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(54) **METHOD IN THE PRODUCTION OF A WEB MATERIAL**

VERFAHREN ZUR HERSTELLUNG EINER MATERIALBAHN

PROCEDE DE PRODUCTION D'UN MATERIAU EN BANDE

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(56) References cited:
- **DATABASE PAPERCHEM, FILE 240 [Online] MITSUBISHI HEAVY LTD 'Dispersion of Pulp in Papermaking', XP002992808 Retrieved from Dialog, accession no. 0567131 -& JP 05 033 283 A 09 February 1993 -& DATABASE WPI Week 199311, Derwent Publications Ltd., London, GB; AN 1993-089151, XP002991950 & JP 05 033 283 A (MITO MITSUBISHI HEAVY IND CO LTD) 09 February 1993**

EP 0 968 329 B1

Description

TECHNICAL FIELD

[0001] The invention relates to a method to improve, in the production of a web which to an essential part consists of cellulosic fibres, the formation of the web material in a one or plural wire machine by, to an essential part, dispersing existing flocks in the stock which is led from an inlet box out onto at least one wire, and to counteract the reformation of flocks in the stock on the wire. The description also includes a short account of a device for performing the method and of a method to clean press felts and wires.

BACKGROUND OF THE INVENTION

[0002] When producing paper and board, the raw material is mainly cellulosic fibres and in most cases also fillers, such as calcium carbonate and/or clay, retention agents and so on are included. The included components tend, in connection with the production of paper and board, to form flocks in the stock with poor distribution of the components as a result. The formation is used as a measurement of how even the components, mainly the fibres and fillers, which are included in the paper or board, are distributed.

[0003] The formation is a very important property of paper and board. A paper or board with poor formation gives a stained impression, has poorer printing properties and poorer strength than a paper or a board with good formation. By improving the formation, essential improvements in quality can be achieved. As an alternative, the basis weight of the paper or board can be decreased with sustained strength, which results in a not unessential economic potential.

[0004] Traditionally, it has been tried to solve the problem with fibre flocks by developing the design of the inlet boxes or equipment in near connection with the inlet box. It has however proved impossibe to definitely solve the problem with formation, since fibre flocks quickly reform after the stock has left the inlet box and has entered onto the wire.

[0005] It has also been suggested different arrangements within the wire section, which to a certain extent can prevent the reformation of fibre flocks, for example different types of vibration and/or shaking means. The installation of top wire structures can also be said to be a part of this goal, although the installation of top wires in the first place is dictated by other purposes.

[0006] As a conclusion it can be said that the equipment, which so far has been used or proposed in order to take care of the problem of fibre flocks, is difficult to control, complicated, capital demanding and that it obstructs or prevents the optimisation of other quality properties than formation in the paper or board. A consequence of this compromising is e.g. that the orientation of fibres in the paper or board is difficult to optimise. A result of the use of so far known equipment for improving the formation, is typically such conditions that more fibres are oriented in the length direction of the web material than in its cross direction. This results in poorer strength properties in the cross direction of the product.

[0007] It is known from DATABASE WPI Week 199311, Derwent Publications Ltd., London, GB; Class F09, AN 1993-089151, XP002991950 & JP 5 033 283 A, 09.02.1993 to expose the stock, during formation of the web on a wire, to vibrations with frequencies of 20-40 Hz and with an amplitude of 2-3 mm.

[0008] EP-A-0318107 discloses a method of forming a fibrous web in a paper-machine, in which method stock is introduced into a wedge-like space or gap. According to one aspect of the method, the formation of flocks is prevented by supplying into the gap energy in the form of a mechanical high-frequency vibration, preferably in the ultrasonic range, said energy causing the breaking down of flocks.

DESCRIPTION OF THE INVENTION

[0009] The object of the invention is to attack the above problems. This is, in connection with the method described in the introduction, achieved by ultrasound energy being furnished to the stock in a plurality of wire sections, suitably by the ultrasound energy being furnished to the stock on the wire in at least one cross directional section of the wire sections along the transport direction of the stock on the wire. The ultrasound energy is furnished as ultrasound waves with frequencies between 15 and 75 kHz, which has surprisingly shown to result in considerably better formation when ultrasound elements (ultrasound generators or elements which can transmit ultrasound energy from one or more generators), which emit energy by means of oscillation with said frequency, are placed within the wire section of a paper or board machine in such a way that ultrasound energy is transmitted to the stock on the wire. In order to achieve the best effect, the ultrasound energy transmitting elements should be positioned directly below the wire or wires which follow after the inlet box or boxes of the paper or board machine. As a consequence of this positioning, the effect can also be achieved that the wire or wires are cleaned. The elements are moreover positioned so that an optimal effect, i.e. optimal ultrasound energy per mass unit of the stock (suspension of fibres/fillers) is achieved, at the same time as it is important that the concentration of the stock (the dry content) in at least one or some of said sections of the wire section still is adequately low so that flocks which are formed are not bound too strong, but can be broken apart. Consequently, at least some ultrasound elements are positioned e.g. so that they mainly influence the stock within at least one section of the wire section where the stock on the wire has a concentration of between 0,2 and 6 %, suitably between 0,5 and 5 % or between 1 and 6 %. A conceivable optimal range of content can also be between 1,5 and 5 %. A

positioning of the ultrasound elements further back on the paper machine, e.g. in or on the inlet box, will for certain result in that flocks which may have been formed possibly can be dispersed there, but these can afterwards be reformed on the wire or wires.

[0010] Consequently, a positioning of the elements before the wire section will result in none or very small improvement of the formation.

[0011] In certain cases, it can be conceived to position elements which transmit ultrasound energy also within one or more sections where the concentration of the stock is more than 5 or 6 %, preferably in order to prevent flocks from being reformed. It can for example be conceived to place ultrasound elements within sections of the area which is common for a top wire section and a sub wire section, within which sections the concentration of the stock may be considerably higher than 5 à 6 % or up to 15 %, preferably a maximum of 12%, as well as within the introductory section of the sub wire, where the concentration of the stock may be lower than 5 à 6 %. The ultrasound elements within the introductory section of the sub wire, where the concentration of the stock is 0.2-6 %, preferably 0.5-5 % or 1-6 %, e.g. 1.5-5 %, hereby act to both dissolve flocks which have already been formed and to prevent new establishment of flocks, while ultrasound elements within the area where the concentration is as much as between 5 and 15 %, preferably between 6 and 12 %, in the first place are acting to preserve the good formation.

[0012] Hence, in a device for performance of the method according to the invention, ultrasound elements which transmit the ultrasound energy to the stock are arranged in a wire loop in contact with the inside of the wire in the loop in the area of the distribution of the stock and thus also in contact with the liquid in the stock via the wire and via the mesh interspaces in the wire for transmission of the ultrasound energy to the stock via the wire and directly to the liquid phase via the mesh interspaces. According to one aspect, the ultrasound elements may be arranged in a sub loop and/or in a top loop. According to another aspect, the ultrasound elements may be arranged opposite each other in a sub wire loop and in a top wire loop. According to yet another aspect, the ultrasound elements and/or ultrasound generators which are connected to the ultrasound elements are adjustable in respect of power and/or frequency which is transmitted to the stock. According to yet another aspect, the ultrasound elements may consist of separate units. According to yet another aspect, the ultrasound elements may be integrated with one or some dewatering elements of the type which include formation tables, foils and suction boxes.

[0013] The ultrasound energy is furnished to the stock on the wire within a plurality of cross directional sections which are arranged after each other, e.g. within three to five after each other following, cross directional sections. This will also result in a possibility to adapt the frequency and/or power of the ultrasound to the concentration of the stock within different sections of the wire section, so that e.g. ultrasound energy with a higher frequency is furnished in at least one section which is closer to the inlet box, than within a subsequent section further away from the inlet box.

[0014] The ultrasound elements are suitably arranged so that the ultrasound power (amplitude) and/or the frequency can be controlled. Hereby, an optimisation of the formation will be possible, so that it can be adapted to the composition of the stock. Consequently, flocks which contain larger amounts of fines and fillers should demand a higher frequency than e.g. a stock which is based on a hard wood pulp with short fibres, which may demand a somewhat lower frequency. The lowest frequency should be demanded in connection with the dispersion of fibres from soft wood pulp with long fibres. Also the wire speed has effect on suitable frequency and/or power. The optimisation of the frequency and power of the ultrasound elements can of course be made by means of a parent control and regulation equipment.

[0015] The ultrasound elements may consequently operate sequentially by changing the frequency and/or power or also the elements may be dedicated for certain prechosen frequencies and/or powers which attack certain flock sizes or a certain content of flock. One aspect of the invention is characterised in that the ultrasound elements are equipped to operate in this way. Further features and aspects of the invention are apparent from the subsequent claims.

[0016] It is also possible to place ultrasound elements in direct contact with press felts, formation wires and/or drying wires in order to clean these felts and/or wires. A water spray can be positioned either on the same side as the ultrasound element or on the opposite side in order to supply the water volume which is necessary to transmit the ultrasound from the element to the inner structure of the felt or wire.

Claims

1. Method to improve, in the production of a web which to an essential part consists of cellulosic fibres, the formation of the web material in a one or plural wire machine by furnishing ultrasound energy to a stock on a wire, which stock is led from an inlet box out onto said wire, in order to, to an essential part, disperse existing flocks in the stock, **characterised in that** ultrasound energy is furnished as ultrasound waves with frequencies between 15 and 75 kHz to the stock on the wire within a plurality of cross directional wire sections which are arranged after each other, such that reformation of flocks in the stock on the wire is counteracted.

2. Method according to claim 1, **characterised in that** the ultrasound energy is furnished to the stock within three to five cross directional sections which are arranged after each other.

3. Method according to any of claims 1-2, **characterised in that** the ultrasound energy is furnished to the stock within at least some section where the stock on the wire has a concentration (dry content) of between 0,2 and 6 %, preferably between 0,5 and 5 % or between 1 and 6 %, suitably between 1,5 and 5 %.

4. Method according to claim 3, **characterised in that** ultrasound energy also is furnished to the stock within at least some section where the concentration of the stock is 5-15 %, preferably 6-12 %.

5. Method according to any of claims 1-4, **characterised in that** the ultrasound energy is furnished to the stock within the area of the first halves of the wire sections.

6. Method according to any of the preceding claims, **characterised in that** the ultrasound waves which are furnished to the stock have different frequencies within at least a couple of said sections.

7. Method according to claim 6, **characterised in that** the ultrasound has a higher frequency within at least one section which is closer to the inlet box than a subsequent section further away from the inlet box, within which subsequent section the ultrasound has a lower frequency.

Patentansprüche

1. Verfahren zur Verbesserung der Bildung des Bahnmaterials bei der Herstellung einer Bahn, welche zu einem wesentlichen Teil aus Cellulosefasern besteht, in einer oder mehreren Siebmaschinen durch Liefern von Ultraschallenergie an einen Papierstoff auf einem Sieb, wobei dieser Papierstoff aus einer Einlassbox auf genanntes Sieb geführt wird, um, zu einem wesentlichen Teil, bestehende Flocken auf dem Papierstoff zu verteilen, **dadurch gekennzeichnet, dass** Ultraschallenergie als Ultraschallwellen mit Frequenzen zwischen 15 und 75 kHz an den Papierstoff auf dem Sieb innerhalb einer Vielzahl von Siebabschnitten in Querrichtung, die hintereinander angeordnet sind, geliefert wird, so dass Neubildung der Flocken in dem Papierstoff auf dem Sieb entgegengewirkt wird.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Ultraschallenergie an den Papierstoff innerhalb von drei bis fünf Abschnitten in Querrichtung, die nacheinander angeordnet sind, bereitgestellt wird.

3. Verfahren nach einem der Ansprüche 1 - 2, **dadurch gekennzeichnet, dass** die Ultraschallenergie an den Papierstoff innerhalb mindestens irgendeines Abschnitts geliefert wird, wo der Papierstoff auf dem Sieb eine Konzentration (Trockengehalt) von zwischen 0,2 und 6 %, vorzugsweise zwischen 0,5 und 5 % oder zwischen 1 und 6 %, zweckmäßigerweise zwischen 1,5 und 5 % aufweist.

4. Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** die Ultraschallenergie auch an den Papierstoff innerhalb mindestens irgendeines Abschnitts geliefert wird, wo die Konzentration des Papierstoffes 5 - 15 %, vorzugsweise 6 - 12 % beträgt.

5. Verfahren nach einem der Ansprüche 1 - 4, **dadurch gekennzeichnet, dass** die Ultraschallenergie an den Papierstoff innerhalb des Bereiches der ersten Hälften der Siebabschnitte geliefert wird.

6. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Ultraschallwellen, die an den Papierstoff geliefert werden, unterschiedliche Frequenzen innerhalb mindestens ein paar der genannten Abschnitte aufweisen.

7. Verfahren nach Anspruch 6, **dadurch gekennzeichnet, dass** der Ultraschall eine höhere Frequenz innerhalb mindestens eines Abschnitts aufweist, der sich näher an der Einlassbox befindet als ein nachfolgender Abschnitt, der sich weiter von der Einlassbox entfernt befindet, wobei der Ultraschall innerhalb dieses nachfolgenden Abschnitts eine geringere Frequenz aufweist.

Revendications

1. Procédé pour améliorer, au cours de la production d'une bande qui pour une part essentielle se compose de fibres cellulosiques, la formation du matériau en bande dans un dispositif à fil simple ou multiple en fournissant de l'énergie ultrasonore à une pâte sur une toile, laquelle pâte est sortie depuis une boîte d'entrée sur ladite toile, afin de, pour une part essentielle, disperser des flocons existant dans la pâte, **caractérisé en ce que** l'énergie ultrasonore est fournie sous forme d'ondes ultrasonores ayant des fréquences entre 15 et 75 kHz à la pâte sur la toile dans une pluralité de sections de toile transversales qui sont disposées l'une après l'autre, de telle sorte que la reformation des flocons dans la pâte sur la toile est contrariée.

2. Procédé selon la revendication 1, **caractérisé en ce que** l'énergie ultrasonore est fournie à la pâte dans trois à cinq des sections transversales qui sont disposées l'une après l'autre.

3. Procédé selon l'une quelconque des revendications 1 et 2, **caractérisé en ce que** l'énergie ultrasonore

est fournie à la pâte dans au moins certaines sections où la pâte sur la toile a une concentration (teneur en matière sèche) comprise entre 0,2 et 6 %, de préférence entre 0,5 et 5 % ou entre 1 et 6 %, de manière adéquate entre 1,5 et 5 %.

4. Procédé selon la revendication 3, **caractérisé en ce que** l'énergie ultrasonore est elle aussi fournie à la pâte dans au moins quelques sections où la concentration de la pâte est de 5 à 15 %, de préférence de 6 à 12 %.

5. Procédé selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** l'énergie ultrasonore est fournie à la pâte dans la zone des premières moitiés des sections de toile.

6. Procédé selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les ondes ultrasonores qui sont fournies à la pâte ont des fréquences différentes dans au moins un couple desdites sections.

7. Procédé selon la revendication 6, **caractérisé en ce que** l'ultrason a une fréquence supérieure dans au moins une section qui est plus proche de la boîte d'entrée qu'une section suivante plus éloignée de la boîte d'entrée, dans laquelle section suivante l'ultrason a une fréquence inférieure.