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(54) **An arrangement and a method for producing coated board**

(57) The invention relates to an arrangement for producing coated board in a board machine such that a coating station (11, 12, 13) is arranged online to the board machine, and that the arrangement further comprises a drying section (21, 22, 23) comprising a contactless air dryer (21 a, 21 b, 21 c, 22a, 22b, 22c, 23a, 23b, 23c), said drying section (21, 22, 23) is arranged after the coating station (11, 12, 13) in a machine direction for drying the coating on the surface of the board, said coating is

solely dried by means of air drying. The invention also relates to a method for producing coated board having a step of producing board in a board machine, a step of applying coating on the surface of said board in a coating station (11, 12, 13), and a step of drying said coating in a drying section (21, 22, 23) such that the coating station (11, 12, 13) is arranged online to the board machine, and the coating is solely dried by means of air drying in the drying section (21, 22, 23).

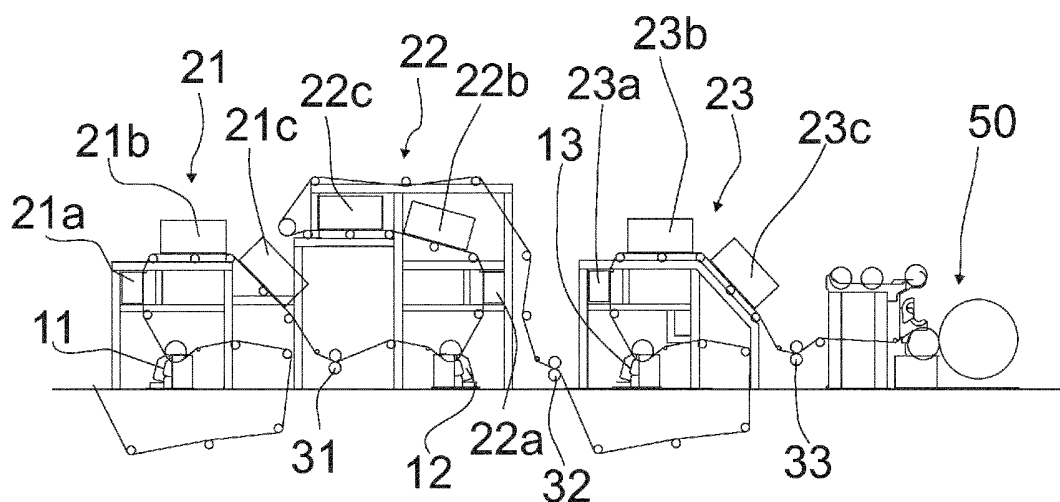


Fig. 3

Description

Field of the invention

[0001] The invention relates to an arrangement for producing coated board as defined in the preamble of the independent claim 1.

[0002] The invention also relates to a method for producing coated board as defined in the preamble of the independent claim 12.

[0003] A traditional way of drying a coating of a board produced in a separate or on-line board machine is using a combination of an infrared (IR) dryer, an air dryer and a cylinder dryer. IR dryer has an advantage of being small in size so that it fits well near to a blade coater, which is a typical coater for coating boards. IR dryer is typically used for pre-heating and initial drying of wet coatings before a board comes into contact with cylinders which finishes the drying of a coating of a board. Normally IR dryers are installed as the first dryers after a coating station to increase the web temperature to the level where fast dewatering makes quick consolidation of the coating color possible.

[0004] EP 1 379 731 B1 discloses an arrangement in the manufacture of coated printing paper based on doctor blade coating technique. It discloses that a paste-like substance is applied on the surface of the printing paper on a coating station and after the coating station the paper passes into a dryer which comprises an infrared dryer and an air dryer and finally the paper web continues to a cylinder group in which the drying of the coated paper continues.

[0005] WO 2008/034513 A1 discloses a method in an online machine for producing coated paper or paper-board. In the method web is formed from a fibrous material mixture in a wire section, the web is dewatered in a pressing section and dried in a drying section which comprises drying cylinders. A precoat is applied to both web sides by way of a size or film press and dried with contactless dryers and in an afterdrying section comprising drying cylinders. The web is presmoothed by way of a soft nip or hard nip calender and finally reeled. A pigment-containing application medium is applied to only one web side of the web after the presmoothing, for which purpose a first coating device, for example a film coater, is used for applying the application medium indirectly by means of an applicator roll and/or a second coating device, for example a blade coater, is used for applying the application medium directly.

[0006] Problem with the above mentioned prior art is that the layout of the machine becomes complicated and the drying of the board is not energy efficient enough for today's energy requirements.

Objective of the invention

[0007] The object of the invention is to provide an energy efficient drying of a coating of a board in a board

machine comprising an online coating station followed by a drying section.

Short description of the invention

[0008] The arrangement for producing coated board according to the invention is characterized by the definitions of the independent claim 1.

[0009] Preferred embodiments of the arrangement are defined in the dependent claims 2 to 11.

[0010] The method for producing coated board according to the invention is correspondingly characterized by the definitions of independent claim 12.

[0011] Preferred embodiments of the method are defined in the dependent claims 13 to 14.

[0012] The invention relates to an arrangement for producing coated board, the arrangement comprising a board machine for producing board and a coating station for applying coating on the surface of the board.

[0013] In a preferred embodiment of the invention board produced in a board machine is coated online in a coating station, preferably in a blade coater, and after that the coating of the board is dried in a drying section solely by means of air. In other words the coating station is arranged online to the board machine and the arrangement further comprises a drying section comprising a contactless air dryer, said drying section arranged after the coating station in a machine direction for drying the coating of the surface of the board, said coating is solely dried by means of air drying. The drying section comprises an air dryer such as an impingement dryer. An impingement dryer is used especially when board is coated only on one side. The single-sided impingement hood is arranged on the side to which the coating is applied and the board is then supported on the opposite side with supporting rolls. The supporting rolls can be arranged to form a linear or curved bath under the dryer. The impingement temperature of air dryer can be on a level of 250 - 450 °C. Although an impingement dryer is typically used when coated only on one side, it can also be used when both sides are coated i.e. it can be used for double sided air drying. The coating station is a blade coater, a curtain coater, a film coater or an air brush coater.

[0014] The invention relates also to a method for producing coated board, said method comprising a step of producing board in a board machine, a step of applying coating on the surface of said board in a coating station and a step of drying said coating in a drying section. The coating station is arranged online to the board machine and the coating is solely dried by means of air drying in the drying section. The coating is dried by at least one air dryer arranged in the drying section and the coating is applied on the surface of the board by a blade coater, a curtain coater, a film coater or an air brush coater.

[0015] In the drying section the coating of the board is solely dried by air such that the drying section can comprise multiple air dryers. Typically the drying section comprises two or three air dryers arranged after the coating

station. The board can be coated on both sides in which case a second coating station with a second drying section follows the first drying section. In between the first drying section and the second coating station a drawing roll group, a cylinder group or a drawing nip is preferably but not necessarily arranged to help the tail threading of the board or can be used for controlling the tension of the board but they do not have any drying properties. The cylinder group can be a cooling cylinder group which cools the board such that the board is not too hot when arriving to a next coating station. In other words a cooling cylinder group reduces absorption of water from the coating. Means for controlling tension of the board is arranged after the drying section and are used for controlling tension of the board or for tail threading purposes, but not for drying of the board. Means for controlling tension of the board is preferably a drawing roll group or a drawing roll nip, but other suitable means for controlling tension of the board can also be used, such as a cooling cylinder group for cooling the board at the same time when used for controlling tension of the board or an S-wrap. S-wrap is achieved by arranging cylinders such that the board travels an S-shaped path. The means for controlling tension of the board do not need to be arranged after every coating and/or drying station, another option is to arrange them after every second station as well. Finally the board is reeled.

[0016] Another possible embodiment of the invention is to use an air flotation dryer in the drying section after the board is coated. Air flotation dryer is used especially when the board is coated on both sides simultaneously or when one side of the board is coated and the other side is for example surface sized or moistened. In an air flotation dryer a board is supported on both sides by air jets or air cushions. One-sided air flotation dryers can also be used. Nozzles used in air flotation dryers are preferably arranged to have a distance of less than 20 mm to the board surface.

[0017] The drying section according to this invention comprises only contactless air dryers such that the coating of the board is solely dried by air. The air contactless air dryers are either impingement dryers, air flotation dryers or a combination of these. An air dryer, such as an air flotation dryer or an impingement dryer, is heated with in-line gas burner or steam coils. Make-up air and combustion air can be taken directly from a fan room or they can be preheated in a heat exchanger. So the heat exchanger is arranged to preheat air used in the gas burner. The energy efficiency of gas heated air dryers can be increased by using heat exchangers where the exhaust air heats up the burner air and make up air and by using the exhaust air in steam heated air dryers. The impingement air is preferably circulated back to the dryer in order to maintain good energy economy. The impingement air can be recirculated by a fan, heated by gas burners and then distributed back to dry the coating of the board. By arranging a heat exchanger and circulating air coming from gas heated burners to steam coils, an efficiency rate

of about 85% can be achieved. A heat exchanger can also be arranged for exhaust air coming from air flotation dryers.

[0018] The air dryers can be used for moisture profiling in a cross machine direction to prevent non-uniform board properties. In other words a contactless air dryer is arranged to adjust and/or control the moisture profile of the board in a cross machine direction.

[0019] The advantage of this invention is to have a compact online finishing section and especially drying section after a coating station in a board machine and having low energy consumption while drying the coating of the board.

15 List of figures

[0020] In the following the invention will be described in more detail by referring to figures, in which

Fig. 1 shows a prior art coating and drying arrangement for board,

Fig. 2 shows one embodiment of the invention, and

Fig. 3 shows another embodiment of the invention.

Detailed description of the invention

[0021] The figure 1 shows an example of a prior art arrangement for drying the coating of the board. Although not shown in the figure the prior art arrangement is an offline process which means that after the board is produced in a board machine it is reeled to be a parent reel and then transferred to an offline coater to be coated in a separate finishing section.

[0022] In the finishing section the first side of the board is coated first on a first blade coater 11 and right after the coating is applied to the surface of the board it goes to a first drying section 21 comprising an IR dryer 21i, two successive air dryers 21a, 21b and a cylinder group 21g. The coating of the board starts drying in an IR dryer 21i. The IR dryer 21i increases the board temperature to a level where fast dewatering makes a quick consolidation of coating color possible. After the IR dryer 21i the board passes into a first air dryer 21a. Figure 1 shows two successive air dryers 21a, 21b. After the two air dryers 21a, 21b the board passes into a cylinder group 21g for further drying. After the drying section 21, i.e. after these four different drying devices the board is coated on the other side as well so another coating station 12 is arranged to coat the uncoated side of the board. After the second coating station 12 which is a blade coater as well a second IR dryer 22i is arranged to dry the coating of the board. The IR dryer 22i is used the same way as the first one, i.e. to start the drying process efficiently before the board moves to air dryers 22a, 22b. After the air dryers 22a, 22b the board passes into a cylinder group 22g for the final drying of the coating of the board. This

arrangement produces board that is coated twice on the upper surface and once for the opposite surface so the board passes after the cylinder group 22g into a third coating station 13 for applying coating to the surface of the board. The third coating station 13 and the third drying section 23 repeats the preceding process in which the board is coated on the blade coater 13 and after the coating is applied to the surface of the board it passes into an IR dryer 23i which starts the drying of the coating and after which the board passes into two successive air dryers 23a, 23b and finally to a cylinder group 23g to finish the drying of the coating of the board. After the last cylinder group 23g the coated board is reeled in a reel 50.

[0023] Drying efficiency of an IR dryer, i.e. the part of electrical energy that is consumed in the heating of the board or evaporation of water, is 25-40%. Some parts of the halogen lamp and the reflectors used in IR dryers cannot stand high temperatures so they have to be cooled. There are also gas IR dryers using gas as an energy source. The portion of energy content of the gas which is transferred to radiation is about 28-55%.

[0024] The main idea of the arrangement for producing coated board according to the invention is to have more energy efficient drying of a coating of a board and this is achieved by using only contactless air drying. Air dryers are typically heated with in-line gas burners or steam coils. Steam pressure in the coils can be regulated so that the impingement temperature can be controlled. The in-line gas burners have a wide area for controlling the impingement temperature. A good energy economy is maintained by circulating about 80-90% of the impingement air back to the dryer and the remaining air is removed as exhaust air. The arrangement according to the invention can comprise air dryers that dry the coating of the board on both sides. Both sided drying is useful when controlling the curling of the board. In prior art arrangements IR dryers are used also to heat the board itself but when arranging an online finishing section with air dryers the need to heat the board is not present anymore and all the heating energy is used for drying the coating of the board.

[0025] The figure 2 shows a first embodiment of the arrangement according to the invention. For the purposes of clarity the figure 2 shows only the finishing section of the board machine although the finishing section is arranged online to the board machine without any reeling or unreeling before it. The board comes from the previous section, which is normally a drying section, to a first coating station 11. The first coating station 11 is preferably a blade coater in which the coating is applied to the board by means of an application roll and the final coating is controlled by a metering blade. Other possibilities for a coating station are a film coater, a curtain coater or an air brush coater. After the first side of the board is coated in the first coating station 11 the board passes into a first drying section 21 which comprises an air dryer 21a, 21b, 21c preferably in the form of an impingement dryer such that the coating of the board is solely dried by means of

air drying. The impingement dryer is preferable in the situation where only one side of the board is coated at a time. An air flotation dryer can be used in situations where both sides of the board are coated simultaneously. A drying section 21, 22, 23 can comprise more than one air dryer but such that the coating of the board is solely dried by air. This means that after a coating station 11, 12, 13 the coating of the board is solely dried by means of air drying. In this embodiment there are three successive air dryers 21a, 21b, 21c arranged to dry the coating of the first side of the board. After the first drying section 21 the board passes into a first drawing roll group 31 which is used for controlling the tension of the board and for tail threading. After the first drawing roll group 31 the board passes into a second coating station 12 into which the uncoated side of the board is coated. From the second coating station 12 the board passes into a second drying section 22 comprising three air dryers 22a, 22b, 22c for drying the coating of the board solely by means of air. After the second drying section 22, in which the coating of the board has dried in three air dryers 22a, 22b, 22c, it travels to the next drawing roll group 32. This embodiment shows an arrangement for producing coated board that comprises two coating layers on one side of the board and one coating layer on the other side of the board. For this reason the board travels after the second drawing roll group 32 into a third coating station 13. In this third coating station 13 a second coating layer is applied to the first side of the board which was coated in the first coating station 11. After the third coating station 13 the board passes into a third drying section 23 comprising three air dryers 23a, 23b, 23c after which the board passes into a third drawing roll group 33 and finally to the reeling section 50 to be reeled.

[0026] The figure 3 shows another embodiment of the invention in which the board path goes the same way as in figure 2 and the online process, i.e. the finishing section being in an online connection to the board machine, comprises three coating stations 11, 12, 13 in which the surface of the board is coated and after each coating station 11, 12, 13 the coating of the board is dried in a drying section 21, 22, 23 in which there are three successive air dryers to dry the coating of the board solely by means of air. All three air dryers in each drying section 21, 22, 23 dry the coating of the board solely by means of air such that after the board has left the last dryer of the coating section the coating of the board is dry enough so that it will not be damaged when moving forward to a next phase in the finishing section. In this embodiment the first dryer 21a in the first drying section 21 is an air flotation dryer having air temperature of over 400 °C or even over 450 °C.

[0027] The coating station 11, 12, 13 is preferably a blade coater, but it can be a curtain coater, a film coater or an air brush coater as well. The board tension is controlled by a drawing roll nip 31, 32, 33 arranged after each drying section 21, 22, 23. In figure 2 the arrangement comprised a drawing roll group instead of a drawing nip

which the drawing roll group takes more space compared to this embodiment with a drawing roll nip and when space for finishing section is limited the drawing nip can be more advantageous. Finally after the last drawing roll nip 33 the board passes into a reeling section with a reel 50.

[0028] In figures 2 and 3 any one of the coating station can be replaced by a surface sizing station for surface sizing one or both sides of the board or moisturizing station for moisturizing one or both sides of the board.

[0029] It is apparent to a person skilled in the art that as technology advanced, the basic idea of the invention can be implemented in various ways. The invention and its embodiments are therefore not restricted to the above examples, but they may vary within the scope of the claims.

Claims

1. An arrangement for producing coated board, the arrangement comprising a board machine for producing board, and a coating station (11, 12, 13) for applying coating on the surface of the board, **characterized in that** the coating station (11, 12, 13) is arranged online to the board machine, and **in that** the arrangement further comprises a drying section (21, 22, 23) comprising a contactless air dryer (21a, 21b, 21c, 22a, 22b, 22c, 23a, 23b, 23c), said drying section (21, 22, 23) is arranged after the coating station (11, 12, 13) in a machine direction for drying the coating on the surface of the board, said coating is solely dried by means of air drying.
2. The arrangement according to claim 1, **characterized in that** the arrangement further comprises means (31, 32, 33) for controlling tension of the board, said means (31, 32, 33) for controlling tension of the board is arranged after a drying section (21, 22, 23) in a machine direction.
3. The arrangement according to claim 2, **characterized in that** the means (31, 32, 33) for controlling tension of the board is a drawing roll nip or a drawing roll group.
4. The arrangement according to claim 2, **characterized in that** the means (31, 32, 33) for controlling tension of the board is an s-wrap.
5. The arrangement according to claim 2, **characterized in that** the means (31, 32, 33) for controlling tension of the board is a cooling cylinder group for cooling the board.
6. The arrangement according to any preceding claims,

characterized in that the contactless air dryer (21a, 21b, 21c, 22a, 22b, 22c, 23a, 23b, 23c) is an air floatation dryer or an impingement dryer or a combination of these.

7. The arrangement according to claim 6, **characterized in that** the contactless air dryer (21a, 21b, 21c, 22a, 22b, 22c, 23a, 23b, 23c) is arranged to adjust and/or control the moisture profile of the board in a cross machine direction.
8. The arrangement according to claim 6 or 7, **characterized in that** the air floatation dryer or the impingement dryer is heated with an in-line gas burner.
9. The arrangement according to claim 8, **characterized in that** a heat exchanger is arranged to preheat air used in the gas burner.
10. The arrangement according to claim 6 or 7, **characterized in that** the air floatation dryer or the impingement dryer is heated with steam coils.
11. The arrangement according to any preceding claim, **characterized in that** the coating station is a blade coater, a curtain coater, a film coater or an air brush coater.
12. A method for producing coated board, said method comprising
 - a step of producing board in a board machine,
 - a step of applying coating on the surface of said board in a coating station (11, 12, 13), and
 - a step of drying said coating in a drying section (21, 22, 23),**characterized in that** the coating station (11, 12, 13) is arranged online to the board machine, and the coating is solely dried by means of air drying in the drying section (21, 22, 23).
13. The method for producing coated board according to claim 12, **characterized in that**, the coating is dried by at least one air dryer (21a, 21b, 21c, 22a, 22b, 22c, 23a, 23b, 23c) arranged in the drying section (21, 22, 23).
14. The method for producing coated board according to claim 12 or 13, **characterized in that**, the coating is applied on the surface of the board by a blade coater, a curtain coater, a film coater or an air brush coater.

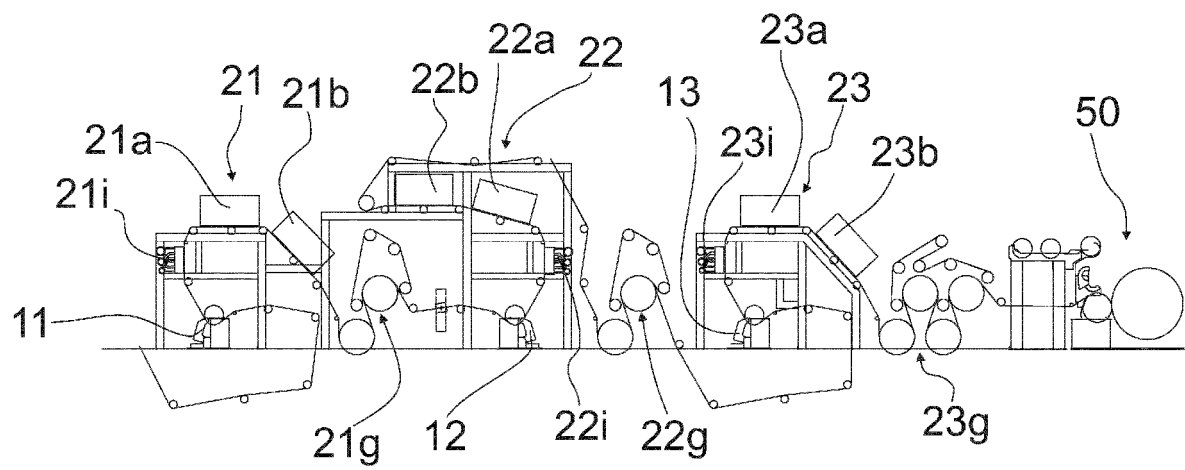


Fig. 1

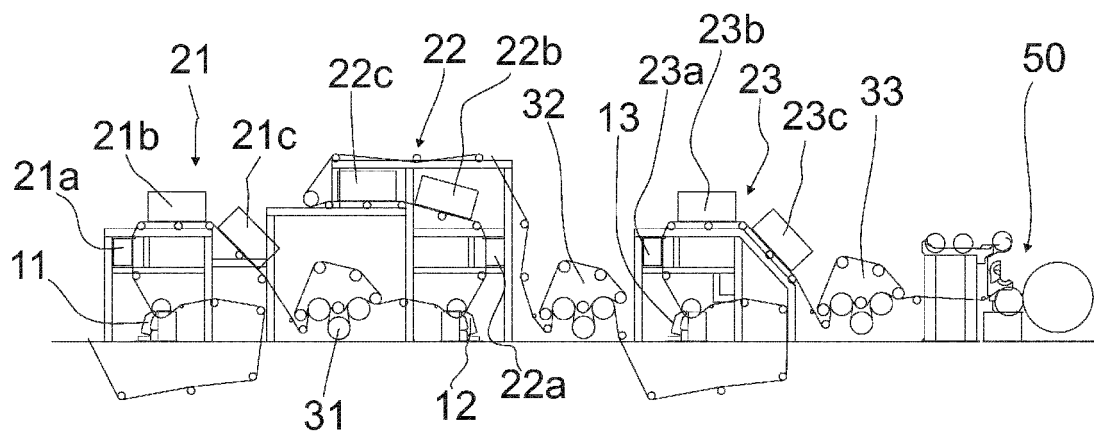


Fig. 2

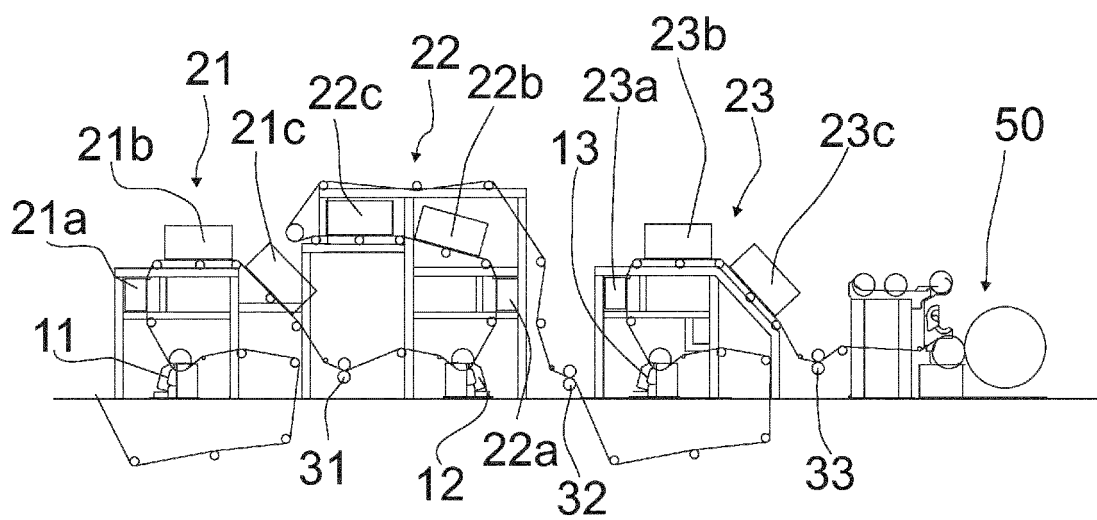


Fig. 3



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