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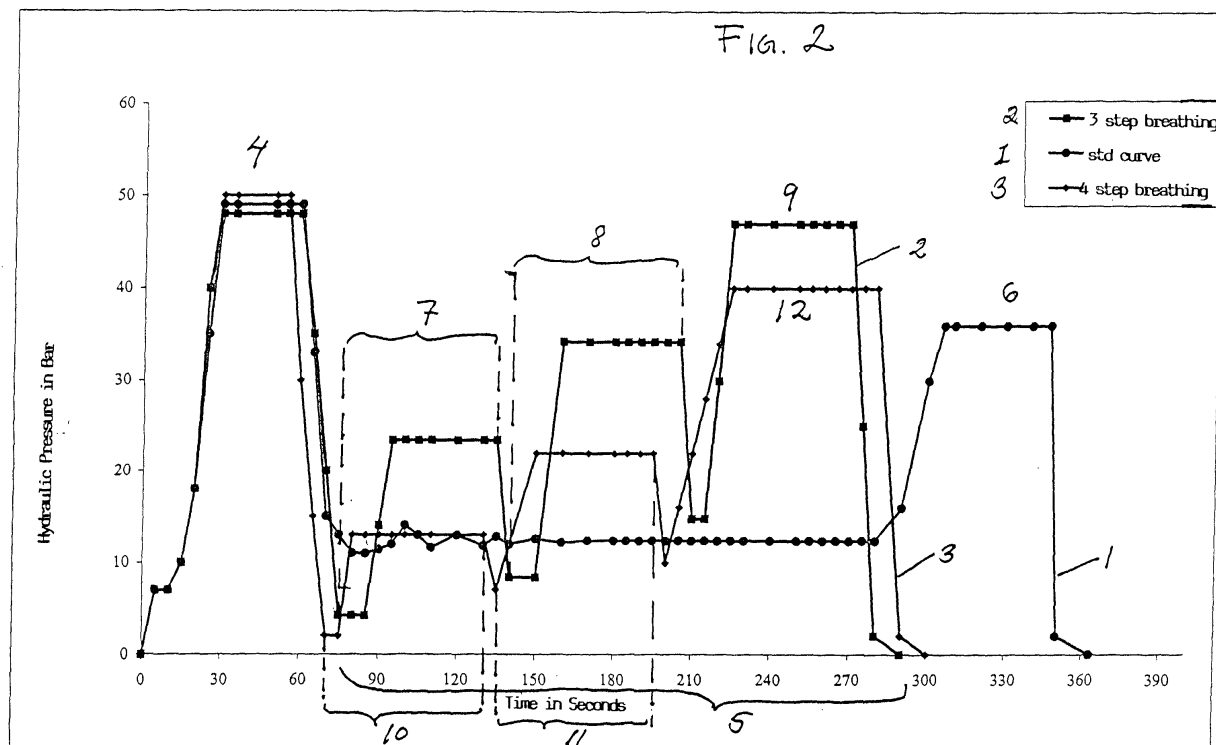
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(54) Method for controlling the pressure in a multi-level press

(57) Device and method for controlling the pressure in pressing cellulose-based boards, where at least one board initially and lastly during said period of time of the pressing is subjected to a high pressure compared to the pressure of an intermediate period called drying period. During the drying period the board is subjected to

at least one breathing cycle, during which the pressure first is decreased to a lower pressure compared to the initial high pressure, and subsequently is increased to a higher pressure compared to the lower pressure of the breathing cycle, and subsequent to the breathing cycle, to a lower pressure compared to the higher pressure of the breathing cycle.



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Description

Technical Field

[0001] The present invention relates to a method and device for controlling the pressure in pressing cellulose-based boards where at least one board initially and lastly during the period of time of said pressing is subjected to a high pressure compared to the pressure of an intermediate period.

Background of the Invention

[0002] Upon production of cellulose-based hardboards, presses are used to squeeze the present material together, and separate the liquid or water from the material, which then is made into hardboards. This is taking place in presses which subject the material to pressuring, and supply heat to the material in order to separate water from the material. In order to increase the productivity of this kind of pressing, so called multi-opening presses has been developed to be able to press several boards simultaneously. Multi-opening presses comprise a frame with several press tables, between which the cellulose-based boards in relation to one another are put on top of each other, separated by the press tables. All these press tables are connected to one another in such way that by pressure on a top piece placed above all press tables, and on a lower piece placed below all press tables, all press tables are pressed together and therefore also the intermediate cellulose-based boards by the tables placed above and below, respectively. The multi-opening presses have been used for a long time in the industry for production of cellulose-based hardboards, e.g. so called Masonite™ Boards.

[0003] The Swedish patent SE 7 603 538-5 discloses a multi-opening press, but first-hand is a vertically adjustable material feeding and press bed feeding out device designed for a multi-opening press for the production of boards presented.

[0004] Further, the Swedish patent SE 8 502 937-9 presents a multi-opening press, but first-hand is a device for multi-opening presses disclosed, which by a feeding lift by means of a feeding device simultaneously transfers an amount of conveying plates loaded with pressing material to the press, and after the pressing operation transfers them away from there by means of an extractor to a feeding out lift.

[0005] The prior art principle of pressing of cellulose-based boards has been used for many decades without any significant changes or improvements of the pressing diagram, which the pressing operation follows. The principles of a standard pressing diagram includes a rapid closing of the multi-opening press and a sharp increase of the pressure to achieve maximum squeeze out of water from the cellulose-based boards. After this relatively short initial high-pressure period a drying pe-

riod follows at a considerably lower pressure compared to the initial high-pressure, and also heat is supplied. The object of these measures during the drying period is to remove remaining damp in the form of water vapour from the boards. In some presses, lastly the boards are also subjected to a high-pressure to consolidate the physical board properties.

[0006] The general believe in the industry has been, if during the period of lower pressure the pressure is decreased to a level of about 8 Bar, there is a risk that the cellulose-based boards will be blown out of the press, due to the intrinsic vapour pressure and that the targeted board densities (950-1050 kg/m³, approximately) will not be reached. It has been shown that the pressure during the low-pressure period during which drying normally occur, in order to reach the final board density, by most of the commercial hardboard lines is significantly higher than the vapour pressure generated within the board at a given press plate temperature.

[0007] Thus, the present invention is based upon the insight that there is a physical limitation of the water vapour to freely leave the intrinsic of the board, resulting in an unnecessarily long drying time period of the board.

The Object of the Invention

[0008] The object of the present invention is to make the production of cellulose-based boards more efficient, preferably in a multi-opening press, by way of suitable pressuring during the drying period, and thus decreasing the time period of the same and in this way enabling a more rapid production rate of the method in accordance with the preamble of claim 1.

Summary of the Invention

[0009] The present inventors' solution of the problem mentioned above is to provide a method and a device providing a radical change in the pressing procedure by replacing the prior art method comprising a drying period with a relatively constant low pressure by a method for controlling the pressure in pressing said cellulose-based boards where at least one board initially and lastly during the period of time of said pressing is subjected to a high pressure compared to the pressure of the intermediate drying period, during the drying period the board being subjected to at least one breathing cycle, during which breathing cycle first the pressure is decreased to a lower pressure compared to the initial high pressure, and then is increased to a higher pressure compared to the lower pressure of the breathing cycle, and subsequent to the breathing cycle, to a lower pressure compared to the higher pressure of the breathing cycle. Preferably, the lower pressure of the breathing cycle is below the pressure used during the drying period in prior art methods, and preferably is adapted to the temperature level reached within the board at this time. This lower pressure allows free escape of generated va-

pour. Increasing the pressing pressure after this initial relatively short low-pressure period results in a more efficient transmission of heat to the board and promotes to give the board its properties. The expected result is a shortened pressing process enabling a considerable increase in production rate to limited investment costs.

[0010] According to an advantageous embodiment of the method according to the invention, the higher pressure of a breathing cycle is lower than the said initial high pressure.

[0011] According to a further advantageous embodiment of the method according to the invention, during the drying period the board is subjected to several breathing cycles, two, for example, or several breathing cycles. Every breathing cycle comprises a low-pressure period followed by a high-pressure period. This further makes the separation of damp in form of water vapour and other gases from the board more efficient.

[0012] According to another advantageous embodiment of the method according to the invention, the higher pressure of a breathing cycle is higher than the higher pressure of a preceding breathing cycle, and it is yet more advantageous if also the lower pressure of the breathing cycle is higher compared to the lower pressure of a preceding breathing cycle. This results in several gradually increases in pressure resulting in a gradual increase in pressure on the board during the drying period until the board is subjected to the final high pressure of the pressing process, which further improves and speed up the separation of liquid or water from the board.

[0013] According to yet another advantageous embodiment of the method according to the invention, the lower pressure of each breathing cycle is in the interval of 1 to 30 % of the said initial high pressure, and the higher pressure of a breathing cycle is in the interval of 2 to 10 times higher than the lower pressure of the same breathing cycle.

[0014] According to an advantageous embodiment of the method according to the invention, the method is executed in a pressing being hydraulically controlled, as, inter alia, the hydraulically controlled pressing is the most common pressing within the field of technology.

[0015] According to a further advantageous embodiment of the method according to the invention, the method is used in a multi-opening press. The multi-opening press has the advantage to be able to simultaneously press several boards and enables an efficient breathing and thus an increased production rate.

[0016] According to the present invention a device is also provided for pressing cellulose-based boards, which comprises a control device arranged to control the pressure in pressing the boards, where at least one board initially and lastly during the period of time of said pressing is subjected to a high pressure compared to the pressure of the intermediate period, the intermediate period being called drying period. Further, during the drying period the control device is arranged to subject

the board to at least one breathing cycle during which the pressure first is decreased to a lower pressure compared to the initial high pressure and subsequently is increased to a higher pressure compared to the lower pressure of the breathing cycle, and subsequent to the breathing cycle, to a lower pressure compared to the higher pressure of the breathing cycle.

[0017] Further, by letting the device according to the invention to adopt the advantageous features presented in the appended claims 1 to 8, several advantageous embodiments of the device according to the invention is provided.

[0018] The present invention introduce totally new ways of reasoning regarding the pressing technology of prior art and to fully execute the present invention in prior art presses, these presses need to be adapted by a suitable, modified controlling equipment. This is due to the practical electromechanical limitations of the hydraulically controlling system of prior art presses.

[0019] Further, an advantage shown in both laboratory and in experiments in factory, due a shortening in the pressing process, is that the surface of the boards becomes lighter and more evenly coloured.

Brief Description of the Drawings

[0020] The present invention will now, with the purpose of exemplifying, be described more in detail by way of embodiments and by referring to the appended drawings, wherein

Fig. 1 shows a conventional multi-opening press, Fig. 2 shows a diagram presenting a curve of the pressure diagram, which prior art pressing processes follow, and the curves of two pressure diagrams, which two embodiments of the pressing method in accordance with the present invention follow.

Detailed Description of the Invention

[0021] Fig. 1 shows an embodiment of a multi-opening press with 25 levels or press tables 1. Intermediate the press tables cellulose-based boards are fed in, for example by way of the feeding in devices disclosed in the Swedish patents 7 603 538-5 and 8 502 937-9. The press is set up on a frame, and is terminated by a top piece 2 placed above all press tables. The frame and top piece 2 are interconnected by way of columns 3 at the longitudinal side of the press, and under the pile of press tables 1, there is a lower piece 4. The pressing pressure is produced by press cylinders provided with pistons 5, to which the lower piece 4 is connected. The press tables 1 comprises of 60 mm, approximately, thick steel plates provided with longitudinal canals for vapour and hot water. The canal system is such that an even distribution of heat is provided over the press table. On the backside of the press, there is a pipe system 6, one end of each pipe of the system being connected to one

press table for inlet and outlet of water or vapour and the other end of each pipe being connected to a vertical pipe 7, which supply vapour and hot water or drain off condensed vapour or cooled hot water. Each part of the press has solid dimensions to be able to work at high pressures.

[0022] By reference to Fig. 2, three curves are shown, of which one curve 1 of a standard pressure diagram is followed by prior art pressing processes, and two curves 2, 3 of two pressure diagrams are followed by two embodiments of the pressing method in accordance with the present invention.

[0023] Pressing of hardboards, preferably 3,2 mm thick hardboards, according to prior art pressing technology shown in Fig. 2 goes on for between 300 seconds and 400 seconds. This period of time is dependent upon the sort of wood raw material and pressing temperature. When each press table is loaded with a board, the boards are subjected to a high initial specific surface pressure 4 between 45 and 55 Bar during 30 to 60 seconds, approximately, in order to reach maximum mechanical squeeze out of liquid. Subsequently follows a low-pressure period 5 called drying period, during which the boards are subjected to a low surface pressure, whereby damp is separated from the board in the form of water vapour. During this low-pressure period 5 the boards are subjected to a specific surface pressure between 10 and 14 Bar, and this low-pressure period 5 goes on for 220 to 240 seconds, approximately. Lastly, the boards are subjected to a final high surface pressure 6 between 30 and 40 Bar during 40 to 60 seconds, approximately. Subsequently, the pressed boards are fed out of the multi-opening press.

[0024] Further, Fig. 2 shows a curve 2 of a pressure diagram, which an embodiment of the present invention follows. First, the boards are subjected to an initial high specific surface pressure 4 of 50 Bar, approximately, during 40 seconds, approximately. Subsequently, the boards are subjected to a first breathing cycle 7, during which the surface pressure is decreased and kept on a lower level, the boards being subjected to a lower specific surface pressure between 2 and 4 Bar during 2 to 10 seconds, approximately, and then is increased and kept on a higher pressure level, the boards being subjected to a higher specific surface pressure between 22 and 25 Bar during 40 seconds, approximately. Subsequent to this first breathing cycle 7 a second breathing cycle 8 follows, during which the boards are subjected to a lower surface pressure between 5 and 10 Bar during 5 to 10 seconds, approximately and subsequently subjected to a higher surface pressure between 32 and 36 Bar during 40 seconds, approximately. Subsequently, the surface pressure is decreased to 12 Bar, approximately, and lastly the boards are subjected to a final high pressure 9 between 45 and 50 Bar during 50 seconds, approximately, and thereafter the pressed boards are fed out of the multi-opening press. This pressing goes on for about 290 seconds.

[0025] Further, Fig. 2 illustrates a curve 3 of a pressure diagram, which an embodiment of the present invention follows. First, the boards are subjected to an initial high specific surface pressure 4 of 50 Bar, approximately, during 30 seconds, approximately. Subsequently, the boards are subjected to a first breathing cycle 10, during which the surface pressure is decreased and kept on a lower pressure level, whereby the boards are subjected to a lower surface pressure of 2 Bar, approximately, during 5 seconds, approximately, and then is increased to and kept on a higher pressure level, whereby the boards are subjected to a higher pressure of between 12 and 14 Bar, approximately, during 45 seconds, approximately. Thereafter a second breathing cycle 11 follows, during which the surface pressure first is decreased, without pressure level keeping, to a lower surface pressure of about 7 Bar and subsequently increased to and kept on a higher surface pressure between 22 and 24 Bar during 45 seconds, approximately. Thereafter, an additional pressure decrease without pressure level keeping to a pressure level on 10 Bar, approximately, is provided, and lastly the boards are subjected to a final high surface pressure 12 between 45 and 50 Bar during 60 seconds, approximately, after which the boards are fed out of the multi-opening press. This pressing goes on for about 300 seconds.

[0026] Emerging from Fig. 2, during a pressing process according to the invention, the surface pressure on the boards is in general between 0 and 60 Bar, and the pressing process of boards, of 3,2 mm thick boards, for example, goes on for a period of time of about 270 to 320 seconds. These intervals are not limiting to the present invention, but the periods of time of the pressing process could be shortened or extended, and in some cases, even the upper level of said pressure intervals can be increased.

Claims

1. Method for controlling the pressure in pressing cellulose-based boards where at least one board initially and lastly during said period of time of the pressing is subjected to a high pressure compared to the pressure of an intermediate period, the intermediate period being called drying period, **characterized in that** during the drying period the board is subjected to at least one breathing cycle, during which the pressure first is decreased to a lower pressure compared to the initial high pressure, and subsequently is increased to a higher pressure compared to the lower pressure of the breathing cycle, and subsequent to the breathing cycle, to a lower pressure compared to the higher pressure of the breathing cycle.
2. Method according to claim 1, **characterized in that** the higher pressure of a breathing cycle is lower

than said initial high pressure.

3. Method according to claim 1 or 2, **characterized in that** during the drying period the board is subjected to several breathing cycles. 5
4. Method according to claim 3, **characterized in that** the higher pressure of a breathing cycle is higher than the higher pressure of a preceding breathing cycle. 10
5. Method according to claim 3 or 4, **characterized in that** the lower pressure of a breathing cycle is higher compared to the lower pressure of a preceding breathing cycle. 15
6. Method according to any of the previous claims, **characterized in that** the lower pressure of each breathing cycle is in the interval of 1-30 % of said initial high pressure, and that the higher pressure of a breathing cycle is in the interval of 2-10 times higher than the lower pressure of the same breathing cycle. 20
7. Method according to any of the previous claims, **characterized in that** said pressing is a hydraulically controlled pressing. 25
8. Method according to any of the previous claims, **characterized in that** the pressing takes place in a multi-opening press, in which several boards simultaneously are pressed. 30
9. Device for pressing cellulose-based boards, which comprises a control device arranged to control the pressure in pressing the boards, where at least one board initially and lastly during the period of time of the pressing is subjected to a high pressure compared to the pressure of the intermediate period, the intermediate period being called drying period, **characterized in that** during the drying period, the control device is arranged to subject the board to at least one breathing cycle during which the pressure first is decreased to a lower pressure compared to the initial high pressure and subsequently is increased to a higher pressure compared to the lower pressure of the breathing cycle, and subsequent to the breathing cycle, to a lower pressure compared to the higher pressure of the breathing cycle. 35 40 45 50
10. Device for pressing according to claim 9, **characterized in that** the control device is arranged to accomplish a pressing operation according to any of the claims 1 to 8. 55

FIG. 1

