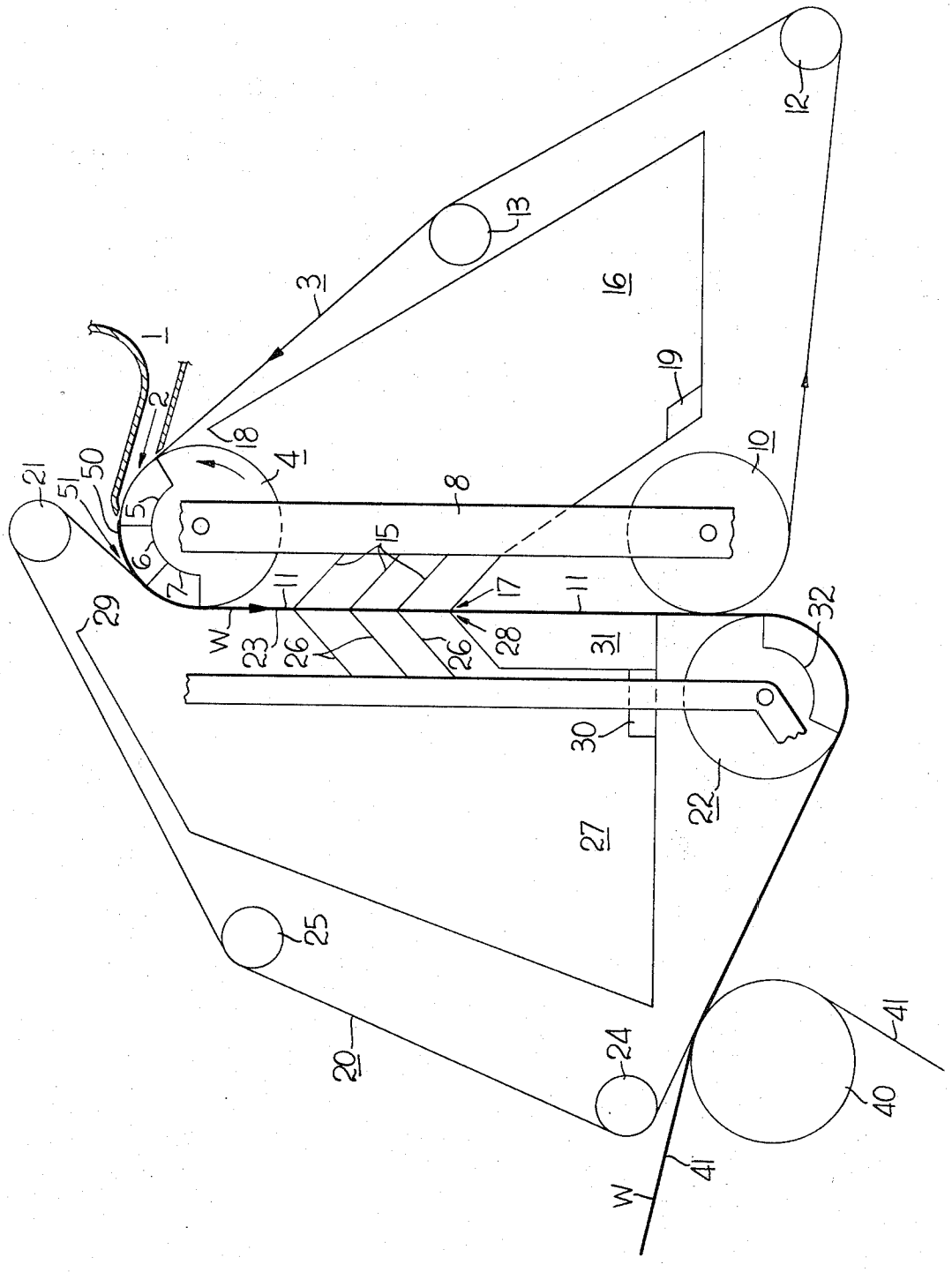
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VERTICAL DUAL WIRE PAPER WEB FORMER

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Inventor
Donald B. De Noyer
By Arthur M. Streich
Attorneys

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VERTICAL DUAL WIRE PAPER WEB FORMER

Donald B. DeNoyer, Beloit, Wis., assignor to Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

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ABSTRACT OF THE DISCLOSURE

A portion of paper making machine is disclosed where a dilute watery fiberous pulp stock is formed into a wet fiberous web. The dilute stock is discharged from a slice opening in a head-box to a first fine mesh endless loop wire lapped over a suction breast roll. The slice directs a jet of stock at the wire on the upturning side of the breast roll. The suction breast roll rotates and withdraws sufficient water from the stock to form a fiberous mat on the first wire. A second fine mesh endless loop wire guided by a turning roll spaced above the suction breast roll, to lap the second wire over the first wire on the downturning side of the suction breast roll. The first and second wire define therebetween a nip tangent to and spaced along the top circumference of the suction breast roll from the headbox slice. The fiberous mat is carried by the first wire moving on the rotating suction breast roll, into the nip and between the wires. A pair of couch rolls are spaced below the single breast roll with one couch roll in the loop of each wire to direct both wires downwardly from the single breast roll and form a web of paper between the two downwardly moving wires by receiving therebetween the fiberous mat preformed on the first wire over the suction breast roll with controlled fiber dispersion and orientation before the fiberous mat is received between the two wires.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to paper making machines having dual wires between which a wet fiberous web is formed and in particular to such machines having rolls directing the web forming reach of the wires downwardly as water is drained through the wires to form the web therebetween.

Description of the prior art

The type of machine to which this invention relates has been known generally to this art at least since U.S. Patent 1,661,678 of 1928. The evolution of this type of machine to present day forms is illustrated by the following patents: U.S. Patent 1,718,574 of 1929; U.S. Patent 1,817,594 of 1931; U.S. Patent 1,875,075 of 1932; U.S. Patent 2,554,968 of 1951; U.S. Patent 2,969,114 of 1961 (reissued as Re. 25,333 in 1963); U.S. Patent 3,149,028 of 1964; and U.S. Patents 3,215,593 and 3,215,594 of 1965. None of the dual wire arrangements disclosed in any of these prior art patents provide for lapping both wires over a single breast roll to define a nip between the two wires where they lap the roll, and none of these prior art arrangements having downwardly moving web forming wires are adapted to use types of headboxes such as have been developed for horizontal fourdrinier machines and which have reached a high state of development and efficiency at reasonably low cost.

SUMMARY OF THE INVENTION

It is among the objects of the present invention to provide a new and improved downwardly moving dual wire web former in which both wires are lapped over a single breast roll to define a nip between the two wires where they lap the same roll.

Another object of the present invention is to provide a new and improved downwardly moving dual wire paper making machine adapted to utilize a headbox of the type developed for horizontal fourdrinier machines.

It is also an object of the present invention to provide a new and improved downwardly moving dual wire web former with improved control over the ratio of cross web direction strength to machine direction strength.

Still another object of the present invention is to provide in such a machine a variable degree of stock dewatering and mat formation before the web forming fibers are moved into the nip between the dual wires.

According to a preferred embodiment of the present invention, dilute stock having from about ½% to 1½% fibers dispersed in 99½% to 98½% water, is discharged from a slice opening in a headbox to a first fine mesh wire lapped over a suction breast roll. The slice directs a jet of stock at the wire on the upturning side of the breast roll. The suction breast roll rotates and withdraws sufficient water from the stock to form a fiberous mat of perhaps about 12 pounds basis weight on the first wire. A second fine mesh endless loop wire is guided by a turning roll spaced above the suction breast roll, to lap the second wire over the first wire on the downturning side of the suction breast roll. The first and second wires define therebetween a nip tangent to and spaced along the top circumference of the suction breast roll from the headbox slice. The fibrous mat formed on the first wire is carried by the first wire moving on the rotating suction breast roll, into the nip and between the wires. A pair of couch rolls are spaced below the single breast roll with one couch roll in the loop of each wire to direct both wires downwardly from the breast roll and form a web of paper between the two downwardly moving wires by receiving therebetween the fiberous mat preformed on the first wire over the suction breast roll with controlled fiber dispersion and orientation before the fiberous mat is received between the two wires.

Other features and objects of the invention that have been attained will appear from the more detailed description to follow with reference to an embodiment of the present invention shown in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying drawing shows diagrammatically a side elevation of a web forming section of a paper making machine according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing, a portion of a dual wire paper making machine according to the present invention is shown wherein a headbox **1** discharges dilute pulp stock through a slice opening **2** onto a first endless fine mesh wire **3** lapped around a suction breast roll **4**. Suction boxes **5**, **6** and **7** are provided within breast roll **4**. Suction breast roll **4** is journaled in support structure **8** and driven by means (not shown) to turn in the same direction indicated by the arrow. The headbox **1** is arranged with the slice **2** closely spaced from the first wire **3** where it engages the circumference of breast roll **4** on its upturning side and this places slice **2** over the first of the suction boxes, namely, suction box **5**, within breast roll **4**.

Within the loop of the first endless wire **3**, a couch roll **10** is arranged beneath the suction breast roll **4** to draw wire **3** in a downward reach **11** from the breast roll **4** to the couch roll **10**. The wire **3** laps couch roll **10** and a turning roll **12** horizontally spaced from the couch roll **10** on the side thereof opposite the downward reach **11** of wire **3**. A guide roll **13** directs wire **3** from turning roll **12**

to lap breast roll 4 with contact therebetween beginning along a portion of a circumference of roll 4 located over suction box 5 and beneath slice 2. The roll 10 may desirably be a grooved or open mesh roll to prevent any film buildup on wire 3 that might be forced back into the web as wire 3 contacts roll 10.

Also within the loop of the first wire 3, a plurality of defectors 15 are arranged against the backside of the downward reach 11 of wire 3, for a purpose that will appear as this description proceeds. A saveall 16 is also arranged within the loop of the first wire 3, having a first upper terminal edge 17 arranged against the backside of the downward reach 11 and beneath the deflectors 15, and second upper terminal edge 18 arranged close to the backside of wire 3 opposite the upturning side of the suction breast roll 4. A drain 19 is provided at the bottom of saveall 16 to discharge water collected therein.

A second endless fine mesh wire 20 of a dual wire arrangement according to the present invention is lapped over a turning roll 21 spaced above the breast roll 4. A suction couch roll 22 with a suction box 32 provided therein, is arranged within the loop of the second wire 20, and couch roll 22 draws wire 20 downward from turning roll 21 to lap the second wire 20 over the downturning side of breast roll 4 and over the first wire 3 which is also lapped over breast roll 4. The couch roll 22 draws the second wire 20 in a downward reach 23 from breast roll 4 to couch roll 22. The second wire 20 laps couch roll 22 and a turning roll 24 horizontally spaced from couch roll 22 on the side thereof opposite the downward reach 23 of the second wire 20. A guide roll 25 directs the second wire 20 from turning roll 24 back to turning roll 21.

Also within the loop of the second wire 20, a plurality of deflectors 26 are arranged against the backside of the downward reach 23 of wire 20. A saveall 27 is also arranged within the loop of the second wire 20, having a first upper terminal edge 28 arranged against the backside of the downward reach 23 and beneath the deflectors 26 and a second upper terminal edge 29 arranged close to the backside of wire 20 above the suction breast roll 4. A drain 30 is provided at the bottom of saveall 27 to discharge water collected therein and a suction box 31 is arranged against the backside of the second wire 20 beneath the terminal edge 28 of saveall 27. Each of the rolls mentioned is journaled in the support structure 8 to be parallel to each other and rotate in a predetermined clock reference direction about a horizontal axis.

A suction pick-up roll 40 lapped by a felt 41 is arranged between the suction couch roll 22 and turning roll 24, and beneath the portion of the second wire 20 passing from the suction couch roll 22 to turning roll 24.

In the operation of the apparatus that has been described, a dilute pulp stock having from about ½% to 1½% fibers dispersed in 99½% to 98½% water, is discharged from slice opening 2 in the headbox 1 which may be a headbox such as disclosed in U.S. Patent 3,164,513 and known to the trade as a Multiplex headbox (Multiplex is a registered trademark of the Allis-Chalmers Manufacturing Company). The stock jets from the headbox 1 onto the portion of the first wire 3 lapped over the first suction box 5 within the turning suction breast roll 4. The suction box withdraws water from the stock to form on the first wire 3 a fiberous mat 50. The fiberous mat 50 is carried by the first wire 3 over the second suction box 6 and into the nip 51 defined by the second wire 20 coming together with the first wire 3 above the downward edge of the second suction box 6. By the time the mat 50 is carried into nip 51, sufficient water can be removed to provide the mate with a basis weight of about 12 pounds on wire 3. As wires 3 and 20, prior to meeting, begin to squeeze the mat 50, some water will discharge through wire 20 into saveall 27, and some water will pass through wire 3 into suction box 6 of roll 4. As the lapped wires 3 and 20 pass over suction box 7 some of the water

will be drawn through wire 3 into suction box 7, and simultaneously some of the water will pass through the backside of wire 20 to be collected in saveall 27. Any water remaining in the holes of roll 4 after passing suction box 7, will be discharged into saveall 16. As the wires 3, 20 and the mat-changing-to-web-material therebetween pass downwardly from suction box 7, the water passing through the backside of wire 3 will no longer be drawn away through suction breast roll 4 and will instead be collected in saveall 16 and discharged therefrom through drain 19.

As the forming web is drawn downwardly between wires 3, 20 toward the couch rolls 10, 22, the wires 3, 20 are kept apart from each other only by the web of pulp being formed therebetween. As the downward reaches 11, 23 of wires 3, 20 move downwardly, the deflectors 15, 26 keep the reaches 11, 23 close together and cause water being squeezed therethrough to be deflected away from the backsides of the wires 3, 20 and into the savealls 16, 27. In order to keep the reaches 11, 23 of wires 3, 20 so close together that they are separated only by the web therebetween, the suction couch roll 22 is arranged slightly lower than the plain couch roll 10.

Initially, all water being drawn from the stock passes through wire 3 into suction boxes 5 and 6. The amount of water withdrawn ahead of nip 51 can be controlled but whatever is withdrawn passes through wire 3. After the nip 51 and over suction box 7, water may be withdrawn into suction box 7 through wire 3 and water will also be discharged through wire 20 into saveall 27 by centrifugal force in going around roll 4 and by squeeze due to wire tension caused by wire 20 wrapping roll 4. Thereafter, as reaches 11, 23 of the wires 3, 20 pass between deflectors 15 and 26, water will be somewhat equally removed through both wires. However, below the terminal edges 17, 28 of savealls 16, 27 the suction box 31 located against the back of the second wire 20 will result in substantially all water being removed at this location passing through the second wire 20. Thus, while initially fibers are pulled toward wire 3 by suction breast roll 4, after a period of balanced water removal between deflectors 15, 26 fibers are then pulled toward wire 20 by suction box 31. These controlled forces acting in opposite directions provides a degree of control over fiber position and orientation within the web W to provide desired control over the ratio of cross web direction strength to machine direction strength, as for example, to change such ratio from 4:1 to 3:1 or even 2:1 which may be desired for certain uses to which the finished paper may be applied.

From the foregoing detailed description of the present invention, it has been shown how the objects of the invention have been attained in a preferred manner. However, modifications and equivalents of the disclosed concepts such as readily occur to those skilled in the art are intended to be included within the scope of this invention.

The embodiments of the invention in which an exclusive property or privilege is claimed and defined are as follows:

1. A paper making apparatus comprising support structure, a suction breast roll and a pair of couch rolls, in which:

(A) each of the rolls are journaled in the support structure to be parallel to each other and rotate in a predetermined clock reference direction about a horizontal axis, with the couch rolls being adjacent to each other and both vertically spaced beneath the breast roll, and with a first of the couch rolls being beneath the breast roll and a second of the couch rolls being horizontally spaced therefrom;

(B) a first endless loop web forming wire is lapped over the breast roll and the first couch roll with the first wire engaging at least a portion of the top and downturning sides of the suction breast roll;

(C) a first turning roll is arranged in vertically spaced

position over the suction breast roll and parallel thereto;

(D) a second endless loop web forming wire is lapped over the first turning roll, over the first wire on the downturning side of the suction breast roll, and over the second couch roll to thereby define a nip between the first and second wire tangent to the circumference of the suction breast roll and a downward web forming reach between the two wires passing from the suction breast roll to the couch rolls;

(E) at least one suction box within the suction breast roll spaced circumferentially and rotationally in advance of the nip to provide for dewatering a dilute watery fiberous pulp stock there deposited on the first wire before the fiberous pulp is carried into the nip by the first wire moving toward the nip on the suction breast roll;

(F) a headbox with a slice opening for discharging watery fiberous pulp stock, with the headbox arranged with its slice opening aimed at the first wire where it laps the suction breast roll and passes over the suction box located within the breast roll and in advance of the nip, to deposit stock thereon for dewatering the fiberous pulp to form a mat of the fiberous pulp before the pulp is carried into the nip by the first wire.

2. In an apparatus according to claim **1**, the first wire laps at least a portion of the upturning, the top and the downturning, sides of the suction breast roll and the slice opening of the headbox is aimed at the first wire where it laps a portion of the upturning side of the suction breast roll.

3. In an apparatus according to claim **2**, at least three suction boxes within the suction breast roll with a first suction box beneath the upturning side of the breast roll lopped by the first wire, a second suction box beneath the nip defined by the first and second wires, and a third suction box internally of the downturning side of the breast roll lapped by both wires.

4. In an apparatus according to claim **1**, one of the couch rolls being a suction couch roll and arranged with its rotational axis in a horizontal plane below the rotational axis of the other couch roll, and the rotational axis of each couch rolls being in vertical planes spaced apart a distance that will locate the facing downward turning sides of the couch rolls in positions that will position the facing downward reaches of the two wires from the breast roll to the couch rolls, to be spaced apart only by the web of pulp formed therebetween.

5. In an apparatus according to claim **4**, a plurality of vertically spaced deflectors within the loop of each wire between the breast roll and couch rolls, with the deflectors engaging the backside of each wire and being inclined downwardly in a direction away from the engaged wire.

6. In an apparatus according to claim **5** a saveall within the loop of each wire with each saveall having one terminal edge engaging the looped wire below the deflectors but above the couch rolls, to collect and dispose of water squeezed from the pulp through the wires passing between the deflectors.

7. In an apparatus according to claim **1**, a suction box within the loop of the second wire engaging the backside of the downward reach of the second wire from the breast roll to the couch roll within the loop of the second wire.

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S. LEON BASHORE, Primary Examiner

R. H. TUSHIN, Assistant Examiner

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