Nov. 5, 1974 M. KANKAANPAA 3,846,233

PAPERMAKING MACHINE HAVING A SINGLE WIRE RUN AND A DOUBLE WIRE RUN OVER A DOWNWARDLY CURVING DEWATERING BOX

Filed Sept. 11, 1972 2 Sheets-Sheet 1

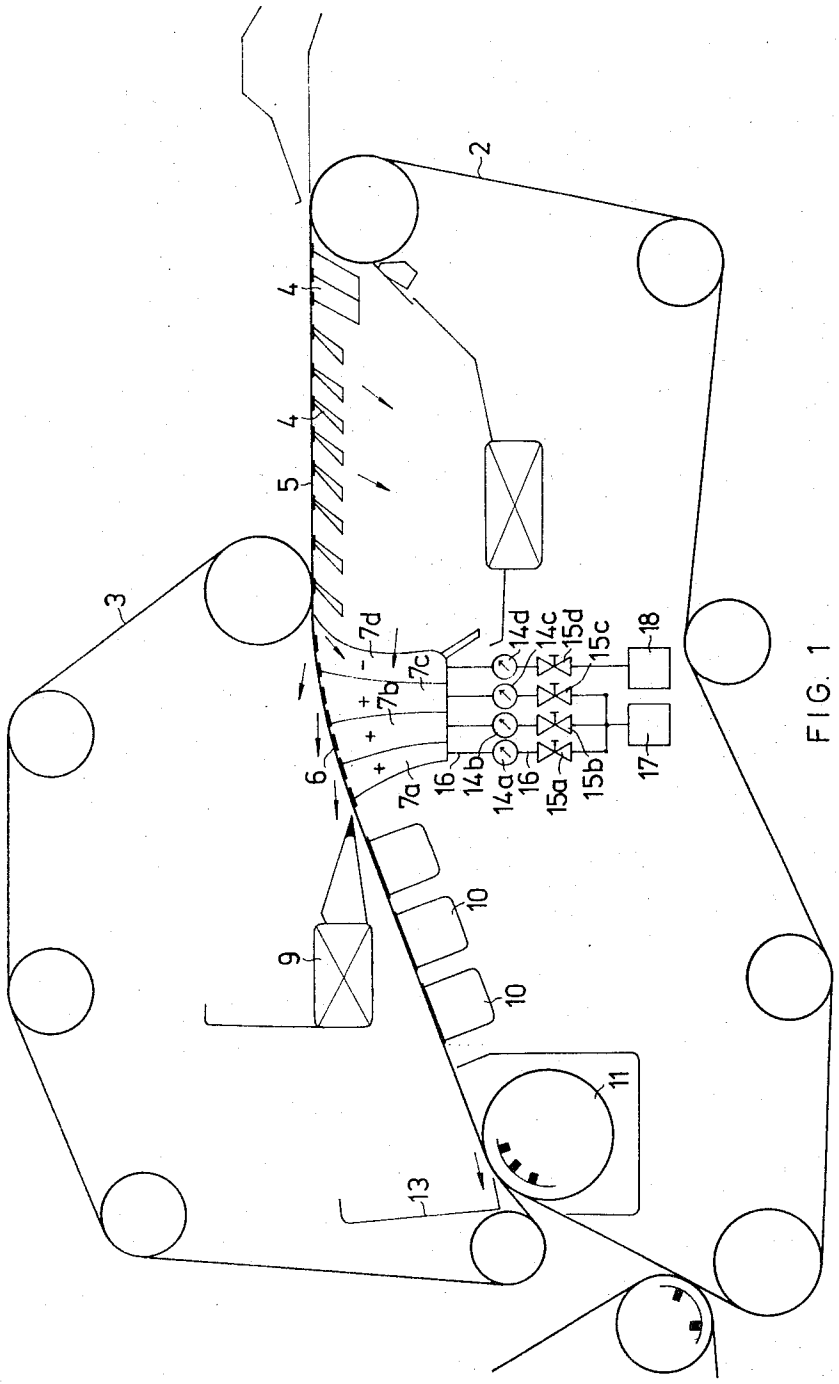

FIG. 1

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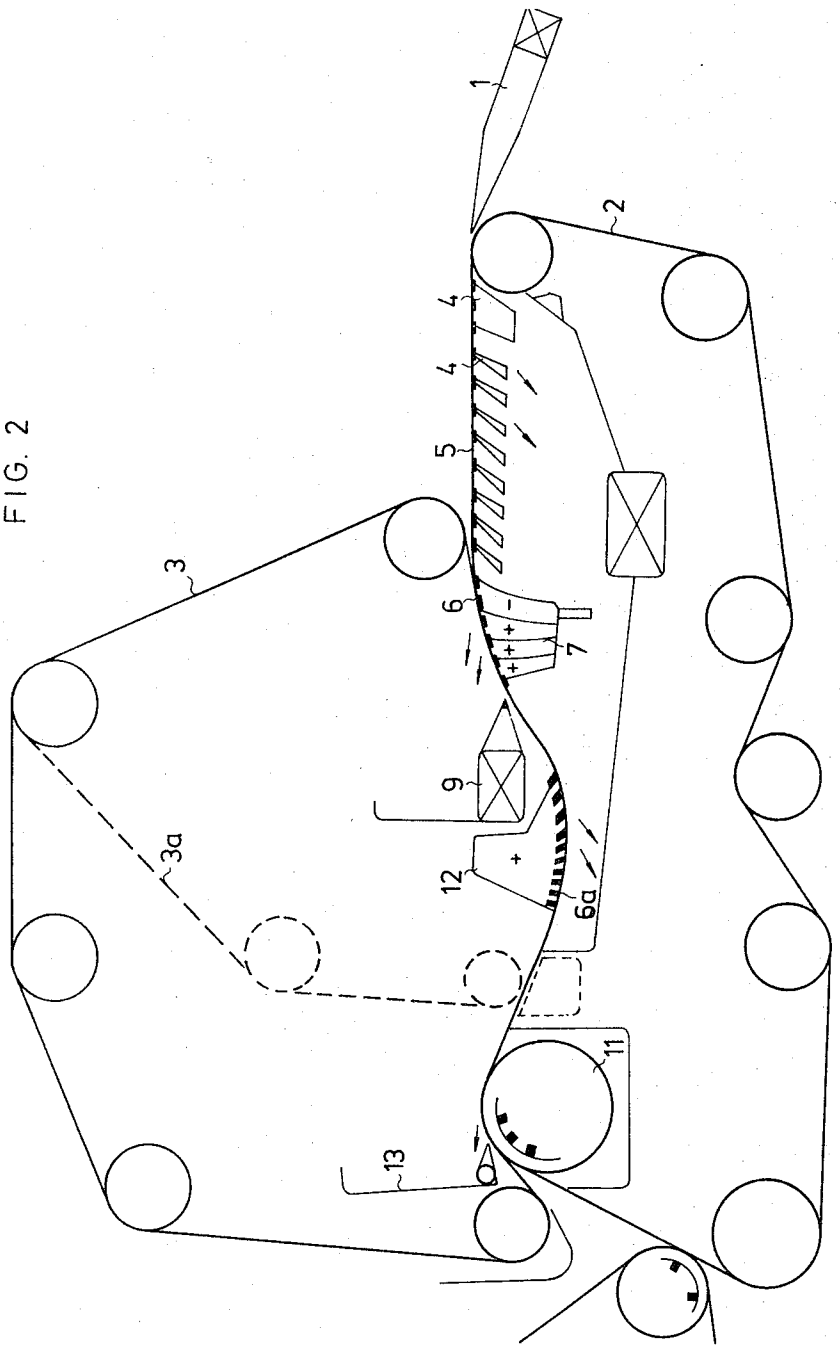
FIG. 2



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PAPERMAKING MACHINE HAVING A SINGLE WIRE RUN AND A DOUBLE WIRE RUN OVER A DOWNWARDLY CURVING DEWATERING BOX

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ABSTRACT OF THE DISCLOSURE

A papermaking machine has a section for the formation of paper from pulp slurry fed into the section, which consists of a first part comprising a single wire and dewatering foils and a second part comprising two wires facing each other and between which the web is enclosed. The wires of this second part are guided by an adjacent dewatering box or roll to follow a downwardly curved path. The invention is particularly characterized by such length of the first part that the pulp web has time, before entering the second part, to achieve a degree of felting such that the fibres are no longer able to move appreciably with reference to each other. The dewatering box or roll contains multiple chambers, the first of which is maintained under vacuum and the rest under positive pressures.

The present invention concerns, in a papermaking machine, a wire section having a single-wire initial portion with dewatering means, by the aid of which water is removed from the pulp web, and which wire section after the initial portion becomes one having two wires, this two-wire portion curving at least at its initial end, guided by a dewatering roll or dewatering box. With regard to its essential features, a paper machine wire section of the kind defined above is known in prior art, e.g., from the Swedish publicizing document No. 308,244, published on Feb. 3, 1969, wherein attention is exclusively paid to efficient dewatering, not at all to the escape of additive substances, such as fillers, or of fine fibres, nor to the low cleavage strength, which is typical of double wire forms.

In the most commonly employed double wire formers of prior art, the pulp is supplied to the wire section in the form of a lean sludge, whereupon either immediately or after a short single wire run there begins a violent dewatering action from the pulp web in both directions or in the same direction as in the single wire part. As a result, a considerable proportion of the fillers, such as kaolin, added to the pulp, and also of the fine fibres, escapes along with the water. Quite obviously this causes a considerable impairment of the quality of the paper web, and in particular those characteristics suffer, for the achievement of which the fillers have expressly been added to the web. Furthermore, in the operation of double wire formers of prior art the circumstance has to be taken into account that in a paper web in the process of being formed which still has a comparatively high water content and in which the structure of the paper web has not yet gained sufficient firmness, the long fibres, too, are relatively free to move with reference to each other. They tend in fact to move from the central part of the paper web into its surface layers when violent dewatering action in both directions is applied. This results in reduced strength of the central part of the web, with a low cleavage or splitting strength as its consequence.

In the wire section of a paper machine according to the invention, the aim is to preserve the well-known advantages of double wire formers, while at the same time the drawbacks outlined above shall be avoided. In order that this might be achieved, the basic idea of the invention is to combine a single wire Fourdrinier wet end with a

wet end comprising two wires, in a manner which shall be disclosed farther below. In the said single wire part, according to the invention, forming of the web takes place with cautious dewatering. After the pulp web has reached a degree of felting which is appropriate in view of the mutual binding of fibres, the wet end becomes a wet end with two wires, wherein dewatering takes place with high efficiency and mainly in accordance with the general principles of operation of double wire formers, but which may be improved in certain details as shall be disclosed later. The abovementioned "appropriate degree of felting," which is essential from the viewpoint of the invention, is not definable, for instance, as a given water content of the web or as a given initial wet strength, because these factors, equally as the "appropriate degree of felting" in view of the present invention, depend on a number of factors, such as the fibre material, fibre length and degree of beating of the fibres. In each individual case, however, the "appropriate degree of felting" from the point of view of the invention can be unambiguously established.

The aim of the present invention is to eliminate the abovementioned drawbacks of double wire formers. Therefore, the invention is characterized in that the single-wire initial part of the wire section has a length such that when dewatering is cautiously performed in this initial part the pulp web has time, before the double wire part, to achieve a degree of felting such that the fibres are no longer able to move appreciably with reference to each other, and that the double wire part is guided by a dewatering roll or a dewatering box to curve downwardly so that water is removed in this curved part by effect of centrifugal force and of a pressure zone through the upper wire and in a direction opposite to that in the single-wire initial part, the object being to reduce the escape of additives of the pulp web, such as fillers, and of fine constituents of the pulp web and to increase the splitting strength of the paper that is being manufactured.

The invention is described in closer detail in the following with reference to the embodiments presented in the attached drawings.

In the drawing, FIG. 1 shows schematically a wire section of a paper machine according to the invention, in elevational view. FIG. 2 shows in elevational view a wire section of a paper machine according to another embodiment of the invention.

The wire section according to the invention consists of two endless wires 2 and 3. One of these wires, 2, is supported by rolls to run so that immediately after the headbox 1 there is formed a normal, single-wire forming table section 5, in connection with which dewatering elements 4 previously known in themselves, such as foils, are operative. In the forming table section 5, cautious dewatering is effected so that the pulp web on this part of wire, 5, attains a degree of felting such that the fibres (at least the longer ones) are unable in subsequent dewatering stages to move with reference to each other, whereby already on the wire section 5 a comparatively stable fibre structure and, owing to the cautious dewatering, a high splitting strength is achieved. Following after the single-wire section 5, the wires 2 and 3 constitute a double-wire section. This has been arranged to curve, either after a short preceding planar part or immediately in its initial part as FIG. 1 shows. In the curved portion 6 thus produced, a dewatering box 7 or a dewatering roll has been fitted to act.

According to FIG. 1, the dewatering box 7 has four separate chambers 7*a*, 7*b*, 7*c* and 7*d*. A vacuum acts in the chamber 7*d* which is first in the direction of travel of the pulp web and this chamber has been provided with a water drain pipe 8. A positive pressure (+) acts in the other chambers 7*a*. 7*b* and 7*c*. Pressure gauges 14*a*, 14*b*,

14*c* and 14*d* are connected by pipes **16** with the chambers 7*a*, 7*b*, 7*c* and 7*d*, respectively. They are also connected with pressure-regulating valves 15*a*, 15*b*, 15*c* and 15*d*. An air pump **17** produces pressure higher than atmospheric pressure in chambers 7*a*, 7*b* and 7*c*, while an air pump **18** produces vacuum in chamber 7*d*. Furthermore, the centrifugal force resulting from the curved path contributes to the dewatering action. The positive pressure and centrifugal force urge the water in a direction opposite to that in the single-wire initial part **5**, which serves to counteract the one-sided distribution of fine constituents and additives caused by the undirectional dewatering on the initial wire part **5**, because said substances are still able to undergo displacement in the otherwise stable fibre structure. The water removed from the web on the topside is collected in a save-all **9**. According to FIG. 1, the double wire section continues with planar configuration up to the suction roll **11**, and in this part, furthermore, suction boxes **10** and save-all elements **13**, previously known in themselves, are operative. In the dewatering box **7**, the suction (−) and positive pressure (+) may be regulated in order to influence the rate of dewatering so that a symmetric fibre structure and fine constituent and additive distribution is achieved. Moreover, the positive pressure (+) relieves the load of the wire and also aids the escape of water to the topside of the wire.

According to FIG. 2, the double wire part has after the curved portion **6** another curved portion 6*a*, which has been shown as curving upwardly. In connection with this curved part 6*a*, too, a dewatering element **12** has been provided within the wire loop **3**. The wire loop **3** may also be replaced by a shorter wire loop 3*a*, as has been indicated with dotted lines in FIG. 2. In the dewatering element **12** most appropriately a positive pressure is applied.

The invention is not confined to the embodiment examples presented in the foregoing. For instance, the number of curved sections may be more than two, causing alternating dewatering action through the upper wire and through the lower wire so that the above-described aims of the invention are achieved.

I claim:

1. In a paper machine, a wire section having a first wire forming a single-wire initial portion with first dewatering means, by the aid of which water is removed from the pulp web, and which wire section after said initial portion comprises a second wire creating a two-wire portion, second dewatering means guiding said two-wire portion to be curved downwardly at least at its initial end, characterized in that said single-wire initial portion of the wire section has a length such that when dewatering of the pulp web is cautiously performed in said single-wire initial portion, the pulp web achieves before the two-wire portion a degree of felting such that the fibres in the pulp web are no longer able to move appreciably with reference to each other, and that said two-wire portion is guided by said second dewatering means to curve downwardly so that water is removed in connection with said second dewatering means mainly by effect of centrifugal force through the upper wire of the two-wire portion and in a direction opposite to that in the single-wire initial portion, the object being to reduce the escape of additives of the pulp web, such as fillers, and of fine constituents of the pulp web, and to increase the splitting strength of the paper that is being manufactured, wherein said second dewatering means comprises a dewatering box which has means for forming several consecutive chambers, means for adjusting the pressures in said chambers in order to achieve a symmetrical fibre structure of the pulp web, of which chambers in the one which is first in the direction if travel of the pulp web or in those which are first in said direction a vacuum has been arranged to act, and in the subsequent chamber or chambers, a positive pressure has been arranged to act.

2. In a paper machine, a wire section having a lower wire constituting a single-wire initial portion with first dewatering means consisting of dewatering foils, by the aid of which water is removed from the pulp web, and which wire section after said initial portion comprises a two-wire portion consisting of said lower wire and an upper wire, second dewatering means guiding said two-wire portion to be curved downwardly, characterized in that the length of said single-wire portion is at least one-half of the length of the two-wire portion, so that, when dewatering of the pulp is performed in said single-wire initial portion, the pulp web achieves before the two-wire portion a degree of felting such that that fibres in the pulp web are no longer able to move appreciably with reference to each other, that said second dewatering means consists of a dewatering box with downwardly curvilinear face against the lower wire of said two-wire portion at the initial end of the two-wire portion, and that said two-wire portion is guided by said dewatering box to curve downwardly at its initital end so that water is removed in connection with said dewatering box mainly by effect of centrifugal force through the upper wire of the two-wire portion and in a direction opposite to that in the single-wire initial portion, the object being to reduce the escape of additives of the pulp web, such as fillers, and of fine constituents of the pulp web, and to increase the splitting strength of the paper that is being manufactured, said dewatering box comprising means for forming several consecutive chambers and openings from said chambers to said curvilinear face of said dewatering box, means for adjusting the pressures in said chambers in order to achieve a symmetrical fibre structure of the pulp web, of which chambers the first in the direction of web travel is maintained under vacuum, and in the subsequent chamber or chambers a positive pressure is arranged to act.

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