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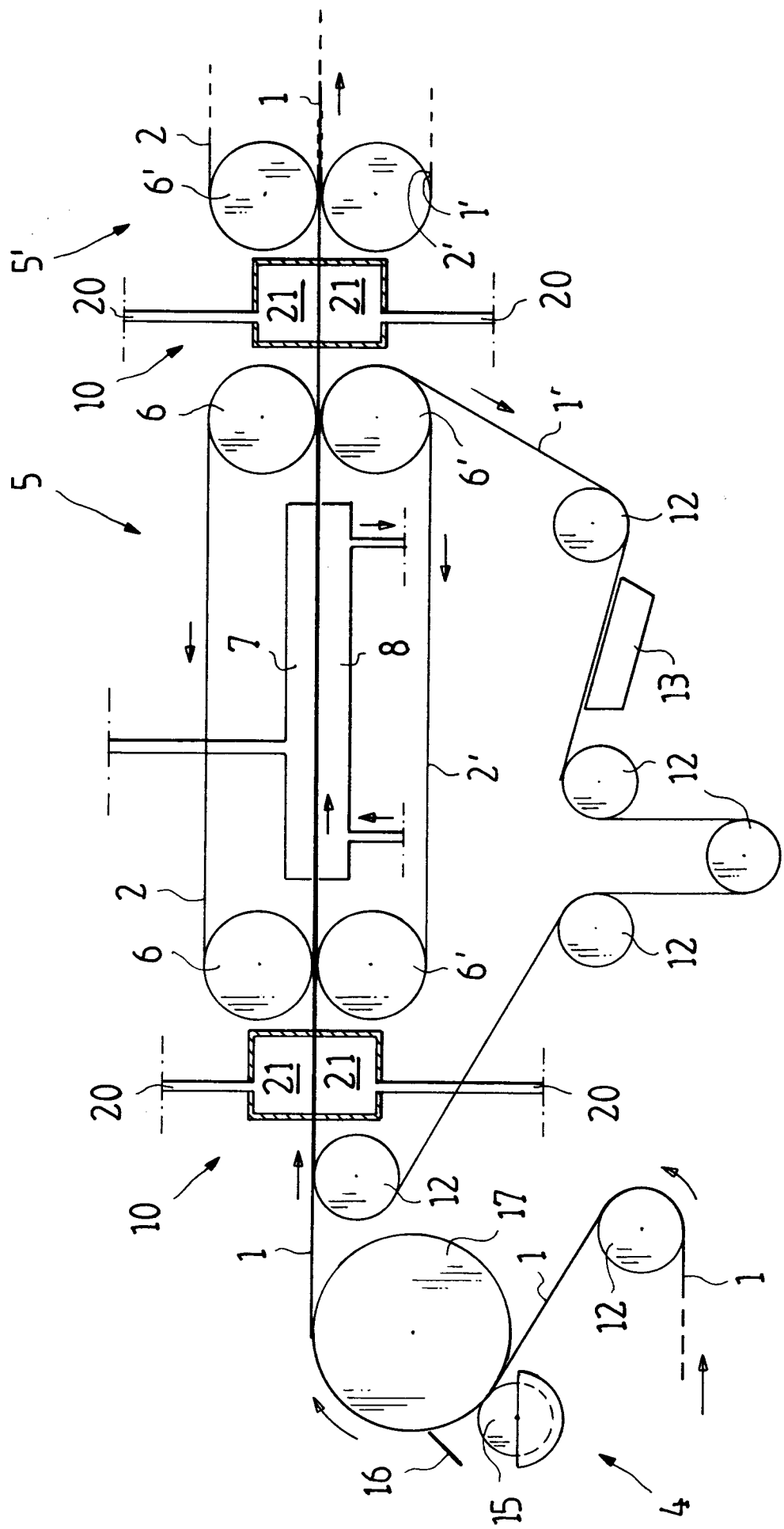
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(54) **Procedure and apparatus for glazing a paper or cardboard web.**

(57) The invention concerns a procedure for glazing a cardboard web, the coated side of the web (1), dry matter content less than 80% by weight, being contacted with the surface of a heated, smooth belt (2), and the opposite side of the web being contacted with a cooled belt (3) or equivalent, and apparatus for implementing the procedure, comprising a smooth belt (2) with heating means (7) for heating the belt, placed immediately after the coating means (4) so that the web is conducted onto the belt immediately after the coating means, with the coating against the belt.



The present invention concerns a procedure for glazing a paper or cardboard web, a coating being applied on one side of the web, the web being dried and the coating glazed.

The invention further concerns apparatus for glazing a paper or cardboard web, comprising a coating means and a drying means.

The methods used to perform glazing of paper and cardboard can be classified by two main groups. To the first main group belong those procedures in which the paper is coated in conventional manner and the coating, dried close to its ultimate dry matter content, is glossed. This group includes several greatly different techniques, such as e.g. brush glossing and high-gloss calendering.

The second main group consists of those procedures in which the coating is dried and glazed on one glossy drying cylinder. This process is known as pour coating.

No very good gloss is achieved with mere brush glossing, and this method is therefore mostly applied in supplementation of calendering. However, calendering has invariably an adverse effect on bulk and stiffness of the cardboard.

In the glossing methods, the pigment coating is first dried, using convection and radiation drying procedures of prior art, and thereafter glossed, using brush glossing or high-gloss calendering. It is however usually necessary to varnish such cardboard which is meant to be printed on, owing to insufficient gloss.

Pour coating gives substantially better gloss than, for instance, brush glossing and high-gloss calendering. Moreover the bulk is not lessened in pour coating. However, the pour coating technique in present use cannot be applied as an on-line process on paper or cardboard machines. This is because the highest running speeds of modern cardboard machines are on the order of 400 to 600 m/min, and paper machines have running speeds up to the order of 1300 m/min. In contrast, the highest feasible running speed in pour coating is on the order of about 100 m/min. The low speed of pour coating is due to the fact that the water to be evaporated from the coating has to be removed on one cylinder through the base web, that is, the wet coating is conducted against a polished cylinder and dewatered through the opposite side of the web. When pour coating is used, the largest possible cylinder diameter is on the order of about 5 m, and this imposes a limit on the region that is available for evaporation, and thus on the drying capacity of the entire process.

The object of the present invention is to eliminate these drawbacks. It is a particular object of the invention, to further develop the pour coating process so that its effectiveness, and the capacity of the pour coating machine, can be raised to be higher than before, retaining at the same time the advantages that

can be gained with pour coating.

Regarding the features characterizing the invention, reference is made to the claims section.

It has been found in investigating the factors affecting the rate of evaporation in connection with the drying of pigment coating on paper or cardboard, that the evaporation rate is affected by the partial pressure of the evaporating substance, that is water, in the close neighbourhood of the evaporation surface compared with the pressure of saturated vapour corresponding to the temperature in the case, and to the partial pressure of any other gases in the region. If drying takes place under atmospheric pressure, the partial pressure of air will be substantially higher than the partial pressure of water vapour. Presence of air retards the evaporation of water substantially. The evaporation rate can be multiplied by removing the air.

Heretofore the so-called Condebelt technique has been employed in connection with papermaking to dry the web. The Condebelt technique is based on the expedient of reducing the air pressure in the pores of the web prior to drying, in addition to which the water vapour produced by evaporation is condensed by cooling, in order to keep the partial pressure of water vapour as low as possible in the evaporating region. The Condebelt technique has not heretofore been used in connection with drying a coating, to say nothing of glazing a coating.

The present invention is based on utilization of the Condebelt technique in connection with coating paper and/or cardboard, and in particular with its glazing. As taught by the invention, the coated side of the paper or cardboard web, dry matter content of the coating less than 80%, is contacted with a heated, smooth, endless and thermally well conductive surface, such as a burnished metal belt, and the opposite side of the web is contacted with a cooled belt, such as a drying felt or equivalent. The moisture present in the coating will then move through the web and it will depart from the web through the opposite side of the web while the coating is in contact with the smooth surface of the belt, so that the gloss of the coating increases during the drying process.

It is thus understood that in the procedure of the invention the Condebelt technique, known in itself in the art in connection with paper drying, is utilized, the coating being, in addition to drying, glazed with the aid of said technique in contact with a smooth belt, e.g. a metallic belt, the coating thus being simultaneously glazed in conjunction with drying. In the procedure, the evaporation rate is multiplied as compared with traditional techniques, by lowering the partial pressure of air and water vapour in the pores of the web. The specific novelty of the procedure is seen in the simultaneous drying and glazing of the coating. Production of gloss is based, in this procedure, on the fact that the exceedingly smooth and glossy metal surface

is replicated on the surface of the wet, and malleable, surface of the coating.

Thanks to the invention, the running speeds can be substantially increased in conjunction with paper coating and glazing. Thanks to the invention, a paper or cardboard web can even be coated in an on-line process adjoined to a paper or cardboard machine. The power applied in drying the coating can be raised to desired level because in the Condebelt technique a metallic belt is used for heat transmitter, instead of a cylinder, and this belt can be made as long as seems desirable, without its imposing any limits on the evaporation distance. If desired, and whenever the drying capacity requires, it is also possible to join a plurality of Condebelt units in succession so that the desired drying capacity will be achieved.

It is particularly essential in the procedure of the invention that the coated side of the web, that is the coating, is contacted with the surface of a heated, smooth and endless belt with good thermal conductivity, immediately after applying the coating and while the coating is moist, dry matter content less than 80%, advantageously less than 70%. Thus, a novel embodiment of the pour coating technique is now concerned. Upon drying the web, the moisture being removed through the web and through the side of the web which is opposed to the coating, the web is released from contact with the smooth belt. The drying technique here employed, the Condebelt technique, is in itself previously known e.g. through the Finnish Patents FI-54514, FI-55539 and FI-59635, which are here included by reference. In the procedure and apparatus of the invention the drying technique and associated vacuum technique known through the references cited, or otherwise, may be applied.

The invention is described in the following in detail with the aid of an embodiment example, referring to the attached drawing presenting an apparatus according to the invention for implementing the procedure.

In Fig. 1 is depicted an apparatus according to the invention for glazing a cardboard web. The apparatus comprises a coating means 4 and a drying means 5. The coating means 4 comprises a conventional applicator roll 15 for spreading the coating material on the surface of the web 1, a doctor blade 16 for levelling the coating, and a backing roll 17, which the web is conducted to lap, running in the direction indicated by arrow 18. The coating means may be any kind of coating means applied in itself in connection with coating paper and/or cardboard.

The drying means 5 comprises an endless, thermally well conductive, polished metallic belt 2, and a heating means 7 for heating this belt e.g. with the aid of steam. The belt 2 is disposed immediately after the coating means 4 in that the web 1 has been conducted onto the belt immediately after the coating means, with the coating against the polished face of the belt

so that the dry matter content of the coating is less than 80% by weight when the coating is being conducted against the belt 2.

Furthermore, the drying means 8 comprises a drying felt 1' with rolls 12 and drying apparatus 13. The drying felt is conducted to run around the rolls 12 in the travelling direction of the web with a speed consistent with that of the web, i.e., of the belt 2. The drying means 5 further comprises and endless, and thermally well conductive, belt 2' with associated rolls and cooling member 8; the belt 2' is conducted to run around the rolls 6' in the direction of travel of the web. The belts 2 and 2' constitute a pair of belts in which the belts run in parallel between the rolls 6 and 6', respectively, pressed against each other. The drying felt 1' and the web disposed upon this drying felt are conducted in between the belts 2,2'.

The polished belt 2 lying against the coating is heated with the aid of a heating means 7; the drying felt under the web is continuously cooled with the cooling means 8 of the belt 1'. The moisture will then move from the coating through the web 2 into the drying felt, and it will condense therein. The drying felt is continuously dried with the aid of the drying means 13, as it makes its circuit of the rolls 12. After passing through the drying means 1, the web is released from the drying felt and conducted to another drying means 5' operating according to the Condebelt technique.

Prior to being conducted into contact with the belt 2, the web has been subjected to vacuum treatment for air removal from the web, that is for reducing the air pressure within the web and the drying felt, in order to enhance the drying process. Web and drying felt are conducted in between the belt 2 immediately following vacuum treatment. The belts 2 and 2' are impermeable to air, and the vacuum treatment of web and felt lowers the air pressure in the web and in the felt, this promoting the drying of the web as the partial pressure of air in the felt is lower than before and thereby the partial pressure of water vapour is enabled to be higher than normal.

The heating means 7 of the belt 2 may be any heating means whatsoever, e.g. electric, gas flame-operated, steam-operated, etc. The heating means may further comprise e.g. a liquid removal means for eliminating the condensed steam.

The cooling means serving the belt 2' and the felt 1' may be any kind of cooling means known in itself in the art, e.g. one operating with a cooled fluid. Furthermore, the drying means 13 serving the felt 1' may be any kind of drying means known in itself in the art, for instance one based on pressure rolls, a heating appliance, vacuum apparatus, etc. Furthermore, the vacuum means 10 may be of any kind whatsoever, based e.g. on vacuum chambers connected with pipelines 20 to a vacuum pump, and sealed against the web 1 and/or the felt 1'.

In the embodiment here presented, the web 1 is

carried in between two belts 2,2' impermeable to air, e.g. of metal, upon a felt 1'. The web may alternatively be conducted to lie against the belt 2, merely upon the felt 1', in which case the cooling means 8 is disposed to cool the felt directly. The felt may in that case be either impermeable or permeable to air.

The embodiment example is meant to illustrate the invention, and the invention is not meant to be confined to the embodiment example; in contrast, its embodiments may vary within the scope of the claims following below.

Claims

1. A procedure for glazing a paper or cardboard web (1), a coating being applied on one side of the web, the web being dried and the coating glazed, **characterized** in that the coated side of the web (1), where the dry matter content of the coating is less than 80% by weight, is contacted with the surface of a heated, smooth, endless and thermally well conductive belt (2), and that the opposite side of the web is contacted with a cooled belt (2) or equivalent so that the moisture present in the coating moves through the web and departs from the web through the opposite side of the web with the coating in contact with said smooth belt, so that the gloss of the coating increases during the drying process.
2. Procedure according to claim 1, **characterized** in that air is removed from the web (1) by means of vacuum treatment.
3. Procedure according to claim 2, **characterized** in that the dry matter content of the coating is less than 70% by weight, advantageously about 55 to 70% by weight, when the web (1) is brought into contact with the smooth belt (2).
4. Procedure according to any one of claims 1-3, **characterized** in that the web (1) and the drying felt (3) are conducted in between two endless and thermally well conductive belts (2,2') impermeable to air, of which the belt adjacent to the coating is heated and the other belt is cooled.
5. Apparatus for glazing a paper or cardboard web, comprising a coating means (4) and a drying means (5), **characterized** in that the drying means (5) comprises a smooth, endless and thermally well conductive belt (2) with rolls (6) and with heating means (7) for heating the belt, said belt being disposed immediately after the coating means (4) in that the web (1) is conducted onto the belt immediately after the coating means (4), with the coating lying against the belt, so that the

dry matter content of the coating is less than 80% by weight, that the drying means includes a cooling means (8) for cooling the opposite side of the web, and that the web is arranged to become detached from contact with the belt after the coating has dried and become glazed against the belt.

6. Apparatus according to claim 5, **characterized** in that the apparatus comprises a vacuum means (10) for removing air from the web by vacuum treatment.
7. Apparatus according to any one of claims 5-7, **characterized** in that the apparatus comprises a drying felt (1') with rolls (12) and drying means (13), the web (1) being conducted against the belt (2) on the felt, and that the cooling means comprises an endless and thermally well conductive belt (2') with rolls (16') and cooling member (8).
8. Apparatus according to any one of claims 5-7, **characterized** in that the apparatus comprises two smooth metallic belts (2,2') with rolls (6,6') and, respectively, heating and cooling means (7,8), that the belts have been arranged to run, on part of their path, parallel and substantially lying against each other, and that the web is conducted in between the belts.
9. Apparatus according to any one of claims 5-8, **characterized** in that the apparatus comprises a plurality of drying means (5), which are placed one after the other in the direction of travel of the web, and that the web is conducted to run through them.

