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(54) **DEWATERING APPARATUS**

ENTWÄSSERUNGSVORRICHTUNG

DISPOSITIF D'EGOUTTAGE

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Description

[0001] The present invention relates to a dewatering apparatus adapted for use in a twin-wire dewatering section of a paper machine. More specifically it relates to an apparatus comprising a rotating forming roll, a head box for supplying stock, arranged before the forming roll, a closed loop first wire, also called inner wire, adapted to be partly wrapped around the forming roll up to a separation line where its contact with the forming roll ceases, and to receive the stock from the head box on its surface not facing the forming roll, a closed loop second wire, also called outer wire, adapted to be partly wrapped around the forming roll on top of the first wire thereby pressing the stock between itself and the first wire, and a first blade substantially parallel to the forming roll, said blade being arranged to support the roll facing side of the first wire after the separation line from the forming roll and being arranged such that the tip of the blade is directed against the wire transporting direction. Such an arrangement is known from WO-A-96/32533.

[0002] One conventional fourdrinier dewatering system for a paper machine comprises table rolls as dewatering elements. The limitations of using table rolls as dewatering elements in fourdrinier wire parts appear at high wire speeds. The local under pressure generated in the outgoing nip between wire bottom and roll surface then becomes too high. This under pressure will generate a local downward movement of the wire, which thereafter has to move back upwards to the top level of the following table roll. The vertical upward movement of the free fibre suspension on top of the wire (and the already dewatered part of the web) will then become so intense that drops form and escape from the suspension surface, which may generate formation disturbances.

[0003] The amplitude of the under pressure pulses generated by the table rolls increases with the square of the wire speed. At wire speeds in excess of approx. 500m/min. the suction pulses will become so intense that the formation deteriorates.

[0004] A further principle of twin-wire dewatering uses blades downstream of the forming roll arranged to support the wires and dewater the remaining fibre suspension through the first and second wires. In such apparatuses initial dewatering of the fibre suspension takes place over the forming roll.

[0005] The wires with the fibre webs and intermediate, remaining un-dewatered fibre suspension are then removed from the forming roll and lead to the subsequent blade arrangement, where dewatering is generated by pressure pulses. At the separation line of the removal of the wires from the forming roll, local under pressures will be generated at closed areas in the surface of the forming roll. These local under pressures correspond to the suction pulses generated in the table roll dewatering in the fourdrinier dewatering arrangement discussed above.

[0006] The local under pressures will deflect the first wire and the fibre web positioned thereon towards the

roll surface, while the second wire is following an essentially straight path towards the first outer dewatering element following the roll. This results in an expanding space between the wires at the departure from the roll.

[0007] The dewatering pressure at the roll dewatering is nominally T/R , where T is the tensile stress of the second wire and R is the radius of the roll. When the two wires leave the roll the dewatering pressure drops down to the atmospheric pressure. This generates an acceleration of the free suspension between the fibre webs. According to the principle of mass conservation this acceleration should be coupled to a decreasing space between the wires.

[0008] The total effect of the two above-mentioned phenomena, i.e. the local increase in wire separation space owing to the under pressure at the departure from the roll simultaneously as the flow velocity increase technically instead would need a local decrease in wire separation, gives rise to different types of disturbances in the remaining fibre suspension, which in turn may result in sheet damages.

[0009] The shortest technically possible length for the first wire from its departure from the forming roll to its reaching the first support blade has so far been of the magnitude of 200 mm.

[0010] This may however result in, as is described above, sheet damages.

[0011] One of the aims with the present invention is therefore to provide an arrangement that substantially reduces these unwanted effects.

[0012] This is obtained in that the distance from the separation line to the blade is less than 100 mm.

[0013] An especially advantageous embodiment of the present invention discloses a distance from the separation line to the blade of less than 30 mm.

[0014] The free wire distance L from roll separation to blade tip obeys the following relationship with the blade tip thickness h and the forming roll diameter D : $L = \sqrt{h \times D}$.

[0015] A further advantageous embodiment of the present invention discloses a blade where the side of the blade facing the forming roll has a shape corresponding to that of the roll surface.

[0016] A more advantageous embodiment of the present invention discloses a blade where the side of the blade facing the first wire is essentially flat.

[0017] Further advantages with the present invention will be described in fuller detail in the following description of preferred embodiments of the invention with reference to the accompanying drawings.

Fig. 1 discloses a fundamental view of an apparatus according to the present invention.

Fig. 2 discloses a detailed side view of a blade according to the present invention.

Fig. 3 discloses a side view of a tip of a blade according to the present invention.

[0018] Fig. 1 discloses a part of a twin-wire forming apparatus with a forming roll 1, a first wire 2 partly wrapped directly around the forming roll 1, a second wire 3 wrapped around the forming roll lying on the first wire 2. Before the forming roll 1 between the two wires 2, 3, a head box 4 is arranged with its opening directed substantially in the feeding direction of the wires 2, 3. The head box feeds stock to the nip between the wires 2, 3 wrapped around the forming roll 1. By changing the angle of the opening of the head box 4 against this nip it is possible to change the direction of the stock fed to the forming apparatus.

[0019] At a distance downstream of the separation line where the wires leave contact with the forming roll surface a first support blade 5 is arranged inside of the first wire 2. This blade is designed to support the first wire 2 and to avoid under pressure generation between the first wire 2 and the surface of the forming roll 1 by breaking the fluid capillary between the first wire 2 and the forming roll surface. If this happens early on any substantial force will not form from a local under pressure between roll and wire. This means that any substantial deformation of wire 2 leading to sheet damage will be avoided. This means in turn that the tip of the blade 5 will not be exposed to any significant radial force from the inner wire, thus not causing any significant blade wear by friction.

[0020] The blade 5 is thus designed so that it supports the inner wire at a distance of at the most approx. 100 mm, and more preferably approx. 20-30 mm downstream of the separation line on the forming roll surface. The blade 5 has for geometrical reasons (the closeness to the roll nip) a very small thickness at its leading edge, of the magnitude of one millimeter, as can be understood from the above equation and from fig. 2. Such a blade gets thereby a low flexural rigidity, and will not be able to carry any significant loads from the inner wire. Therefore the blade 5 is designed so that the inner side has a curvature adjusted to support against the forming roll while the outer side is essentially plane to support the inner wire.

[0021] Referring now to fig. 3, by choosing different tapering of the roll and wire side resp. (see a and b resp.) of the tip of the blade the radial force generated by the flow deflections can be controlled. A higher value of the taper on the roll side gives a resulting force to the wire side.

[0022] Minimum wear between the roll side of the blade 5 and the roll surface must be ensured. The blade tip must therefore be designed so that a suitable amount lubricating water is let through between the blade and the roll surface. This is effected by the taper (α) on the roll side of the tip, see figure 3. As can be seen from the figure, this taper angle is α .

[0023] Minimum wear between the wire side of the blade 5 and the first wire 2 is obtained by that a suitable water layer is let through between the wire and the blade 5. This is accomplished by a suitable tapering (β) of the wire side of the tip of blade 5, see figure 3. As can

be seen from the figure, this taper angle is β .

[0024] Downstream of the first blade 5 other blades can be arranged further supporting and deflecting the wires, thus creating pressure pulses for dewatering of the remaining fibre suspension.

[0025] Test runs in the experimental paper machine FEX at STFI-Packforsk have shown that with conventional design the inner wire 2 may, already at forming speeds of approx. 1200 ml/min, and a suction box vacuum of 10 kPa in the forming roll, separate owing to local under pressures, whereby the free suspension between the wires is redistributed. At a roll surrounding angle of 30° thereby serious formation damages arose. By using the blade according to the invention these damages were completely avoided.

[0026] With decreased suspension quantity between the wires, which was obtained from an increase of the wire surrounding angle to 35°, the web structure damages appeared as distinct bands. Also these damages were avoided completely by using a blade according to the invention.

[0027] The design of the blade according the invention can, of course, be given different forms within the scope of the claims, and is not limited to the example above. The blade may be manufactured from ceramic, polymeric or metallic materials, or combinations thereof. Also other material combinations are possible.

Claims

1. Dewatering arrangement adapted for use in a twin-wire dewatering section of a paper machine, said arrangement comprising a rotating forming roll (1), a head box (4) for supplying stock arranged before the forming roll (1), a closed loop first wire (2) adapted to be partly wrapped around the forming roll (1) up to a separation line where its contact with the forming roll (1) ceases, and to receive the stock from the head box (4) on its surface not facing the forming roll (1), a closed loop second wire (3) adapted to be partly wrapped around the forming roll (1) on top of the first wire (2) thereby pressing the stock between itself and the first wire (2), and a first blade (5) substantially parallel to the forming roll (1), said blade (5) being arranged to support the roll facing side of the first wire (2) after the separation line from the forming roll (1) and being arranged such that the tip of the blade (5) is directed against the wire transporting direction, **characterized in that** the distance from the separation line to the blade (5) is less than 100 mm.
2. Dewatering arrangement according to claim 1, where the distance from the separation line to the blade is less than 30 mm.
3. Dewatering arrangement according to one of claims

1-2, where the side of the blade facing the forming roll has a shape corresponding to that of the roll surface.

4. Dewatering arrangement according to one of claims 1-3, where the side of the blade facing the first wire is essentially flat. 5
5. Dewatering arrangement according to one of claims 1-4, where the tip of the blade on its side facing the forming roll is tapered with an angle α to the longitudinal axis of the blade. 10
6. Dewatering arrangement according to one of claims 1-5, where the tip of the blade on its side facing the first wire is tapered with an angle β to the longitudinal axis of the blade. 15
7. Dewatering arrangement according to one of claims 1-6, where the blade is manufactured of ceramic material. 20
8. Dewatering arrangement according to one of claims 1-6, where the blade is manufactured of polymeric material. 25
9. Dewatering arrangement according to one of claims 1-6, where the blade is manufactured of metallic material. 30
10. Dewatering arrangement according to one of claims 1-6, where the blade is manufactured of a combination of two or more materials of a group comprising ceramic material, polymeric material and metallic material. 35

Patentansprüche

1. Entwässerungsanordnung zur Verwendung in einem Doppelsiebentwässerungsteil einer Papiermaschine, wobei die Anordnung eine rotierende Formierwalze (1) aufweist, einen vor der Formierwalze (1) angeordneten Stoffauflauf (4) zur Zuführung von Stoff, eine erste geschlossene Siebschleife (2), die ausgebildet ist, die Formierwalze (1) teilweise zu umgreifen bis zu einer Trennlinie, wo ihr Kontakt mit der Formierwalze (1) endet, und den Stoff vom Stoffauflauf (4) auf ihrer von der Formierwalze (1) abgewandten Seite aufzunehmen, eine zweite geschlossene Siebschleife (3), die ausgebildet ist, die Formierwalze (1) über dem ersten Sieb (2) teilweise zu umgreifen, wodurch der Stoff zwischen dieser und dem ersten Sieb (2) zusammengepresst wird, und ein erstes, im Wesentlichen parallel zur Formierwalze (1) stehendes Blatt (5), wobei das Blatt (5) derart angeordnet ist, dass sie die der Walze zugewandte Seite des ersten Siebs (2) nach der Trennlinie von 40 45 50

der Formierwalze (1) stützt, und derart angeordnet ist, dass die Spitze des Blatts (5) gegen die Transportrichtung des Siebs gerichtet ist, **dadurch gekennzeichnet, dass** der Abstand zwischen der Trennlinie und dem Blatt (5) weniger als 100 mm beträgt.

2. Entwässerungsanordnung nach Anspruch 1, wobei der Abstand zwischen der Trennlinie und dem Blatt weniger als 30 mm beträgt.
3. Entwässerungsanordnung nach einem der Ansprüche 1 bis 2, wobei die der Formierwalze zugewandte Seite des Blatts eine Form aufweist, die derjenigen der Walzenoberfläche entspricht.
4. Entwässerungsanordnung nach einem der Ansprüche 1 bis 3, wobei die dem ersten Sieb zugewandte Seite des Blatts im Wesentlichen flach ist.
5. Entwässerungsanordnung nach einem der Ansprüche 1 bis 4, wobei die Spitze des Blatts auf ihrer der Formierwalze zugewandten Seite um einen Winkel α zur Längsachse des Blatts abgeschrägt ist.
6. Entwässerungsanordnung nach einem der Ansprüche 1 bis 5, wobei die Spitze des Blatts auf ihrer dem ersten Sieb zugewandten Seite um einen Winkel β zur Längsachse des Blatts abgeschrägt ist.
7. Entwässerungsanordnung nach einem der Ansprüche 1 bis 6, wobei das Blatt aus Keramikmaterial hergestellt ist.
8. Entwässerungsanordnung nach einem der Ansprüche 1 bis 6, wobei das Blatt aus Polymermaterial hergestellt ist.
9. Entwässerungsanordnung nach einem der Ansprüche 1 bis 6, wobei das Blatt aus metallischem Material hergestellt ist.
10. Entwässerungsanordnung nach einem der Ansprüche 1 bis 6, wobei das Blatt aus einer Kombination von zwei oder mehr Materialien einer Gruppe bestehend aus Keramikmaterial, Polymermaterial und metallischem Material hergestellt ist.

Revendications

1. Système d'essorage adapté à être utilisé dans une section d'essorage à double toile d'une machine à papier, ledit système comprenant un rouleau de formation (1) rotatif, une caisse d'arrivée (4) pour amener la pâte, agencée avant le rouleau de formation (1), une première toile (2) en boucle fermée qui est adaptée à être partiellement enroulée autour du rou-

- leau de formation (1) jusqu'à une ligne de séparation où son contact avec le rouleau de formation (1) cesse, et à recevoir la pâte de la caisse d'arrivée (4) sur sa surface qui n'est pas en regard du rouleau de formation (1), une deuxième toile (3) en boucle fermée, adaptée à être partiellement enroulée autour du rouleau de formation (1) par-dessus la première toile (2) de manière à comprimer la pâte entre elle-même et la première toile (2), et une première lame (5) substantiellement parallèle au rouleau de formation (1), ladite lame (5) étant agencée de manière à supporter le côté en regard du rouleau de la première toile (2) après la ligne de séparation du rouleau de formation (1), et étant agencée de telle manière que la pointe de la lame (5) est tournée contre la direction de transport de la toile, **caractérisé en ce que** la distance entre la ligne de séparation et la lame (5) est inférieure à 100 mm.
2. Système d'essorage selon la revendication 1, où la distance entre la ligne de séparation et la lame est inférieure à 30 mm.
 3. Système d'essorage selon l'une des revendications 1 à 2, où le côté de la lame en regard du rouleau de formation a une forme qui correspond à celle de la surface du rouleau.
 4. Système d'essorage selon l'une des revendications 1 à 3, où le côté de la lame en regard de la première toile est essentiellement plat.
 5. Système d'essorage selon l'une des revendications 1 à 4, où la pointe de la lame est effilée du côté en regard du rouleau de formation à un angle α avec l'axe longitudinal de la lame.
 6. Système d'essorage selon l'une des revendications 1 à 5, où la pointe de la lame est effilée du côté en regard de la première toile à un angle β avec l'axe longitudinal de la lame.
 7. Système d'essorage selon l'une des revendications 1 à 6, où la lame est fabriquée à partir d'un matériau céramique.
 8. Système d'essorage selon l'une des revendications 1 à 6, où la lame est fabriquée à partir d'un matériau polymère.
 9. Système d'essorage selon l'une des revendications 1 à 6, où la lame est fabriquée à partir d'un matériau métallique.
 10. Système d'essorage selon l'une des revendications 1 à 6, où la lame est fabriquée à partir d'une combinaison de deux ou plusieurs matériaux d'un groupe comprenant un matériau céramique, un matériau po-

lymère et un matériau métallique.

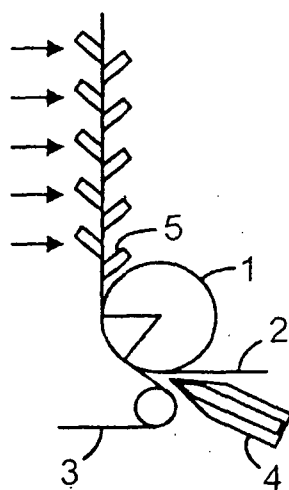


FIG. 1

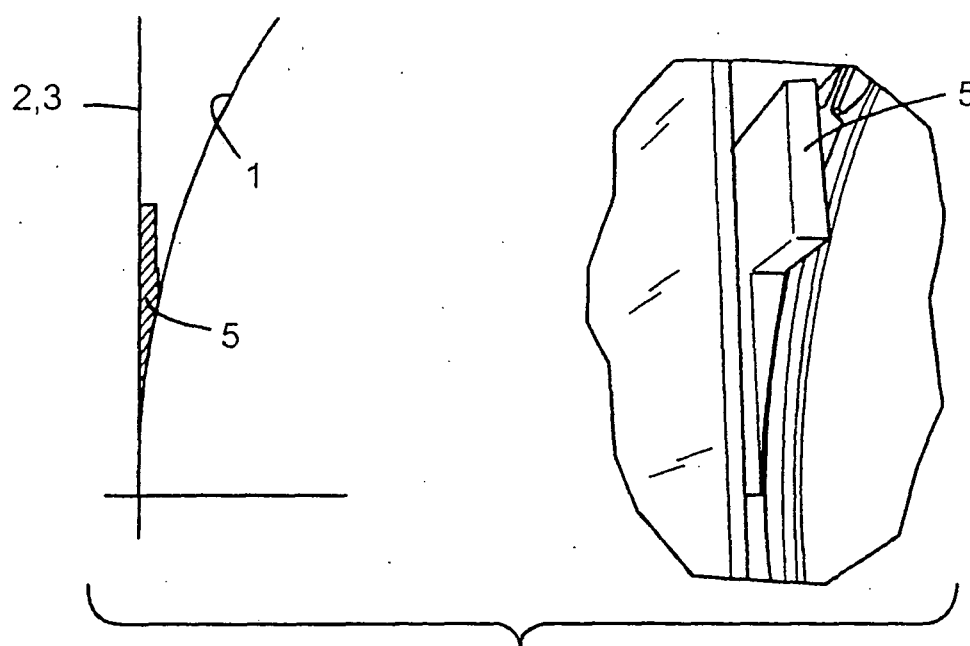


FIG. 2

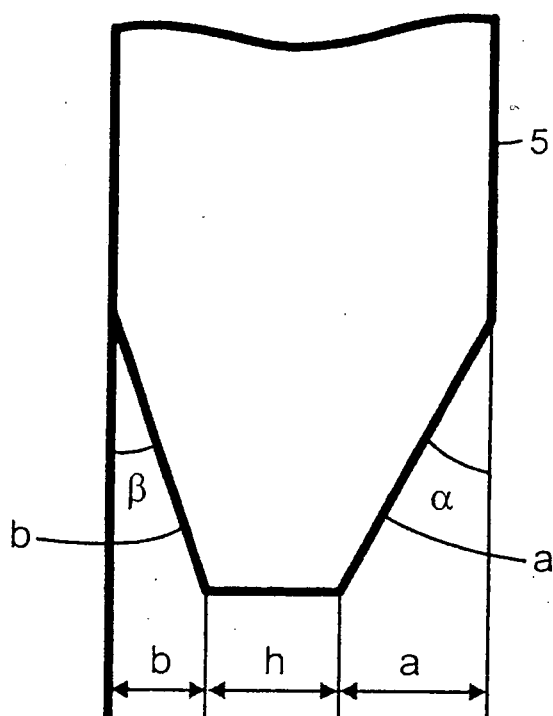


FIG.3

REFERENCES CITED IN THE DESCRIPTION

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