

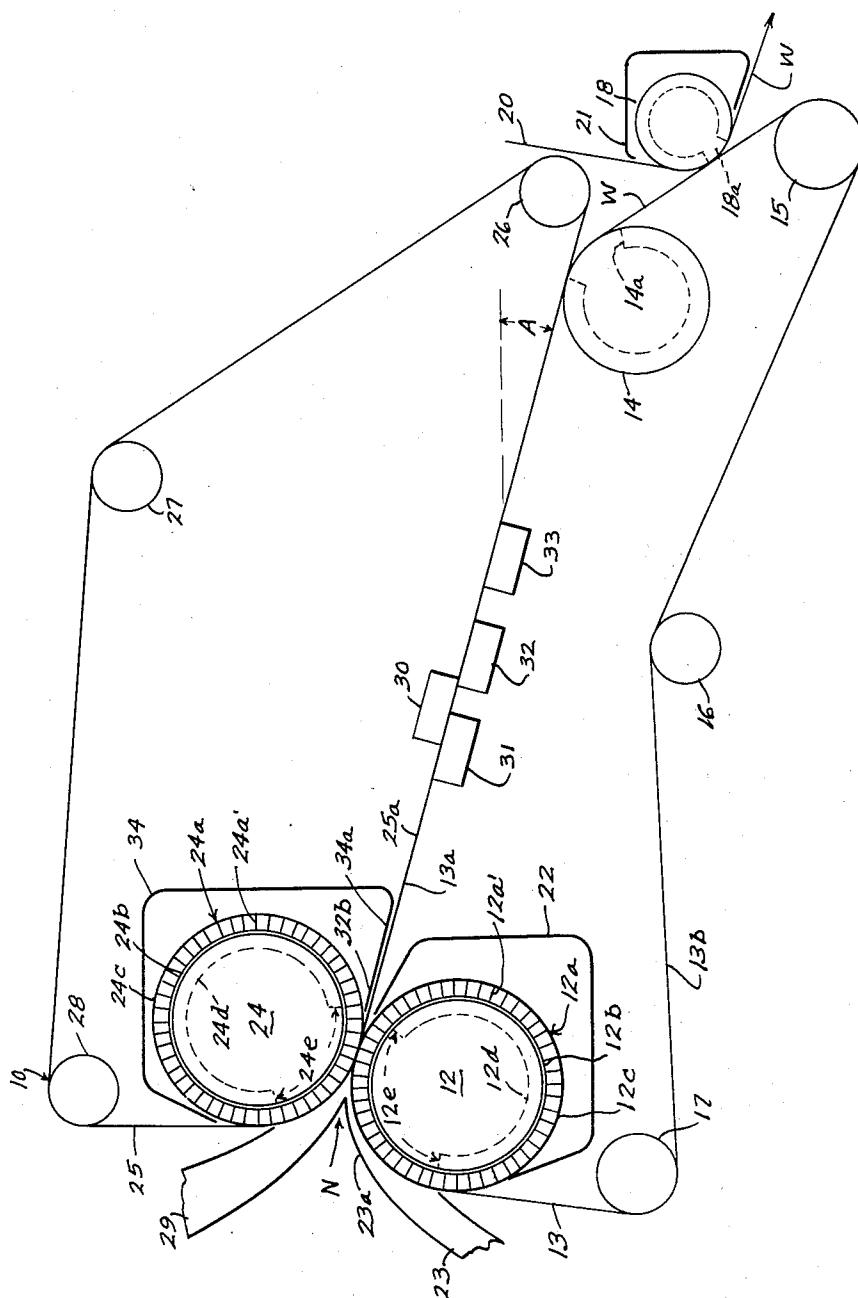
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PAPER MACHINE FORMING SECTION

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PAPER MACHINE FORMING SECTION

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The instant invention relates to an improvement in paper machines, and more particularly, to an improvement in the paper forming section of paper machines.

In general, paper machines have been suggested employing top and bottom forming wires wherein stock is delivered between the forming wires. The prevailing idea in the art is that the stock is fed at a rate substantially equal to the rate of travel of the wire; but the necessity for draining from the stock large quantities of water at controlled rates of flow has led to increasingly longer wire parts and the use of various devices for controlling drainage, all of which leave something to be desired.

The instant invention is based upon an entirely different concept wherein two opposed cellular faced breast rolls are mounted in nip-defining relationship wherein the nip is of substantially the thickness of the web, and the stock is forced into an enclosed forming zone at the oncoming side of the nip at such speed and under such pressure as to create turbulence at the nip and to drive the major part of the water in the stock through the cellular faces of the rolls and into the interior thereof. Vacuum is maintained in the interior of the rolls so as to assist in drawing the water thereinto. In addition, separate stock feeds may be employed so as to feed two different kinds of stock into superimposed streams at the oncoming side of the nip. In each case the bulk of the water drained from the stock is drained past the cellular faces of the rolls, leaving only a relatively small amount of water (of the total water drained) in the cellular faces of the rolls. The nip and the off-running wire runs are aligned in a plane that is downwardly inclined from the horizontal and a save-all is mounted beneath the upper roll and between that roll and the wire trained thereover so as to prevent the roll from throwing the water in the cellular face thereof back down on the wire at the off-running side of the nip. The lower roll is also equipped with a save-all for the same purpose.

The instant invention results in the creation of a desired turbulence in the forming zone so as to achieve better formation and better integration of the two partial webs forming on the two converging wires.

It is, therefore, an important object of the instant invention to provide an improved paper machine and an improved method of forming a paper web.

It is a further object of the instant invention to provide an improved method of making a paper web which comprises driving a stream of stock in a given path, rotating in the direction of stock travel a pair of foraminous cylindrical surfaces in the stock path, maintaining said surfaces spaced apart substantially the thickness of said web, and maintaining superatmospheric pressure in the stock contacting one side of the foraminous surfaces and subatmospheric pressure on the opposite side of the foraminous surfaces to force water through the surfaces.

Another object of the instant invention is to provide an improved web-forming machine which comprises a pair of opposed cellular faced rolls, a forming wire trained over each roll defining an inlet nip of substantially the thickness of said web, means for delivering dilute stock under pressure to said rolls, and means within said rolls for subjecting the roll faces to a vacuum, whereby web formation is accomplished on both wires at the rolls.

Other and further objects, features and advantages of

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the present invention will become apparent to those skilled in the art from the following detailed disclosure thereof and the drawings attached hereto and made a part hereof.

In the drawing, the reference numeral 10 indicates generally a paper forming device embodying the instant invention. The paper machine 10 comprises a first open cellular-faced roll 12. The general structure of the roll 12 is well understood in the art and it comprises a cellular periphery 12a mounted for rotation with the roll 12. The outer periphery 12a of the roll 12 is open and provided with a plurality of circumferentially spaced cells, the walls of which are defined by circumferentially spaced radially aligned short baffles or strips, which project from the roll shell and extend in the axial direction so that the individual cells extend longitudinally from one end of the roll to the other. As here shown diagrammatically the baffles are the short radially extending lines (indicated at 12a') in the cellular periphery 12a. The baffles are mounted on a shell 12b which contains perforations or apertures (not shown) which afford communication between the cells and the interior of the roll. The outwardly extending edges of the baffles are covered by a helical wire (indicated by the line 12c) which provides a foraminous surface offering very little resistance to the flow of water. In the interior of the roll 12 there is a suction gland indicated in dotted lines at 12d which subjects the roll shell 12b and the cellular periphery 12a to vacuum in the region or area 12e. The roll 12 is, of course, rotatably mounted on means (not shown) and the suction gland 12d is equipped with gas and liquid withdrawing means (not shown) that are mounted coaxially of the roll 12 and the bearing means (not shown) therefor. The general construction of rolls having an open cellular periphery such as the roll 12 is well understood in the art and need not be further described herein.

A bottom forming wire 13 is trained over the roll 12 and has an upper forming run 13a and a lower return run 13b. The wire 13 passes from the upper forming run 13a over a couch roll 14 having a suction area 14a which serves to retain the web W on the wire 13 as it turns downwardly over the couch roll 14 in the direction of a turning roll 15. The wire then returns over return rolls 16 and 17 back to the cellular breast roll 12. A suction pickup roll 18 with suction area 18a, covered by a suction pickup felt 20 urges the felt 20 against the web W and picks up the web W from the wire 13. As indicated diagrammatically a save-all 21 is mounted around the suction pickup roll 18 to prevent the roll 18 from throwing water back on to the felt 20 as it separates therefrom. A save-all 22 (shown diagrammatically) is mounted around the roll 12 to collect water thrown therefrom. A stock inlet 23 feeds stock onto the oncoming side of the wire covered open cylinder 12 along the upper quadrant thereof.

A second roll 24 having an open cellular periphery and having the same structure as the roll 12 (with the exception of the location of the suction area 24e) is rotatably mounted overlying the first roll 12. A top forming wire 25 is trained over the second roll 24 and has a bottom forming run 25a overlying the upper forming run 13a of the bottom wire 13. The bottom forming run 25a of the top wire 25 continues to overlie the top forming run 13a of the bottom wire 13 until both wires pass over the couch roll 14, whereat the top forming run 13a carrying the web W is separated from the bottom forming run 25a. The wire 25 then turns back around a turning roll 26 and over return rolls 27 and 28 back around the cellular breast roll 24. A stock inlet 29 feeds stock onto the oncoming side of the cellular roll 24 (which in this case is the down-running side) along the lower quadrant thereof.

As will be appreciated, the stock inlets 23 and 29 are both connected to suitable sources of stock under pressure (not shown) so that the volume of stock fed therethrough may be controlled. The inlets 23 and 29 may be connected to the same source of stock under pressure or to different sources of stock under pressure. A particular advantage of the instant invention is that the inlets 23 and 29 are separate so that different types of stock can be fed therethrough. Also, it will be appreciated that the inlets 23 and 29 cooperate with the opposed wire covered rolls 12 and 24 to define enclosed forming zones. For example, the forming zone along the surface of the wire covered roll 12 is at first enclosed by the back extremity 23a of the inlet and as the zone approaches the nip N between the rolls 12 and 24 (or the wires 13 and 25 covering such rolls) the forming zone is enclosed by the stock stream from the upper inlet 29 as well as the wire covered upper roll 24. The nip N between the wire covered rolls 12 and 24 is of substantially the thickness of the web to be formed on the machine. In this way the web W actually fills the nip N and the entire forming zone (defined by the two inlets 23 and 29) is closed. The stock is fed through the inlets 23 and 29 under superatmospheric pressure so as to actually develop a pressure head in the region of the nip N (as contrasted to "free" flow heretofore used with stock). In this way the pressure at the oncoming side of the nip N within the stock itself (which is superatmospheric pressure) cooperates with the subatmospheric pressure at the suction areas 12e and 24e so as to actually draw water into the interior of the rolls 12 and 24 and past the open cellular peripheries 12a and 24a thereof. Actually, the water is drawn past the cellular peripheries 12a and 24a into the suction glands 12d and 24d. In this way the major portion of the water passing through the wires 13 and 25 is drawn directly into the interior (or suction glands 12d and 24d) of the rolls 12 and 24. Also, the web formation substantially filling the nip area makes it necessary that substantially all of the water in the stock suspension passes through the forming wires 13 and 25 at the oncoming side of the nip N. The development of pressure within the stock stream itself at the oncoming side of the nip N results in a desired turbulence in the stock in the forming area which gives superior paper formation and superior integration between the halves of the web which are forming on the two wires 13 and 25 in this region. It will further be noted that the nip N and the wire runs 13a and 25a at the immediate off-running side of the nip N lie in a downwardly directed plane.

A save-all pan 34 has a lower portion 34a (shown diagrammatically) interposed between the top roll 24 and the bottom forming run 25a of the wire 25 in close running relation to the off-running side of the nip N so as to catch water retained in the cellular face 24a of the roll 24. The cooperation between the save-all portion 34a and the downwardly inclined wire run 25a is important, because this prevents the throwing of water from the roll face 24a back on to the wire run 25a. In order to obtain effective operation of the save-all 34a it has been found necessary to incline the wire run 25a downwardly at least about 15° from the horizontal. Preferably the angle A (that the wire 13a is downwardly inclined) may range from about 15° to about 45° from the horizontal. The forwardmost tip 32b of the save-all 34 is in close running relation with the nip N and with the roll 24 and this tip 34b should be angularly disposed about 10° to about 50° behind the off-running side of the suction area 24e (which is just past the nip N). In this way the best operating conditions are obtained and much greater operating speeds can be used because the tendency for water to be thrown back down on the wire run 25a is substantially eliminated.

As will be noted, additional dewatering of the web between the wire runs 13a and 25a may be accomplished by suction boxes 31, 32 and 33 associated with the under-

side of the top forming run 13a and/or by a suction box such as the box 30 associated with the top side of the wire run 25a.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

We claim as our invention:

1. A web-forming machine which comprises a pair of superimposed cellular faced rolls, a forming wire trained over each roll defining an inlet nip of substantially the thickness of said web, means for delivering dilute stock under pressure to said rolls, and means within said rolls for subjecting the roll faces to a vacuum, whereby web formation is accomplished on both wires at the rolls.

2. A web-forming machine which comprises a pair of superimposed cellular faced rolls, a forming wire trained over each roll defining an inlet nip of substantially the thickness of said web, separate means for delivering separate stock streams under pressure to each of said wires at said nip, and means within said rolls for subjecting the roll faces to a vacuum, whereby web formation is accomplished on both wires at the rolls.

3. A web-forming machine which comprises a first roll having an open cellular periphery, a bottom forming wire trained over said first roll having an upper forming run, a second roll having an open cellular periphery and overlying said first roll, a top forming wire trained over said second roll having a bottom forming run overlying the upper forming run of said bottom wire, said wire covered rolls defining a nip of substantially the thickness of the web, first means for delivering stock to the bottom wire at the oncoming side of said nip, second means for delivering stock to the top wire at the oncoming side of said nip, and means creating a suction within each said rolls to draw water thereinto.

4. A web-forming machine which comprises a first roll having an open cellular periphery, a bottom forming wire trained over said first roll having an upper forming run, a second roll having an open cellular periphery and overlying said first roll, a top forming wire trained over said second roll having a bottom forming run overlying the upper forming run of said bottom wire, said wire covered rolls defining a nip of substantially the thickness of the web, said nip and said wire runs at the off-running side of said nip lying in a downwardly inclined plane, a save-all pan interposed between said second roll and the bottom forming run of said top wire in close running relation to the off-running side of said nip, and means creating a suction within each said rolls to draw water thereinto.

5. A web-forming machine which comprises a first roll having an open cellular periphery, a bottom forming wire trained over said first roll having an upper forming run, a second roll having an open cellular periphery and overlying said first roll, a top forming wire trained over said second roll having a bottom forming run overlying the upper forming run of said bottom wire, said wire covered rolls defining a nip of substantially the thickness of the web, said nip and said wire runs at the off-running side of said nip lying in a downwardly inclined plane, a save-all pan interposed between said second roll and the bottom forming run of said top wire in close running relation to the off-running side of said nip, first means for delivering stock to the bottom wire at the oncoming side of said nip, second means for delivering stock to the top wire at the oncoming side of said nip, and means creating a suction within each said rolls to draw water thereinto.

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