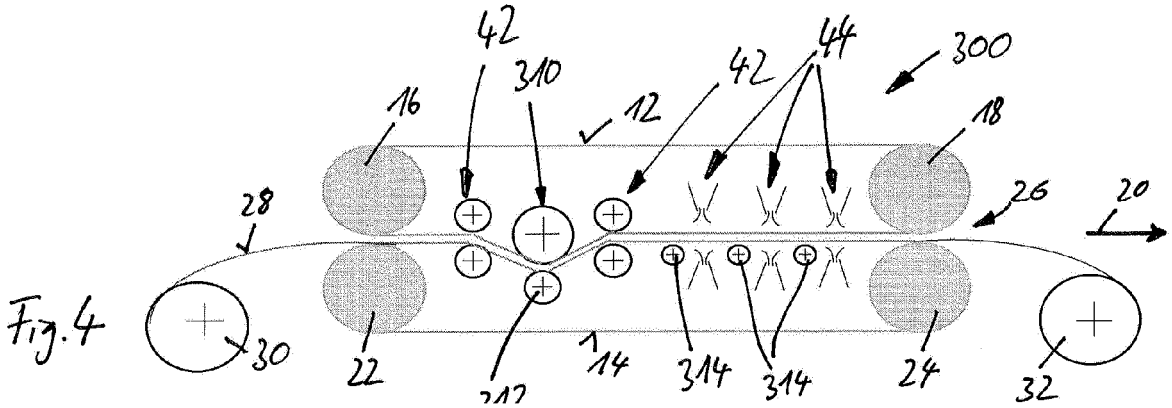

Fig.4

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EUROPEAN SEARCH REPORT

Application Number
EP 22 15 3302

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Y	* page 3, line 26 - page 5, line 22; claim 5; figures 2-5 *	4,5,12, 16	
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D21H
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D21G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 July 2022	Swiderski, Piotr

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