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(54) **METHOD AND DEVICE FOR CALENDERING PAPER, COMPRISING A HEATABLE ROLL**

VERFAHREN UND VORRICHTUNG ZUM KALANDRIEREN VON PAPIER MIT EINER BEHEIZTEN WALZE

PROCEDE DE CALANDRAGE DE PAPIER ET DISPOSITIF CORRESPONDANT COMPRENANT UN ROULEAU CHAUFFABLE

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Description

[0001] The invention relates to a method for calendering paper in a calender according to the preamble of claim 1.

[0002] Such a method is known from DE 4 322 876.

[0003] When the standard of calendering of a paper web is improved, with the conventional solutions, in actual fact, the only possibility in supercalenders has been to increase the number of calendering nips. This has resulted in a more complicated construction of the calender and in more difficult control and tail threading of the paper web. In the case of on-line machines in particular, it must be possible to solve the contradictions arising from high running speed and from threading at full speed. Attempts have been made to solve these problems, among other things, by means of various belt and shoe calenders by which the calendering nip is extended and, thus, the operation of the nip is made more efficient. Belt calenders have been described previously, among other things, in Finnish patents 95 061, 102 304 and 102 305. Technology relating to shoe calenders has in turn been described, for example, in DE publication 43 44 165 and US patent 5 163 364.

[0004] Belt and shoe calenders, i.e. more generally extended-nip calendering, provide a gloss that corresponds to that of a supercalendered quality or is at least fairly close to the gloss achieved by means of supercalendering, but it is difficult to achieve corresponding smoothness. The maximum pressure in the nip of a belt and a shoe calender remains, because of a wider nip, lower than in conventional nips formed between two rolls, for which reason extended-nip calenders are most suitable for paper grades in which bulk preservation is of high significance. Extended-nip calendering has been found to be particularly good in calendering of low-gloss (under 40 % Hunter) paper grades. If clearly higher gloss is desired and required, the nip pressure provided by an extended-nip calender is not in itself sufficient to form gloss.

[0005] The aim of the present invention is to provide a novel method for calendering paper, by which method the drawbacks associated with the state of the art are avoided and which method provide an improved calendering result with respect to the prior art. With a view to achieving this aim, the method according to the invention is mainly characterized by the feature of the characterizing part of claim 1.

[0006] The invention provides a number of advantages over the prior art and of these advantages, for example, the following can be stated in this connection. The properties of an extended-nip calender and a conventional calender provided with a roll nip have been combined in the invention, with the result that, in particular when an extended and low-pressure nip is used as the first nip of the calender, such an extended and low-pressure nip makes it possible to heat, plasticize and suitably mould the paper before the subsequent roll nip. By this means, bulk of the paper can be preserved without compromising

other quality characteristics. At the standard gloss level, a bulk saving of even about 7 % can be achieved as compared with conventional supercalendering. The achieved benefit is based on longer nip dwell time and on higher calendering temperatures. The calendering process is usually a rather "violent" operation towards the paper, but especially when a calendering nip extended in the manner according to the invention is used as the first nip of the calender in particular, it does not put so great stress on the paper as conventional roll nips, with the result that the structure of the paper does not suffer in calendering. The strength properties of the paper can be kept good. The arrangement according to the invention provides more forces parallel to the paper surface and, by the action of these forces parallel to the surface as well as by the action of plasticization of the web, the smoothness of the calendered paper also becomes better than that of the conventional standard. When compared with today's soft calendering in particular, improved microroughness and higher gloss in addition to bulk preservation can be considered to be benefits of the invention. The caliper profiling of the web is, however, performed by means of the roll nip. The other advantages and characteristic features of the invention come out from the following detailed description of the invention.

[0007] In the following, the invention will be described by way of example with reference to the figure in the accompanying drawing, which is a schematic side view of an embodiment of the calender according to the invention intended in particular for two-sided calendering.

[0008] The calender shown in the figure comprises two calender units 10, 110, which have been arranged one after the other with respect to the running direction of a paper web W. The calender comprising the two calender units 10, 110 shown in the figure is used in the case where the paper web W is calendered on both sides. Typically, papers of this kind to be calendered on both sides are, for example, fine papers intended for offset printing. Of course, the invention can also be applied to one-sided calendering of the paper web W, in which connection only one of the calender units shown in the figure is needed. Typically, papers of this kind to be calendered only on one side are, for example, label papers.

[0009] The first calender unit 10 comprises a calender frame 11 in which an extended-nip roll 12, a heatable calender roll, i.e. a so-called thermo roll 16, and a third calender roll 17 have been fitted to form a stack. Said rolls 12, 16, 17 form with one another calendering nips N_1 , N_2 , of which the nip N_1 between the extended-nip roll 12 and the heatable calender roll 16 is an extended nip and, in a corresponding way, the nip N_2 between the heatable calender roll 16 and the third calender roll 17 is a roll nip. In the illustration shown in the figure, the extended-nip roll 12 comprises a roll support 13, a belt shell 14 disposed on it, as well as a loading shoe 15 by means of which the belt shell 14 is loaded against the heatable calender roll 16 to form the extended nip N_1 . The third calender roll 17 can be, as shown in the figure, a so-

called soft roll which is provided with a soft roll cover 18, especially with a polymer cover. In this kind of case, the roll nip N_2 between the heatable calender roll 16 and the third calender roll 17 is a soft nip. On the other hand, if the paper that is being calendered so demands, the third calender roll 17 may be without a soft polymer cover so that the third calender roll 17 is a hard roll, in which connection the roll nip N_2 is also a hard nip.

[0010] In the illustration of the figure, the paper web W is passed, while guided by a spreader roll 20, first into the extended nip N_1 of the calender unit 10. From the extended nip N_1 the paper web W is passed by means of a take-out roll 21 and a spreader roll 22 into the roll nip N_2 . From the second nip of the first calender unit 10, i.e. from the roll nip N_2 , the paper web W is passed, in the illustration of the figure, by means of guide and alignment rolls 23 - 27 to the second calender unit 110 of the calender. If the paper web W needs to be calendered only on one side, it is, of course, not passed to the second calender unit 110, but the paper web W can be passed after the second nip, i.e. the roll nip N_2 of the first calender unit 10 directly to further processing, for example, to a reel-up.

[0011] As already stated above, the calender shown in the figure of the drawing also includes the second calender unit 110, the structure and the operation of which are similar to those of the first calender unit 10. Thus, in the figure, the frame of the second calender unit has been denoted by the reference numeral 111, the extended-nip roll fitted in the frame by the reference numeral 112, the heatable roll by the reference numeral 116, and the third calender roll by the reference numeral 117. Similarly to the first calender unit 10, the extended-nip roll 112 in the second calender unit 110 also comprises a roll support 113, a belt shell 114 disposed on the support, as well as a loading shoe 115 by means of which the belt shell 114 is loaded against the heatable calender roll 116 to form the first nip of the second calender unit 110, i.e. an extended nip N_3 . Further, similarly to the first calender unit 10, the third calender roll 117 forms with the heatable roll 116 the second nip of the calender unit, i.e. a roll nip N_4 . In this calender unit too, the third calender roll 117 may be a soft-surface roll provided with a soft roll cover, in particular with a polymer cover 118, but instead of this it is also possible to use a hard roll when the process so demands. As shown in the figure, the paper web W is passed, while guided by the guide and alignment rolls already previously mentioned as well as by a guide roll 119 and a spreader roll 120, from the first calender unit 10 into the first nip of the second calender unit 110, i.e. into the extended nip N_3 . From this extended nip N_3 , the paper web W is passed, in the embodiment of the figure, by means of a take-out roll 121 and a spreader roll 122 into the second nip of the calender unit, i.e. into the roll nip N_4 . From the roll nip N_4 , the paper web W is passed to further processing, for example, to a reel-up.

[0012] In the embodiment shown in the figure, the paper web W is thus calendered on both sides, first by the

extended nip N_1 , N_3 and after that by the roll nip N_2 , N_4 , which roll nip may be either a soft or a hard nip. Further, as described above, a considerable saving of bulk is achieved by using the extended nip N_1 , N_3 as compared, for example, with traditional supercalendering, and the calendering effect is enhanced by the roll nip N_2 , N_4 in order to provide sufficient gloss. The caliper profiling of the paper web is performed by means of the roll nip.

[0013] Above, the invention has been described by way of example with reference to the figure in the accompanying drawing. However, the invention is not exclusively confined to the example shown in the figure, but the different embodiments of the invention may vary within the scope of the accompanying claims.

Claims

1. A method for calendering paper in a calender which comprises at least one calender unit (10; 110) in which a first calendering nip (N_1 ; N_3) is formed between a heatable calender roll (16; 116) and a first roll (12; 112), through which nip a paper web (W) is guided to run in order to calender the paper on at least one side, in which calender unit (10; 110), a second calendering nip (N_2 ; N_4) is formed with the heatable calender roll (16; 116) and a third calender roll, and the paper web (W) is guided to run through said second calendering nip (N_2 ; N_4) such that, in both calendering nips (N_1 , N_3 ; N_2 , N_4), the same side of the paper web (W) is in contact with the heatable calender roll (16; 116), the first roll (12; 112) being an extended nip roll, so that said first nip is an extended nip, the paper web (W) being calendered in the calender unit (10; 110) first by means of the first calendering nip (N_1 ; N_3), i.e. the extended nip, and after that by means of the second calendering nip (N_2 ; N_4), **characterized in that** the second calendering nip (N_2 ; N_4) is a roll nip formed between the heatable calender roll (16; 116) and the third calender roll (17; 117) that is either a calender roll (17; 117) provided with a soft roll cover (18; 118) such that said second calendering nip (N_2 ; N_4) is a soft nip or a hard-surface calender roll (17; 117) such that said second calendering nip (N_2 ; N_4) is a hard nip.
2. A method according to claim 1, **characterized in that** between the first calendering nip (N_1 ; N_3) and the second calendering nip (N_2 ; N_4), the paper web (W) is taken out of contact with the surface of the heatable calender roll (16; 116).
3. A method according to any one of the preceding claims, **characterized in that**, in the calendering unit (10; 110), caliper profiling of the paper web (W) is performed by means of the roll nip (N_2 ; N_4).
4. A method according to any one of the preceding

claims, **characterized in that**, in the calender, the paper web (W) is passed through two successive calender units (10; 110), between which the paper web (W) is turned such that in the successive calender units a different side of the paper web comes into contact with the heatable calender roll (16; 116) in order to calender the paper web (W) on two sides.

Patentansprüche

1. Verfahren zum Kalandrieren von Papier bei einem Kalandrer, der zumindest eine Kalandriereinheit (10; 110) aufweist, bei der ein erster Kalandrierspalt (N_1 ; N_3) zwischen einer erwärmbaren Kalandrierwalze (16; 116) und einer ersten Walze (12; 112) ausgebildet ist, wobei durch den Spalt eine Papierbahn (W) geführt wird, um zu laufen, damit das Papier an zumindest einer Seite kalandriert wird, wobei bei der Kalandriereinheit (10; 110) ein zweiter Kalandrierspalt (N_2 ; N_4) mit der erwärmbaren Kalandrierwalze (16; 116) und einer dritten Kalandrierwalze (17; 117) ausgebildet ist, und wobei die Papierbahn (W) so geführt wird, dass sie durch den zweiten Kalandrierspalt (N_2 ; N_4) derart läuft, dass bei beiden Kalandrierspalten (N_1 , N_3 ; N_2 , N_4) die gleiche Seite der Papierbahn (W) mit der erwärmbaren Kalandrierwalze (16; 116) in Kontakt steht, wobei die erste Walze (12; 112) eine Langspaltwalze ist, so dass der erste Spalt ein Langspalt ist, wobei die Papierbahn (W) in der Kalandriereinheit (10; 110) zunächst mittels des ersten Kalandrierspalts (N_1 ; N_3), d.h. mittels des Langspalts, und danach mittels des zweiten Kalandrierspalts (N_2 ; N_4) kalandriert wird, **dadurch gekennzeichnet, dass** der zweite Kalandrierspalts (N_2 ; N_4) ein Walzenspalt ist, der zwischen der erwärmbaren Kalandrierwalze (16; 116) und der dritten Kalandrierwalze (17; 117) ausgebildet ist, die entweder eine mit einer weichen Walzenbedeckung (18; 118) versehene Kalandrierwalze (17; 117) ist, so dass der zweite Kalandrierspalt (N_2 ; N_4) ein weicher Spalt ist, oder eine mit einer harten Oberfläche versehenen Kalandrierwalze (17; 117) ist, so dass der zweite Kalandrierspalt (N_2 ; N_4) ein harter Spalt ist.
2. Verfahren gemäß Anspruch 1, **dadurch gekennzeichnet, dass** zwischen dem ersten Kalandrierspalt (N_1 ; N_3) und dem zweiten Kalandrierspalt (N_2 ; N_4) die Papierbahn (W) von dem Kontakt mit der Oberfläche der erwärmbaren Kalandrierwalze (16; 116) weg herausgenommen wird.
3. Verfahren gemäß einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** bei der Kalandriereinheit (10; 110) ein Dickenprofilieren der Papierbahn (W) mittels des Walzenspalts (N_2 ; N_4) ausgeführt wird.

4. Verfahren gemäß einem der vorherigen Ansprüche, **dadurch gekennzeichnet, dass** bei dem Kalandrer die Papierbahn (W) durch zwei aufeinanderfolgende Kalandriereinheiten (10; 110) tritt, zwischen denen die Papierbahn (W) derart gedreht wird, dass bei den aufeinanderfolgenden Kalandriereinheiten eine andere Seite der Papierbahn mit der erwärmbaren Kalandrierwalze (16; 116) in Kontakt gelangt, um die Papierbahn (W) an beiden Seiten zu kalandrieren.

Revendications

1. Procédé de calandrage de papier dans une calandre qui comprend au moins une unité de calandrage (10 ; 110) dans laquelle un premier pinçage de calandrage (N_1 ; N_3) est formé entre un cylindre de calandrage chauffable (16 ; 116) et un premier cylindre (12 ; 112), à travers lequel un pinçage une bande de papier (W) est guidée pour circuler afin de calandrer le papier sur au moins un côté, dans laquelle unité de calandrage (10 ; 110), un deuxième pinçage de calandrage (N_2 ; N_4) est formé avec le cylindre de calandrage chauffable (16 ; 116) et un troisième cylindre de calandrage, et la bande de papier (W) est guidée pour circuler à travers ledit deuxième pinçage de calandrage (N_2 ; N_4) de sorte que, dans les deux pinçages de calandrage (N_1 , N_3 ; N_2 , N_4), le même côté de la bande de papier (W) est en contact avec le cylindre de calandrage chauffable (16 ; 116), le premier cylindre (12 ; 112) étant un cylindre de pinçage étendu, de sorte que ledit premier pinçage est un pinçage étendu, la bande de papier (W) étant calandree dans l'unité de calandrage (10 ; 110) d'abord au moyen du premier pinçage de calandrage (N_1 ; N_3), à savoir le pinçage étendu, et ensuite au moyen du deuxième pinçage de calandrage (N_2 ; N_4), **caractérisé en ce que** le deuxième pinçage de calandrage (N_2 ; N_4) est un pinçage de cylindre formé entre le cylindre de calandrage chauffable (16 ; 116) et le troisième cylindre de calandrage (17 ; 117) qui est soit un cylindre de calandrage (17 ; 117) muni d'un revêtement de cylindre souple (18 ; 118) de sorte que ledit deuxième pinçage de calandrage (N_2 ; N_4) est un pinçage souple ou un cylindre de calandrage à surface dure (17 ; 117) de sorte que ledit deuxième pinçage de calandrage (N_2 ; N_4) est un pinçage dur.
2. Procédé selon la revendication 1, **caractérisé en ce qu'**entre le premier pinçage de calandrage (N_1 ; N_3) et le deuxième pinçage de calandrage (N_2 ; N_4), la bande de papier (W) est prélevée en dehors du contact avec la surface du cylindre de calandrage chauffable (16 ; 116).
3. Procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce que**, dans l'unité

de calandrage (10 ; 110), un profilage d'épaisseur de la bande de papier (W) est réalisé au moyen du pinçage de cylindre (N₂ ; N₄).

4. Procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce que**, dans la calandre, la bande de papier (W) passe à travers deux unités de calandrage successives (10 ; 110), entre lesquelles la bande de papier (W) est retournée de sorte que dans les unités de calandrage successives un côté différent de la bande de papier vient en contact avec le cylindre de calandrage chauffable (16 ; 116) afin de calandrer la bande de papier (W) sur les deux côtés.

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