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54 **Procedure for coating a paper web**

57 The invention concerns a procedure for coating a paper web, in the procedure coating material being applied on the surface of the web being run at high speed and the coating being levelled by scraping. According to the procedure, levelling of the coating is carried out with the aid of a pre-doctor so that the quantity of coating remaining on the web is 12 to 30 g/m², advantageously 12 to 20 g/m², after levelling performed with the pre-doctor, steam is conducted onto the web surface, and the coating levelled with the pre-doctor is levelled a second time with the aid of a scraping doctor so that the quantity of coating remaining on the web, after levelling, is 6 to 14 g/m².

The present invention concerns a procedure for coating a paper web, wherein coating material is applied on the surface of the web which is run at high speed and the coating is levelled by scraping.

Specifically, the invention relates to a procedure for coating a paper web, the running speeds being high, that is in excess of 1000 m/min, advantageously over 1200 m/min, even higher than 1400 m/min, up to the speed of 2000 m/min or even beyond.

In this context paper is understood to be printing paper, e.g. MWC and LWC paper brands, especially printing papers with wood content having a base mass on the order of 30 to 70 g/m².

When paper is being coated at high running speeds, problems occur in the quality of coating, such as gloss, uniformity and faultlessness of coating and other characteristics, and in the runability of the paper. Moreover, at said high running speeds, problems are caused by formation of blade beard on the doctor. These drawbacks could not be eliminated by any procedures of prior art. The drawbacks are in particular problematic in the case of low coating rates, e.g. 6 to 14 g/m².

The object of the present invention is to eliminate the drawbacks discussed in the foregoing. It is a specific object of the invention to disclose a novel procedure for coating a paper web by using which such coating can be done at high running speed.

It is a further object of the invention to disclose a novel paper coating procedure by using which the quality criteria of the paper are high ones, especially at coating rates of 6 to 14 g/m².

Especially, the object of the invention is to disclose a novel paper coating procedure which is applicable in coating printing papers containing wood, e.g. MWC and LWC paper brands, base mass of the base paper advantageously in the range of 30 to 70 g/m².

Regarding the characteristic features of the invention, reference is made to the claims.

The invention is based on the fact observed in studies that have been made, that when pre-levelling of the coating (the first step) is carried out immediately upon coating, by means of scraping with a pre-doctor, so that the coating quantity remaining on the web will be 12 to 30 g/m², advantageously 12 to 30 g/m², and steam is conducted onto the web and the coating levelled with the aid of a pre-doctor is levelled with the aid of a doctor blade (second step) so that the quantity of coating remaining on the web after levelling will be 6 to 14 g/m², the coating meets the desired quality criteria, that is desired gloss, calendering properties etc. characteristics are attained. Furthermore, when the procedure of the invention is employed, no doctor beard will form on the pre-doctor and/or the scraping doctor, which would constitute a factor limiting runability in connection with coating using existing procedures.

The invention is largely based on the circumstance that in the procedure of the invention the paste quantity remaining on the web in the first step thereof is so thin, that is 12 to 30 g/m², that steam can be added on the surface of the web, whereby the moisture gradient of the web is changed so that the formation of doctor beard becomes controllable, that is no doctor beard interfering with runability forms on the pre-doctor or on the scraping doctor. If steam is conducted onto the web surface in a conventional paper web coating procedure, such addition of steam usually does not usually improve the runability of the web, that is the steam added is no help in view of runability of the web. Further, if in the procedure coating in two steps is not applied, i.e., no pre-doctor is used in the procedure, and if the coating quantity applied on the web does not meet that specified in Claim 1, addition of steam is to no avail in view of the web's runability and/or control of doctor beard.

It should be noted in particular that in the second step coating is removed from the web surface and levelling of the remaining coating is done. Heretofore, two-step levelling of the coating has not been performed at high running speeds, that is over 1000 m/min, advantageously over 1200 m/min, not to speak of running speeds over 1400 m/min. Furthermore, the use of steam at such running speeds in order to eliminate problems causing runability is new and unexpected; particularly perseverance of the steam on the surface of the paper web, and in fact its adhesion to the web surface and its transport along with the web, is new and unexpected.

The mode of application of the coating on the web may be any mode of application previously known in itself. Therefore the procedure suits to be used e.g. in connection with application by means of an applicator roll, with nozzle application (in which case the edge of the nozzle adjacent to the web may constitute the pre-doctor), or in general with any mode of coating known in itself in the art. The essential feature of the procedure is that in the second levelling step coating is removed from the surface of the paper web, at the same time levelling the remaining coating.

The steaming can be done close to the pre-doctor or close to the scraping doctor, or anywhere between the two. It should be noted in connection with steaming that a large quantity of steam reduces the dry matter content of the paste. The steam quantity may thus advantageously be selected to be such that it will not substantially reduce the dry matter content of the coating paste.

The effect of the steam can be enhanced by directing the steam onto the web surface by the aid of a special housing, which constitutes a housing confining the web on one side thereof from one margin to the other, and which is sealed with the walls of the housing against the margins of the counter-roll, over a given distance,

e.g. 0.05 to 0.7 m or more in the direction of travel of the web.

Levelling of the coating with the pre-doctor, that is the first levelling step, and levelling of the coating remaining on the web surface and partial removal of the coating, the second scraping step, are advantageously performed against one and the same counter-roll so that the counter-roll braces the web in relation to the coating from the side opposite thereto.

Levelling the coating with the aid of a scraping doctor, the second levelling step, is advantageously performed immediately after the levelling effected with the aid of the pre-doctor, the first step, e.g. up to 5 cm to 0.7 m (even up to 2 m) after the pre-doctor.

When the procedure of the invention is applied, the coating material will form a coating more coherent and presenting better quality than before. The procedure is fit to be used in connection with coatings of any kind of paper known in the art.

The invention is described in detail in the following, with the aid of an embodiment example and referring to the attached drawing, wherein

Fig. 1 presents an embodiment of the procedure of the invention, in elevational view and schematically, and

Fig. 2 presents another embodiment of the procedure of the invention, likewise in elevational view and schematically.

In Figs 1-2, the endless paper web moving in a paper machine in travelling direction a has been conducted to run against a counter-roll 2, partly lapping this roll and being braced by it. On the surface of the web, coating is applied with the aid of an applicator 3, in a way known in itself in the art. Subsequent to the applicator 3, in the running direction a of the web, a pre-doctor 4 has been provided, which levels the coating applied on the web surface so that the quantity of coating remaining on the web surface will be 12 to 30 g/m², advantageously 12 to 20 g/m². After the levelling performed with the pre-doctor 4, the first levelling step, steam is conducted onto the surface of the web, e.g. with the aid of a steam nozzle 5. The steam travels a certain distance along with the web and acts on the coating which was levelled in the first levelling step.

Next, while moving in the travelling direction 4, the web and the coating applied on its surface, levelled and steamed, go to the second levelling step, in which the coating is scraped with the aid of a scraping doctor 6 so that the quantity of coating remaining on the web after levelling is 6 to 14 g/m². In the second levelling step part of the coating is removed from the web surface and, at the same time, the coating is levelled once again. The quality of the coating thus obtained on the paper is high-standard of its quality criteria, and of prime quality.

In Fig. 1, the first coating step has been implemented with the aid of a conventional applicator roll 3. In the procedure, coating material is applied onto the surface of the applicator roll 3 e.g. from a trough 7. The pre-doctor 4 removes the excess of coating material, which is returned to circulation, that is into the trough 7.

In Fig. 1 the steaming has been implemented with the aid of a special housing 8, surrounding the web on its side opposite to its bracing roll 2. The steaming housing 8 aids the deposition of steam on the web surface and, thus, its moistening effect on the coating. Furthermore, the steam, obviously owing to said moistening effect, prevents any doctor beard from forming on the scraping doctor 6; such a beard would otherwise constitute a factor generally limiting the coating process.

In Fig. 2, the first step coating is implemented, using so-called nozzle coating. The edge of the nozzle, in the travelling direction a, on the underside constitutes in this case the pre-doctor levelling the coating.

The speed of the paper web in a procedure as shown in Figs 1-2 may vary e.g. over 1000 m/min, advantageously over 1200 m/min, up to e.g. 2000 m/min, and even beyond.

Example 1

In order to study the usability of the procedure and its advantages, a paper web was coated in this test, using the procedure of the invention. In steam test 1, roll application was employed, and pre-doctor scraping, the operator side was steamed (machine side without steam), and doctor scraping. In steam test 2, likewise roll application was used, and pre-doctor scraping, steaming, and doctor scraping. Paper coated by normal doctor coating served as reference, the coating being applied on the web surface using roll application, and it was scraped in normal manner in single-step doctor scraping. The base paper of the web used in the test was a paper brand containing wood, 34 g/m². The paste used in the test contained 100 parts kaolin and 10 parts latex, dry matter content 62.7% by weight, steaming over the whole web breadth, or 1/2 breadth, test running speed was 1200 m/min in the steam tests. The coating quantity objective was 10 g/m² in the first and second coating steps. The test running speed was 1200 m/min in the reference test.

The dry matter content of the paste in the machine circulation did not change in the application step during the run, although various test plots were run for about 15 to 20 min. with the same paste. In particular during

steaming no changes were noticed in the paste dry matter. The paste dry matter content was 62.6% by weight at commencement and 62.4% by weight on termination of the entire run. In the paste sample from the second scraping doctor the steam effect was observed. The dry matter content of the paste being scraped diminished about 2.5% by weight (initial value 62.6, sample about 60% by weight). The moisture was presumably on the surface of the scraped paste. The quantity of coating measured on the surface of the paper was 10 g/m².

The moisture gradient required for supply was achieved by conducting steam through a nozzle, after the pre-doctor, onto the paste surface about 0.6 kg H₂O per minute and metre of breadth.

The test results are presented in Table 1.

TABLE 1

	Reference	Steam test 1	Steam test 2
Gloss, Hunter, ks	12.9	12.7 (op.s.)/12.5 (m.s.)	12.7
Roughness, Bendtsen	150	150 (jp)/130 (m.s.)	150

The embodiment examples are only meant to illustrate the invention, and embodiments of the invention may vary within the scope of the claims following below.

Claims

1. A procedure for coating a paper web, base mass 30 to 70 g/m², in the procedure coating material being applied on the surface of the web being run and the coating being levelled by scraping, characterized in that the running speed of the web is in excess of 1000 m/min; and that levelling of the coating is carried out in two steps; that the quantity of coating remaining on the web in the first step is 12 to 30 g/m², advantageously 12 to 20 g/m², after levelling performed with a pre-doctor; that steam is conducted onto the web surface immediately after levelling performed with the pre-doctor; and that the coating levelled with the pre-doctor and the steamed coating are levelled in the second step with the aid of a scraping doctor so that the quantity of coating remaining on the web, after levelling, is 6 to 14 g/m² in the second step.
2. Procedure according to claim 1, characterized in that levelling of the coating with the aid of a scraping doctor is performed immediately after levelling taking place with the aid of a pre-doctor.
3. Procedure according to claim 1 or 2, characterized in that application of coating on the web is performed using nozzle coating or, alternatively, an applicator roll.
4. Procedure according to any one of claims 1-3, characterized in that the dry matter content of the paste is on the order of 56 to 66%, advantageously 58 to 64%.
5. Procedure according to any one of claims 1-4, characterized in that the coating is levelled with a pre-doctor so that the quantity of coating remaining on the web after the pre-doctor is on the order of 12 to 18 g/m² and that the quantity of coating remaining on the web surface after levelling performed with a scraping doctor is 6 to 12 g/m².

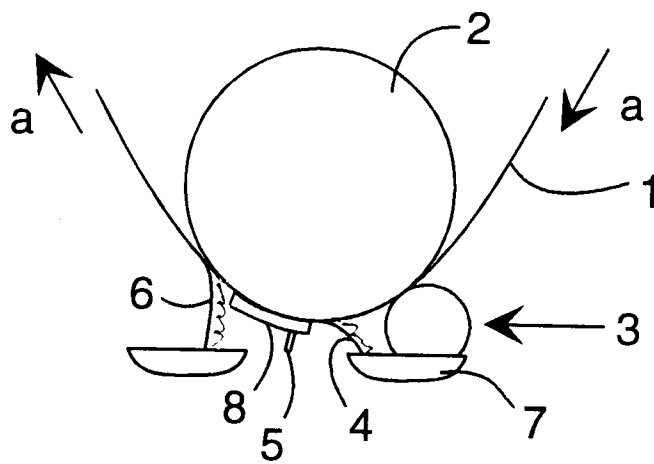


Fig 1

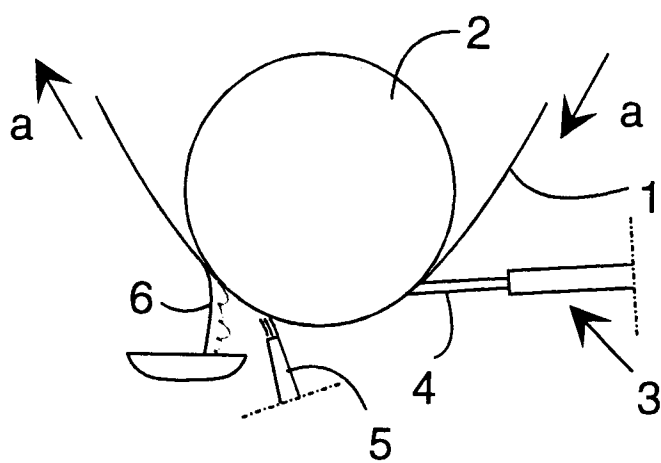


Fig 2