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(54) **METHOD AND DEVICE FOR FORMING A MULIPLY WEB**

VERFAHREN UND VORRICHTUNG ZUR HERSTELLUNG EINER MEHRLAGIGEN BAHN

PROCEDE ET DISPOSITIF DE FORMATION D'UNE BANDE MULTICOUCHES

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WO-A1-99/09249 **US-A- 3 056 719**

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Description

[0001] This invention concerns a method for high speed forming of a multi-ply paper or board according to the preamble of claim 1, and a forming apparatus according to the preamble of claim 6.

Background of the invention

[0002] Multi-ply forming enables the cost performance relationship of the product to be optimized by using different furnishes in different plies. For many paper products multi-ply technology makes it possible to increase the content of recycled paper and high yield pulps which are interesting both for cost reducing reasons and for environmental reasons. Existing technology fails however to accomplish the task of high speed forming of multi-ply paper or board with superior mechanical properties as well as favourable ply coverage characteristics.

[0003] The need for a forming technology applicable to high production rates is stressed by recent developments in wet pressing technology. Shoe presses giving high press impulses and high pressing efficiency are now being installed in the production of most major paper and board grades.

[0004] Good ply coverage characteristics, i.e. good forming and purity of the individual plies, is an obvious requirement in order to fully utilize the potential of a multi-ply product. The need for a forming technology yielding superior mechanical properties is stressed by the growing interest to use raw materials with a relatively low strength potential such as recycled fibres and high yield pulps.

[0005] Multi-ply forming technology may be grouped into three main categories:

1. Forming each ply in a separate forming unit before couching the plies together.
2. Simultaneous forming of all plies in one forming unit using a multi-layer head box.
3. Forming the web plies on top of each other in a sequential mode, i.e. forming the second ply on top of the first ply and the third ply on top of the second ply etc. The present invention belongs to this category.

[0006] Separate forming is commonly carried out with a multi-fourdrinier machine. Hybrid forming or twin-wire forming (cf. e.g. DE 44 02 273 C2) may also be applied. The increase in dewatering capacity given by two or more separate forming units may be utilized for increased production rates and/or lowered forming consistency for improved sheet properties. All variants of separate forming have one problem in common, however, viz. the ply bonding which generally limits the Z-direction strength of the multi-ply product. Often starch or some other bonding agent have to be sprayed on the plies before couching them together.

[0007] While twin-wire forming would be preferable for speeds above 1000 m/min, avoiding free surface instabilities and providing higher dewatering capacity, the problem of ply-bonding then becomes worse. This is because a twin-wire-formed sheet ply has two wire sides with poor ply-bonding ability, in contrast to a fourdrinier ply which has one wire side and one top side with a better ply-bonding ability.

[0008] Simultaneous forming of a multi-ply product with a multi-layer head box may also be employed. Examples of multi-layer head boxes are found in EP 0 681 057 A2 and in GB 2 019 465. With this method, however, the dewatering capacity is limited to that given by a single dewatering unit. Hence, this principle is not suitable for high speed forming of moderate to high grammages at low forming consistency. Hitherto, it has moreover proved difficult to accomplish acceptable ply coverage characteristics with simultaneous forming.

[0009] Multi-ply forming in a sequential mode has traditionally been applied in the forming of two-ply liner board using a secondary head box placed some distance downstream a fourdrinier wire with dewatering of the top ply through the primary web ply formed upstream of the secondary head box. The problem of ply-bonding is essentially avoided by depositing a fibre suspension onto the pre-formed web. This means that the Z-direction strength of the multi-ply product is often determined by the Z-direction strength of the individual plies rather than by the ply-bonding. Forming a top ply onto a primary web ply on a fourdrinier wire involves several disadvantages, however. It suffices to mention the drawback regarding dewatering capacity and the severe grammage variations due to the free surface occurring especially above 1000 m/min.

[0010] Dewatering in a twin-wire zone created by the wire carrying the primary web ply and an additional, web-free wire through which the top ply is essentially dewatered has been applied shortly after the secondary head box in units relying extensively on vacuum generated dewatering (see e.g. Attwood (1991) "Multi-ply forming", Pulp and Paper manufacture Vol. 7 Paper Machine Operations, TAPPI & CPPA; p.250-251). Dewatering through the previously formed web is thus essentially avoided whereby an improved dewatering efficiency is achieved. Dewatering of the top ply through a web-free wire is moreover advantageous with regard to purity and forming of the top ply, because a separate handling of the white-water of the top ply is possible and because any influence of the primary web ply structure on the top ply is substantially avoided. The capacity of this kind of units is still limited, however, and they are typically used on multi-ply board machines running slower than 600 m/min.

[0011] Roll forming according to Webster's method was introduced in its basic sense some four decades ago (US 3,056,719), and is well-known in the field of high speed production of single-ply paper. The forming

occurs between two wires running over a rotating forming roll, by introducing the fibre suspension jet into the twin-wire nip at such a velocity that the outer one of the tensioned wires is deflected while maintaining a substantially constant tension during the deflection of the outer wire by fact that the outer wire is supported by a rotating support, at least one of which one is resiliently or displaceably mounted to compensate for the deflection. The dewatering pressure is determined by the tension of the outer wire divided with the instantaneous radius of curvature, and during the roll dewatering the pressure rises steeply during an initial phase, after which it levels out to a plateau.

[0012] In WO 99/09249 a method and an apparatus for multi-ply forming are shown, where roll forming according to Webster's method is used for forming a top-ply on top of a primary base ply. Roll forming according to Webster is preferably applied to form all plies including the primary web ply. Two forming and dewatering rolls are shown for each forming unit.

[0013] According to one of the machine configurations shown, a long base wire runs through all the dewatering units, which may imply problems concerning the wire stability as several dewatering units are used. According to another configuration shown, each wire runs over two forming units at the most. A problem with the latter configuration concerns the separation of one of the wires from the paper web and the second wire after the second roll in the forming units, where the second dewatering roll lies over the first roll. The separation herein occurs by means of the outer wire over the second roll leaves this, while the web and the inner wire continues substantially horizontally to next forming unit. At the separation of one of the wires from the paper web and the second wire, there is in the actual dry soilds area a risk that pieces come loose from the paper web. With the actual configuration pieces of the paper web may be thrown out of the nips and due to gravity fall down on the paper web, which may lead to damages on the finished product and to paper web breakage.

[0014] Another drawback with the previous machine constructions concerns the difficulty to obtain a sufficiently short free jet length after the head boxes for the second and the following plies. The incoming wire runs substantially horizontally while the centre of rotation of the chest roll is located substantially vertically over/under the centre of the forming roll. The angle between the incoming wire and the connection line between the centre of rotation of the forming roll and centre of rotation of the chest roll ("the aperture angle"), is thus 90° in the construction described above. With a long free jet length the jet tends break up by instabilitiess before it hits the nip, at which the forming is impaired.

Summary of the invention

[0015] The object of the present invention is to achieve a method for forming a multi-ply paper or board product at high speed, having a low investment cost with maintained high dewatering capacity and avoiding runnability problems related to pieces coming loose from the paper web at the separationpoint of one wire from the paper web and the second wire. According to claim 1, this has been achieved by means of that forming of each ply occurs over only one forming roll, that the wire winding angle over the forming rolls is at least 110°, that the axes of rotation of the forming rolls are located alternatingly in an upper plane and in a lower plane, that for the forming roll or rolls having the axis of rotation in the upper plane where the wires leave the roll in a lower quadrant thereof, where the paper web follows the outer wire, and for the forming roll or rolls having the axes of rotation in the lower plane the wires leave the roll in an upper quadrant thereof, where the paper web also in this case follows the outer wire.

[0016] The wire winding angle should preferably be at least 120° for enabling a high dewatering capacity.

[0017] At the forming rolls being used for forming of the second ply and the following plies, according to a preferred embodiment, the wire with the incoming paper is lead to the respectively forming roll, at an angle of at least 10°, preferably at least 15°, relative to the horizontal plane. In this way space for the head boxes is given while avoiding long free jet lengths.

[0018] Further the invention refers to an apparatus according to claim 6 for forming a multi-ply paper or board product applying the method defined above.

[0019] Further details and characteristics of the invention are stated in the following description and in the dependent claims.

Brief description of the drawings

[0020]

Figure 1 shows schematically an example of an apparatus for forming a three-ply paper web.

Figure 2 schematically illustrates the sectors where the wires leave the roll.

Figure 3 schematically illustrates the geometry around the head box relative to the roll and incoming wire.

Description of embodiments

[0021] A fibre furnish which is fed out from the head box 1 is introduced into a nip created between two tensioned wires, an inner wire 2 and an outer wire 3, both of which wrap around a rotating forming roll 4. The fibre suspension jet is introduced into the twin-wire nip at such a high speed that the outer wire 3 of the tensioned wires is deflected such as is described in US-A-3,056,719. The tension of the outer wire 3 is maintained substantially constant during the deflection, by the fact that it is supported by a rotating support 5, being resiliently or displaceably mounted to compensate for said

deflection. In order ro reduce the cost for the machine investment the principal dewatering occurs in each forming unit over only one forming roll 4, i.e. the wires runs with the fibre suspension/the paper web between over only one roll- the forming roll 4. For obtaining a sufficient dewatering capacity, the roll winding angle α of the outer wire 3 should be at least 110° and preferably at least 120°. The diameter of the roll should be at least 1,2 m, preferably approx. 2 m.

[0022] According to the invention, the forming phase is completed during the roll dewatering. Thereafter the fibre network structure is essentially fixed so that any significant rearrangement of the fibres does not occur as the paper web passes over further dewatering elements. Further consolidation of the paper web may then be accomplished according to well-known methods such as couch rolls, suction boxes and the like, before the paper web enters the press section or another forming unit.

[0023] The wires 2,3 leave the roll 4 in an upper quadrant (see fig. 2), in the example shown, the upper upward quadrant E, where the paper web follows the outer wire 2. The separation of the outer wire 2 with accompanying paper web from the inner wire 3 occurs by means of a suction box 6, or in another way, accomplishing that the paper web follows the outer wire after the forming roll 4. The paper web here follows the outer wire 2 upwards and is later turned over a turn roll 7. By the fact that the paper web and the outer wire 2 is now transported above the inner wire 3 the risk for runnability problems have been reduced, since possible paper web pieces which have come loose at the separation follow the inner wire 3, from which they are removed by a wire sprout or the like. The wires 2, 3 may also leave the roll in the upper downward quadrant F.

[0024] Afterwards the wire 2 transfer the formed primary web ply to a second forming unit. Further dewatering may occur over suction boxes. The second forming comprises a head box 9, a twin-wire nip formed by the wire 2, which now may constitute the inner wire, and an outer wire 10 and also a forming roll 11.

[0025] For avoiding high machine constructions the forming rolls are placed alternatingly in two planes. Thereby the difference in height between the extreme points of the forming rolls are limited to preferably maximum 4-5 m. The first forming roll 4 over which the primary web-ply is formed, thus, is located in a lower plane while the second forming roll 11 is located in an upper plane.

[0026] In the second forming unit a second web-ply is formed on the moist primary web-ply, which preferably has a dryness of 7-15 % by weight. The head box 9 delivers a fibre suspension jet in to the twin-wire nip created by the wires 2 and 10. In this case the jet impingement also occurs at such a speed that the outer wire 10 is deflected.

[0027] The tension of the outer wire 10 is maintained substantially constant during the deflection, by the fact that it is supported by a rotating support 12, being resiliently or displaceably mounted to compensate for said deflection. The forming occurs in an equivalent way as in the first forming unit. The wires 2, 3 leave the roll 4 in a lower downward quadrant H (see fig.2), where the paper web follows the outer wire 10 downwards. The separation of the outer wire 10 with accompanying paper web of the inner wire 2 occurs by means of a suction box 13, or in another way accomplishing, that the paper web follows the outer wire after the forming roll 11. The paper web here follows the outer wire 10 downwards to later be lead over a turn roll 14. Possible pieces of the paper web which have come loose at the separation and followed the outer wire 10 are removed downwards as the outer wire 10 and the paper web are deflected over the turn roll 14. Additional dewatering of the paper web may occur over suction boxes 15. It is also possible that the wires 2, 10 leave the roll a certain distance inside the lower upward quadrant G.

[0028] For a roll rotating in counterclockwise direction in the upper plane the wires leave the roll, in this case preferably in the downward quadrant G (Fig.2).

[0029] In the third forming unit a third web-ply is formed on top of the both other formed plies. The third forming unit is located on the same plane- the lower plane- as the first forming unit. The head box 16 delivers a fibre suspension jet in the twin-wire nip being created by the wires 10 and 17. In this case the jet impingement also occurs at such a speed that the outer wire 17, being supported of a resiliently or displaceably support 19, is deflected.

[0030] In a corresponding way as in the first forming unit the wires 10,17 leave the roll 18 in an upper quadrant E (se fig. 2), where the paper web follows the outer wire 17. The separation of the outer wire 17 with accompanying paper web from the inner wire 10 occurs by means of a suction box 20, or in another way accomplishing, that the web follows the outer wire 17 after the forming roll 18. The paper web follows the outer wire 17 upwards to later be lead over a turn roll 21. Possible pieces of the paper web which have come loose at the separation follow the inner wire 17, from which they are removed by a wire sprout or the like.

[0031] For the most head box constructions a requirement of short free jet length implies an aperture angle of at least 110°. Hence, in all the forming stations an increased space has been created for the head boxes 4, 11 and 18 by means of the fact that the wire with the incoming paper web is angled in relation to the horizontal plane. Thus, the wire forms an angle β to the incoming paper web of at least 10° with respect to the horizontal plane. By this long free jet lengths are avoided at the same time as the decrease of the wire winding angle on the forming roll is reduced.

[0032] The invention is of course not limited to the embodiment shown and described, but several modifications thereof are possible within the scope of the claims. The invention also comprises that one or several of the

head boxes may be a multi-layer head box.

Claims

1. Method for forming a multi-ply paper or board product, in which all the plies are formed on top of each other in a sequential mode, each ply being formed by a roll forming technique of the type where a fibre suspension jet is fed into a nip created between two tensioned wires (2, 3; 2, 10; 10, 17) which wrap around a rotating forming roll (4; 11; 18), the fibre suspension jet being fed into said nip at such a speed that the outer one (2; 10; 17) of the two wires is deflected while maintaining a substantially constant tension during the deflection of the outer wire by supporting the outer wire on rotating supports (5, 7; 12, 14;19; 21), at least one (5; 14; 19) of which is resiliently or displaceably mounted to compensate for said deflection
characterised in that

   - the forming of each ply occurs over only one forming roll (4; 11; 18),
   - the wire winding angle (α) over the forming rolls is at least 110°,
   - the axes of rotation of the forming rolls are located alternatingly in a lower plane and in an upper plane, and
   - for the forming roll or rolls (11) having the axis of rotation in the upper plane the wires (2,10) leave the roll in a lower quadrant (G, H) thereof, where the paper web follows the outer wire (10), and for the forming roll or rolls (4; 18) having the axis of rotation in the lower plane the wires (2, 3; 10, 17) leave the roll in an upper quadrant (E, F) thereof, where the paper web also in this case follows the outer wire (2; 17).

2. Method as claimed in claim 1,
characterised in that the wire winding angle (α) over the forming rolls (4; 11; 18) is at least 120°.

3. Method as claimed in claim 1 or 2,
characterised in that at the forming rolls (11;18) used for forming the second ply and the following plies the wire (2; 10) with the incoming paper web is lead to the respective forming roll (11; 18) at an angle (β) of at least 10°, preferably of at least 15°, relative to the horizontal plane.

4. Method as claimed in any of the previous claims,
characterised in that for the forming roll or rolls (4; 18) having the axis of rotation in the lower plane the wires (2, 3; 10, 17) leave the roll in an upper upward quadrant (E) thereof.

5. Method as claimed in any of the previous claims,
characterised in that for the forming roll or rolls (11) having the axis of rotation in the upper plane the wires (2, 10) leave the roll in a lower downward quadrant (H) thereof.

6. Apparatus for forming a multi-ply paper or board product carrying out the method according to claim 1, in which apparatus the plies are formed on top of each other in a sequential mode, and which apparatus as the only forming unit for forming each ply comprises a roll forming unit of the type where a fibre suspension jet is fed into a nip created between two tensioned wires (2, 3; 2, 10;10, 17) which wrap around a rotating forming roll (4; 11; 18), the fibre suspension jet being fed into said nip at such a speed that the outer one (2; 10; 17) of the two wires is deflected and where the outer wire (2; 10; 17) is supported on rotating supports (5, 7; 12, 14; 19,21), at least one (5; 14; 19) of which is resiliently or displaceably mounted to compensate for said deflection and maintain a substantially constant tension during the deflection of the outer wire,
characterised in that

   - the apparatus comprises only one forming roll (4; 11; 18) for forming each ply,
   - the wire winding angle (α) over the forming rolls is at least 110°,
   - the axes of rotation of the forming rolls are placed alternatingly in a lower plane and in an upper plane, and
   - for the forming roll or rolls (11) having the axis of rotation in the upper plane the wires (2, 10) are arranged to leave the roll in a lower quadrant (G, H) thereof, where the paper web follows the outer wire (10), and for the forming roll or rolls (4; 18) having the axis of rotation in the lower plane the wires (2, 3; 10, 17) are arranged to leave the roll in an upper quadrant (E, F) thereof, where also in this case the paper web follows the outer wire (2; 17).

7. Apparatus for forming a multi-ply web as claimed in claim 6,
characterised in that the wire winding angle (α) over the forming rolls (4;11;18) is at least 120°.

8. Apparatus as claimed in claim 6 or 7,
characterised in that at the forming rolls (11; 18) used for forming the second ply and the following plies the wire (2; 10) with the incoming paper web is lead to the respective forming roll (11; 18) at an angle (β) of at least 10°, preferably at least 15°, relative to the horizontal plane.

9. Apparatus as claimed in any of claims 6 to 8,
characterised in that for the forming roll or rolls (4; 18) having the axis of rotation in the lower plane the

wires (2, 3; 10, 17) are arranged to leave the roll in an upper upward quadrant (E) thereof.

10. Apparatus as claimed in any of claims 6 to 9, **characterised in that** for the forming roll or rolls (11) having the axis of rotation in the upper plane the wires are arranged to leave the roll in a lower downward quadrant (H) thereof.

Patentansprüche

1. Verfahren zum Bilden eines mehrlagigen Papier- oder Pappeprodukts, bei dem alle Lagen in einem sequentiellen Modus übereinander ausgebildet sind, wobei jede Lage durch eine Formierwalzentechnik des Typs ausgebildet ist, bei dem ein Fasersuspensionsstrahl in einen Spalt gespeist wird, der durch zwei gespannte Siebe (2, 3; 2, 10; 10, 17) erzeugt ist, die um eine sich drehende Formierwalze (4; 11; 18) gewickelt sind, wobei der Fasersuspensionsstrahl mit einer Geschwindigkeit in den Spalt eingespeist wird, so dass das äußere (2; 10; 17) der zwei Siebe abgelenkt wird, während durch Unterstützen des äußeren Siebes während der Ablenkung des äußeren Siebes auf sich drehenden Trägern (5, 7; 12, 14; 19, 21), von denen wenigstens einer (5; 14; 19) nachgiebig oder versetzbar angebracht ist, um die Ablenkung zu kompensieren, eine im wesentlichen konstante Spannung aufrecht erhalten wird,
dadurch gekennzeichnet, dass

- das Bilden jeder Lage lediglich über eine Formierwalze (4; 11; 18) stattfindet,
- der Siebwicklungswinkel (α) um die Formierwalzen wenigstens 110° entspricht,
- die Rotationsachsen der Formierwalzen abwechselnd in einer unteren und in einer oberen Ebene angeordnet sind, und
- die Siebe (2, 10) für die Formierwalze oder Walzen (11), deren Rotationsachse in der oberen Ebene liegt, die Walze in einem unteren Quadranten (G, H) davon verlassen und die Siebe (2, 3; 10, 17) für die Formierwalze oder Walzen (4; 18), deren Rotationsachse in der unteren Ebene liegt, die Walze in einem oberen Quadranten (E, F) davon verlassen, indem die Papierbahn auch in diesem Fall dem äußeren Sieb (2; 17) folgt.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der Siebwicklungswinkel (α) um die Formierwalzen (4; 11; 18) wenigstens 120° beträgt.

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** bei den Formierwalzen (11; 18), die zum Bilden der zweiten Lage und der folgenden Lagen verwendet werden, der Sieb (2; 10) mit der einlaufenden Papierbahn zu der entsprechenden Formierwalze (11; 18) in einem Winkel (β) von wenigstens 10°, vorzugsweise von wenigstens 15°, relativ zu der horizontalen Ebene geführt wird.

4. Verfahren nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Siebe (2, 3; 10, 17) für die Formierwalze oder Walzen (4; 18), deren Rotationsachse in der unteren Ebene liegt, die Walze in einem oberen nach oben gerichteten Quadranten (E) davon verlassen.

5. Verfahren nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Siebe (2, 10) für die Formierwalze oder Walzen, deren Rotationsachse in der oberen Ebene liegt, die Walze in einem unteren nach unten gerichteten Quadranten (H) davon verlassen.

6. Vorrichtung zum Bilden eines mehrlagigen Papier- oder Pappeprodukts durch Ausführen des Verfahrens gemäß Patentanspruch 1, bei der die Lagen in einem sequentiellen Modus übereinander ausgebildet werden und bei dem die Vorrichtung als die einzige Formiereinheit zum Bilden jeder Lage eine Formierwalzeneinheit des Typs umfasst, bei der ein Fasersuspensionsstrahl in einen Spalt eingespeist wird, der zwischen zwei gespannten Sieben (2, 3; 2, 10; 10, 17) erzeugt ist, die um eine sich drehende Formierwalze (4; 11; 18) gewickelt sind, wobei der Fasersuspensionsstrahl mit einer derartigen Geschwindigkeit in den Spalt eingespeist wird, dass das äußere (2; 10; 17) der zwei Siebe abgelenkt wird und bei dem das äußere Sieb (2; 10; 17) auf sich drehenden Trägern (5, 7; 12, 14; 19, 21) gestützt ist, wobei wenigstens einer (5; 14; 19) davon elastisch oder versetzbar angebracht ist, um die Ablenkung zu kompensieren und während der Ablenkung des äußeren Siebs eine im wesentlichen konstante Spannung aufrecht zu erhalten,
dadurch gekennzeichnet, dass

- die Vorrichtung lediglich eine Formierwalze (4; 11; 18) zum Bilden jeder Lage umfasst,
- der Siebwicklungswinkel (α) um die Formierwalzen wenigstens 110° beträgt,
- die Rotationsachsen der Formierwalzen abwechselnd in einer unteren und einer oberen Ebene angeordnet sind, und
- die Siebe (2, 10) für die Formierwalze oder Walzen (11) mit der Rotationsachse in der oberen

Ebene derart angeordnet sind, dass sie die Walze in einem unteren Quadranten (G, H) davon verlassen, indem die Papierbahn dem äußeren Sieb (10) folgt, und die Siebe (2, 3; 10, 17) für die Formierwalze oder Walzen (4; 18) mit der Rotationsachse in der unteren Ebene derart angeordnet sind, dass sie die Walze in einem oberen Quadranten (E, F) davon verlassen, indem auch in diesem Fall die Papierbahn dem äußeren Sieb (2; 17) folgt.

7. Vorrichtung zum Bilden einer mehrlagigen Bahn nach Anspruch 6, **dadurch gekennzeichnet, dass** der Siebwicklungswinkel (α) um die Formierwalzen (4; 11; 18) wenigstens 120° beträgt.

8. Vorrichtung nach Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** das Sieb (2; 10) mit der einlaufenden Papierbahn an den Formierwalzen (11; 18), die zum Bilden der zweiten Lage und der folgenden Lagen verwendet werden, zu der entsprechenden Formierwalze (11; 18) in einem Winkel (β) von wenigstens 10°, vorzugsweise wenigstens 15°, relativ zu der horizontalen Ebene geleitet wird.

9. Vorrichtung nach einem der Ansprüche 6 bis 8, **dadurch gekennzeichnet, dass** die Siebe (2, 3; 10, 17) für die Formierwalze oder Walzen (4; 18) mit der Rotationsachse in der unteren Ebene derart angeordnet sind, dass sie die Walze in einem oberen nach oben gerichteten Quadranten (E) davon verlassen.

10. Vorrichtung nach einem der Ansprüche 6 bis 9, **dadurch gekennzeichnet, dass** die Siebe für die Formierwalze oder Walzen (11) mit der Rotationsachse in der oberen Ebene derart angeordnet sind, dass sie die Walze in einem unteren nach unten gerichteten Quadranten (H) davon verlassen.

Revendications

1. Procédé de formation d'un produit de type papier ou carton multicouche, dans lequel toutes les couches sont formées les unes sur les autres dans un mode séquentiel, chaque couche étant formée au moyen d'une technique de laminage du type dans lequel on introduit une suspension de fibres en jet dans une zone de contact créée entre deux toiles métalliques tendues (2, 3 ; 2, 10 ; 10, 17) qui s'enroulent autour d'un rouleau de formation en rotation (4 ; 11 ; 18), le jet de suspension de fibres étant envoyé dans ladite zone de contact à une vitesse qui fait que la toile extérieure (2 ; 10 ; 17) des deux toiles est déviée tout en maintenant une tension sensiblement constante pendant la déviation de la toile extérieure en supportant la toile extérieure sur des supports rotatifs (5, 7 ; 12, 14 ; 19, 21), dont au moins un (5 ; 14 ; 19) est monté de manière élastique ou de manière mobile pour compenser ladite déviation,

caractérisé en ce que

- la formation de chaque couche se produit sur un seul rouleau de formation (4 ; 11 ; 18),
- l'angle d'enroulement (α) des toiles sur les rouleaux de formation est supérieur ou égal à 110°,
- les axes de rotation des rouleaux de formation sont situés alternativement dans un plan inférieur et dans un plan supérieur, et
- pour le ou les rouleau(x) de formation (11) dont l'axe de rotation est dans le plan supérieur, les toiles (2, 10) quittent le rouleau dans un quadrant inférieur (G, H) de celui-ci, où la bande de papier suit la toile extérieure (10), et pour le ou les rouleau(x) de formation (4 ; 18) dont l'axe de rotation est dans le plan inférieur, les toiles (2, 3 ; 10, 17) quittent le rouleau dans un quadrant supérieur (E, F) de celui-ci, où la bande de papier, ici aussi, suit la toile extérieure (2 ; 17).

2. Procédé selon la revendication 1, **caractérisé en ce que** l'angle d'enroulement (α) des toiles sur les rouleaux de formation (4 ; 11 ; 18) est supérieur ou égal à 120°.

3. Procédé selon la revendication 1 ou 2, **caractérisé en ce que**, au niveau des rouleaux de formation (11 ; 18) utilisés pour former la deuxième couche et les couches suivantes, la toile (2 ; 10), avec la bande de papier qui arrive, est conduite au rouleau de formation respectif (11 ; ; 18) en formant un angle (β) d'au moins 10°, de préférence au moins 15°, par rapport au plan horizontal.

4. Procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce que**, pour le ou les rouleau(x) de formation (4 ; 18) dont l'axe de rotation est dans le plan inférieur, les toiles (2, 3 ; 10, 17) quittent le rouleau dans un quadrant supérieur et vers le haut (E) de celui-ci.

5. Procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce que**, pour le ou les rouleau(x) de formation (11) dont l'axe de rotation est dans le plan supérieur, les toiles (2, 10) quittent le rouleau dans un quadrant inférieur et vers le bas (H) de celui-ci.

6. Dispositif permettant de former un produit de type papier ou carton multicouche en exécutant le procédé de la revendication 1, dans lequel dispositif les couches sont formées les unes sur les autres dans un mode séquentiel, et lequel dispositif, com-

me seule unité de formation pour former chaque couche, comprend une unité de formation à rouleaux du type dans lequel on introduit une suspension de fibres en jet dans une zone de contact créée entre deux toiles métalliques tendues (2, 3 ; 2, 10 ; 10, 17) qui s'enroulent autour d'un rouleau de formation en rotation (4 ; 11 ; 18), le jet de suspension de fibres étant envoyé dans ladite zone de contact à une vitesse qui fait que la toile extérieure (2 ; 10 ; 17) des deux toiles est déviée et où la toile extérieure (2 ; 10 ; 17) est supportée sur des supports rotatifs (5, 7 ; 12, 14 ; 19, 21), dont au moins un (5 ; 14 ; 19) est monté de manière élastique ou de manière mobile pour compenser ladite déviation et maintenir une tension sensiblement constante pendant la déviation de la toile extérieure,

caractérisé en ce que

- le dispositif comprend un seul rouleau de formation (4 ; 11 ; 18) pour former chaque couche,
- l'angle d'enroulement (α) des toiles sur les rouleaux de formation est supérieur ou égal à 110°,
- les axes de rotation des rouleaux de formation sont situés alternativement dans un plan inférieur et dans un plan supérieur, et
- pour le ou les rouleau(x) de formation (11) dont l'axe de rotation est dans le plan supérieur, les toiles (2, 10) sont agencées pour quitter le rouleau dans un quadrant inférieur (G, H) de celui-ci, où la bande de papier suit la toile extérieure (10), et pour le ou les rouleau(x) de formation (4 ; 18) dont l'axe de rotation est dans le plan inférieur, les toiles (2, 3 ; 10, 17) sont agencées pour quitter le rouleau dans un quadrant supérieur (E, F) de celui-ci, où la bande de papier, ici aussi, suit la toile extérieure (2 ; 17).

7. Dispositif de formation d'une bande multicouche selon la revendication 6, **caractérisé en ce que** l'angle d'enroulement (α) des toiles sur les rouleaux de formation (4 ; 11 ; 18) est supérieur ou égal à 120°.

8. Dispositif selon la revendication 6 ou 7, **caractérisé en ce que**, au niveau des rouleaux de formation (11 ; 18) utilisés pour former la deuxième couche et les couches suivantes, la toile (2 ; 10), avec la bande de papier qui arrive, est conduite au rouleau de formation respectif (11 ; 18) en formant un angle (β) d'au moins 10°, de préférence au moins 15°, par rapport au plan horizontal.

9. Dispositif selon l'une quelconque des revendications 6 à 8, **caractérisé en ce que**, pour le ou les rouleau(x) de formation (4 ; 18) dont l'axe de rotation est dans le plan inférieur, les toiles (2, 3 ; 10, 17) sont agencées pour quitter le rouleau dans un quadrant supérieur et vers le haut (E) de celui-ci.

10. Dispositif selon l'une quelconque des revendications 6 à 9, **caractérisé en ce que**, pour le ou les rouleau(x) de formation (11) dont l'axe de rotation est dans le plan supérieur, les toiles sont agencées pour quitter le rouleau dans un quadrant inférieur et vers le bas (H) de celui-ci.

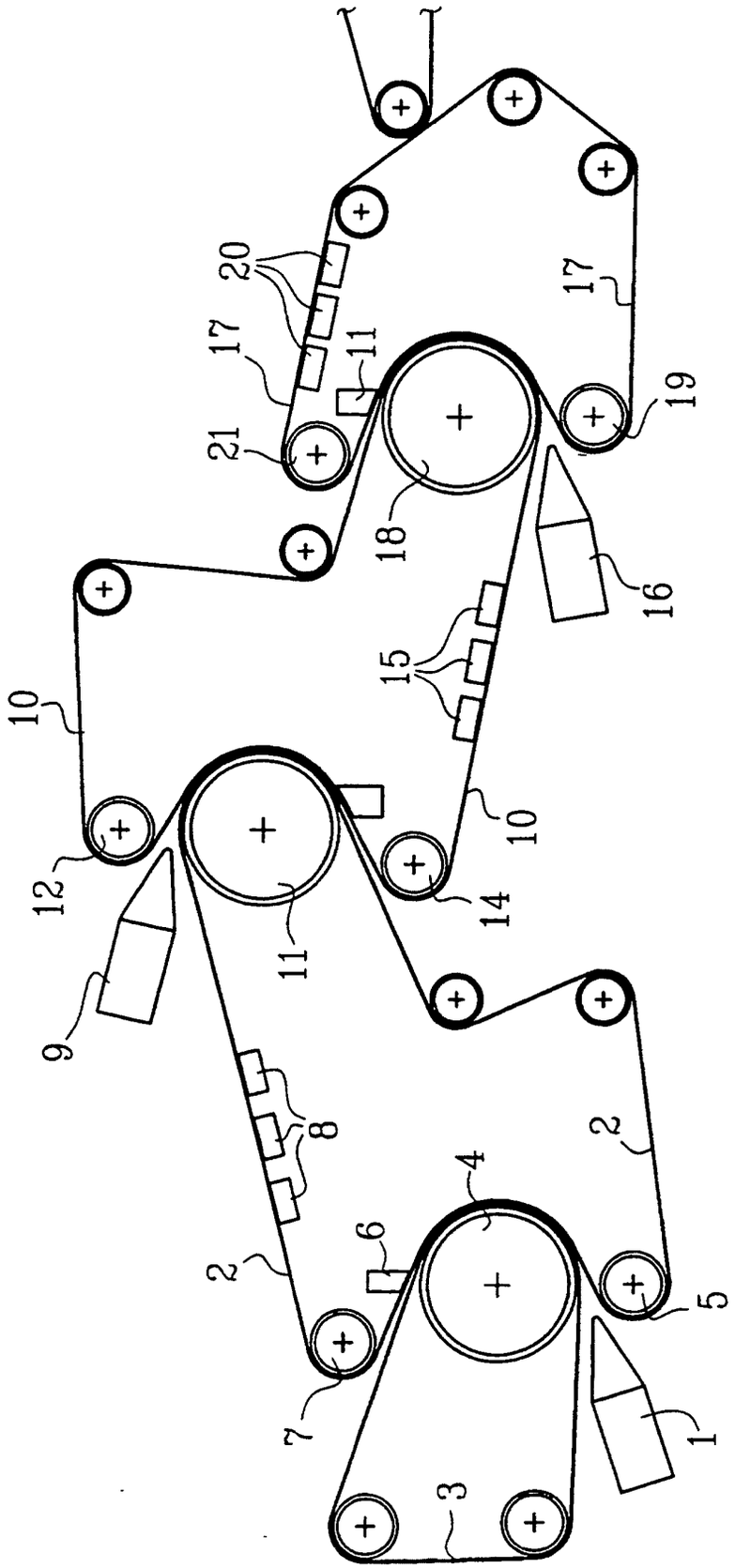


FIG. 1

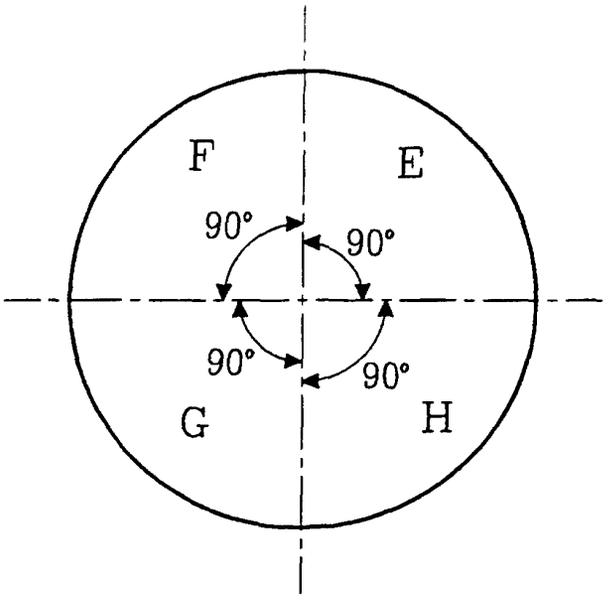


FIG.2

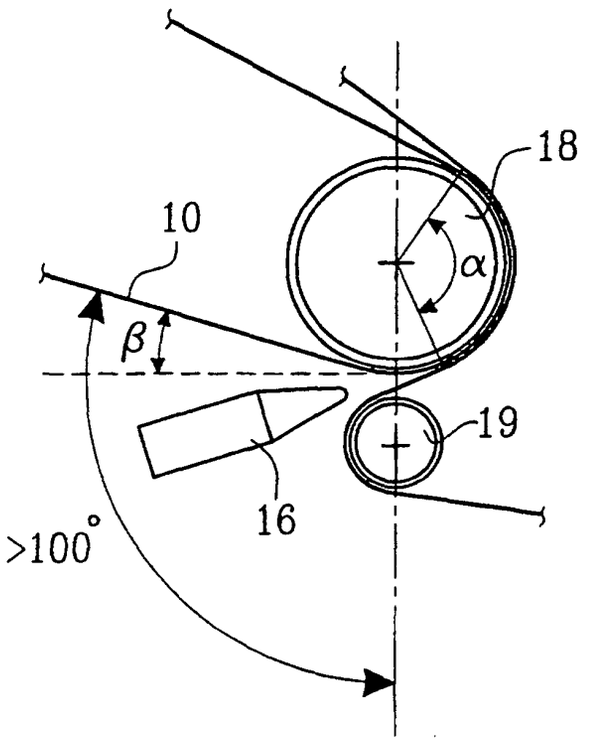


FIG.3