United States Patent [19]

Langdon

[11] **3,915,791**

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[54] **METHOD FOR PRODUCING MULTI-PLY PAPER ON A TWIN-WIRE MACHINE**

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[21] Appl. No.: **493,227**

Related U.S. Application Data

[63] Continuation of Ser. No. 252,573, May 12, 1973, abandoned.

[52] **U.S. Cl.** **162/132;** 162/203; 162/303

[51] **Int. Cl.²** **D21F 11/04**

[58] **Field of Search** 162/123, 132, 133, 203, 162/211, 300, 301, 303, 304, 348, 351, 352

[56] **References Cited**

UNITED STATES PATENTS

1,366,821	1/1921	Monaghan	162/211
2,028,952	1/1936	Reimer	162/348 X
2,098,733	11/1937	Sale	162/130
3,578,556	5/1971	Notbohm et al.	162/203
3,867,252	2/1975	Skrabak et al.	162/203

FOREIGN PATENTS OR APPLICATIONS

1,904,962	8/1970	Germany	162/303

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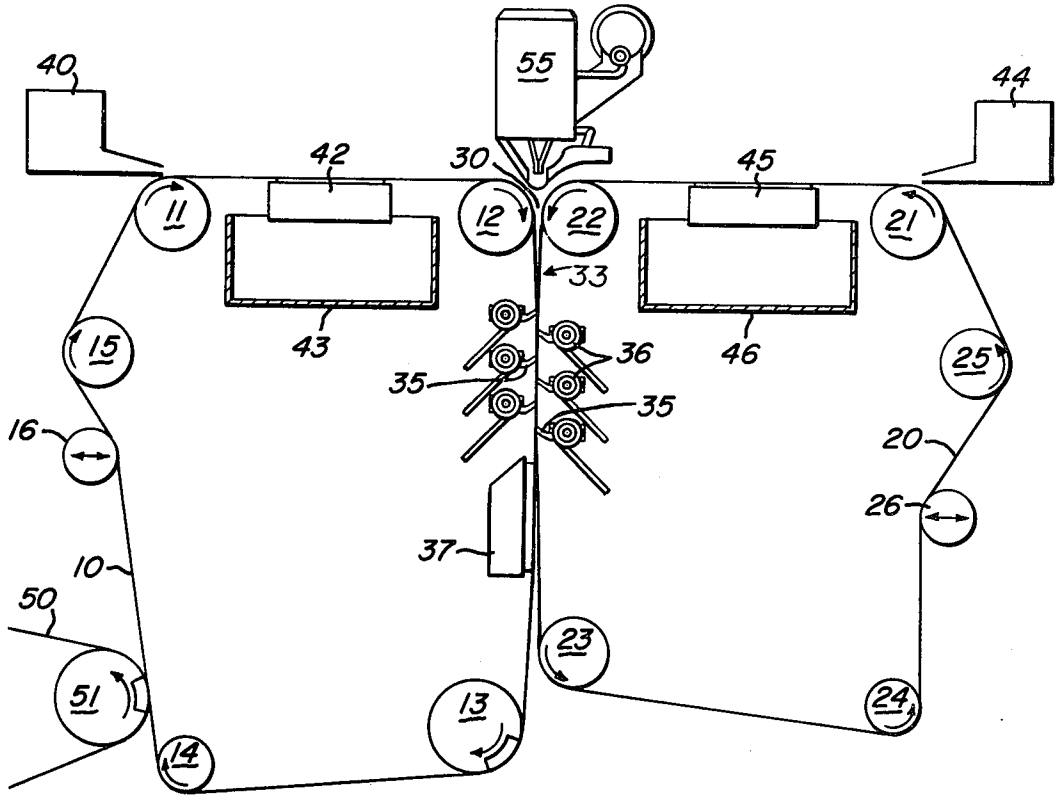
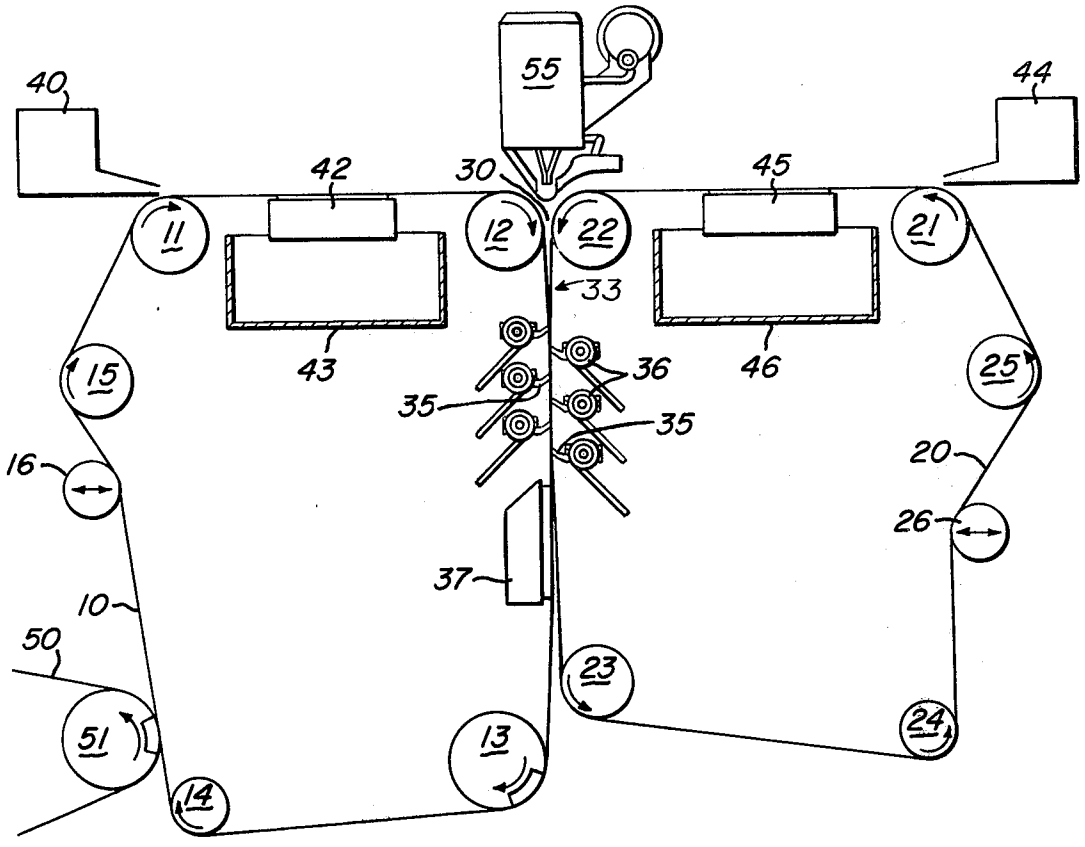
Assistant Examiner—Richard V. Fisher
Attorney, Agent, or Firm—Biebel, French & Bugg

[57] **ABSTRACT**

In apparatus for producing multi-ply paper by means of a pair of forming wires, the wires are arranged to travel horizontally toward each other and then to turn downwardly in converging relation. Multi-ply paper is produced by forming a separate sheet on each of the horizontally traveling reaches of wire and controlling the drainage of liquid through the wires to a low rate sufficient to maintain the consistency of the sheets at aproximately 5 to 12% so that they readily merge with each other as they travel into converging relation on the wires. A head box is provided above the converging portions of the wires for adding stock or other liquid to the converging sheets if desired.

3 Claims, 1 Drawing Figure

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METHOD FOR PRODUCING MULTI-PLY PAPER ON A TWIN-WIRE MACHINE

RELATED APPLICATION

This application is a continuation of application Ser. No. 252,573 filed May 12, 1973, now abandoned.

BACKGROUND OF THE INVENTION

Multi-ply paper has been produced for many years by means of a plurality of cylinder type paper machines, with the plies which are separately formed on the several cylinder molds being superposed on a common felt and transported thereby to presses and other finishing stations. Many variations of this arrangement have been attempted, but in each case, the separate plies have been relatively well formed before they were combined, and the bond between contiguous plies have been more the result of pressure then of intermingling of the fibers in the adjacent surface portions of the plies.

Another prior art approach, involving the use of basic Fourdrinier paper machine construction, has been to apply multiple layers of paper making stock on the same forming wires through the use of successive headboxes. Due to the fact that the first ply drains freely through the forming wire so that the fibers therein felt out on the wire, drainage of each successive ply is appreciably retarded, and this necessitates the use of a correspondingly long run of the wire. The same is true of multi-ply machines of the Fourdrinier type which use multiple wires, a typical example being shown in Thomas et al. U.S. Pat. No. 2,821,120.

More recently there has been increasing interest in the use of multiple wire paper machines in which the wires travel generally vertically, as first disclosed in Baxter U.S. Pat. No. Re. 24,333, and in the application of this general application to the production of multi-ply sheet. For example, Chupka U.S. Pat. No. 3,471,637 shows a multi-ply paper machine comprising a plurality of vertical forming zones, with each successive ply being formed in one of these zones between a bare forming wire and the previously formed sheet carried by the other wire. Once again, this arrangement requires substantial wire length, as well as substantial overall height for the machine.

SUMMARY OF THE INVENTION

The present invention has as its primary purpose the production of multi-ply paper wherein the adjacent plies are intimately bonded to each other by intermingling of the fibers composing the surface portions of contiguous plies. The invention has the additional objective of accomplishing this primary purpose by means of a twin wire paper machine which includes a vertical forming zone and which does not differ substantially in overall dimensions from commercial twin wire single ply paper machines already in operation.

The invention accomplishes its purpose and objective by simultaneously forming a separate paper sheet on each of a pair of reaches of forming wire traveling linearly in opposite directions to a pair of turning rolls supported in closely spaced relation defining a gap therebetween. Drainage of liquid from the sheets which form on these linearly traveling reaches is retarded or otherwise controlled to a low rate such that the sheets are of relatively low consistency as they reach their respective turning rolls.

The two wires are caused to loop portions of the respective turning rolls and then to travel downwardly in closely spaced converging relation. In the resulting tapered merging zone, the sheets are forced gently together so that the fibers in their opposed surface portions intermingle as these surfaces are brought into contact and additional liquid is extruded through the converging wires, so that major drainage of both plies takes place simultaneously while the plies are being urged into increasingly intimate contact. If desired, additional liquid, which may comprise paper making stock, may be delivered from above through the gap between the turning rolls to effect dilution of the opposed surface portions of the two plies and correspondingly increased intermingling of the fibers in those surface portions.

The primary objects of this invention are to provide a method and apparatus as outlined above for producing multi-ply paper sheet. Additional objects and advantages will in part be apparent and in part be pointed out in the course of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The single view is a side elevation illustrating diagrammatically a form of multi-ply paper making machine constructed in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the twin-wire paper machine shown in the drawing, the lefthand forming wire **10** is looped around a breast roll **11,** a turning roll **12,** a suction couch roll **13,** an additional turning roll **14** and a guide roll **15,** and it is also provided with a tensioning roll **16.** The righthand wire **20** is similarly looped around its breast roll **21,** first turning roll **22,** additional turning rolls **23–24** and guide roll **25,** and it is provided with a tensioning roll **26.** The term "wire" is used herein as generically including a foraminous forming web of any material suitable for the purpose.

The two first turning rolls **12** and **22,** which are in the positions customarily occupied by the breast rolls of a twin-wire single ply paper machine, are supported with their axes preferably in the same horizontal plane and with their closest surface areas controlably spaced to define a vertically extending narrow gap **30,** for example a gap of the order of 1 to 2 inches in horizontal width. The breast rolls **11** and **21** are supported in such relation with their associated first turning rolls so that the reaches of wires **10** and **20** between rolls **11–12** and **21–22** respectively travel towards each other along substantially linear paths.

The wires **10** and **20** are guided to wrap portions of their respective turning rolls and then to travel downwardly through the gap **30** into closely spaced relation along converging paths defining a merging zone **33** of tapered section. This guiding action is supplied in part by the couch roll **13** and turning roll **23,** but primarily by the wire supporting deflector blades **35,** which may be of any suitable design satisfactory for use in a single ply twin wire paper machine. These deflector are shown as having adjustable mounting assemblies **36** of the type disclosed in McCarrick et al. U.S. Pat. No. 3,578,561, but they may be of other forms, for example as shown in Baxter et al. U.S. Pat. No. 3,215,594. In ad-

dition to the deflectors **35**, a suction box **37** is mounted within the loop of the wire **10** above the couch roll **22**.

A headbox **40** is supported to deliver paper making stock onto the wire **10** on the off-running side of breast roll **11**. The construction and arrangement of headbox **40** may be of any type conventionally used on a Fourdrinier paper machine, and liquid from the stock delivered thereby onto the wire **10** will drain through the wire to form a paper sheet on the reach of wire traveling to the turning roll **12**. It is important to the objectives of the invention, however, that the consistency of this newly formed paper sheet be controlled to a level low enough to provide for the subsequent bonding of additional plies when it travels around the turning roll **12**. This result is aided by the provision of a relatively short wire run between rolls **11** and **12**, for example a distance of **10** feet or less. It can also be aided positively by supporting the linear wire reach by means **42**, such as forming boards or foils, which tend to control drainage through the wires into the collecting pan **43**.

The wire **20** is similarly provided with a headbox **44**, drainage control means **45** and collecting pan **46** for effecting formation of a relatively low consistency paper sheet on the linear reach between rolls **21** and **22**. Preferably the consistency of each of these newly formed sheets should not be significantly greater than is necessary to cause the sheets to be retained on the wires as they travel around the turning rolls **12** and **22**, namely a consistency in the range of 5 to 12% depending in part on the speed of the machine as well as on the character of the stock and the thickness of each ply.

It should be noted that the stock for each sheet need not be the same, and in a typical example, the stock from the headbox **40** may be designed to form top ply or liner, while the stock from headbox **44** is designed to form an under-ply or filler layer. In view of the extent of these variables, there may be conditions where it is necessary to control the consistency of one or both of the plies by applying vacuum to the sheet during its initial formation, and the drainage control means **42** and **45** are to be correspondingly construed as including suction boxes suitable for such purposes.

With the two newly formed sheets as described, their opposed surface portions readily intermingle as they are carried into contact with each other in the merging zone. Further, with the wire runs which define the merging zone guided as described along closely spaced converging paths, the two paper sheets are forced gently together as the fibers intermingle and as additional water is extruded from the zone through both wires. It is especially desirable in this connection that the deflectors **35** be arranged in vertically staggered relation such that each deflector blade occupies a generally horizontal plane which is spaced vertically from the similar plane occupied by the nearest deflectors on the opposite side of the forming zone, for example by a distance of the order of **6** inches in each direction. With this arrangement, as one wire passes the edge of any of the deflectors, it will be drawn tightly around the deflector, but the other wire will be constrained only by its tension, and therefore can move as may be required to maintain the proper spacing between the wires as well as the proper pressure to effect the desired merging of the contacting surface portions of the two sheets.

The two wires reach their closest relative spacing as they pass the lowermost deflector within the loop of the wire **20**. As they pass the suction box **37** with the sheet sandwiched between them, its suction action holds the sheet on the wire **10** while the wire **20** diverges toward the roll **23**. The wire **10** with the sheet thereon then wraps the rolls **13** and **14**, and the sheet is transferred to the carrying felt **50** wrapping the pickup roll **51** which engages the wire **10** between rolls **14** and **16**.

The paper machine is also shown in the drawing as provided with a headbox **55** positioned immediately above the gap **30** between the turning rolls **12** and **24**. This headbox may be of any construction found suitable for use for twin-wire single ply vertical paper machines, and it provides the machine with substantial versatility. For example, the machine can be used to produce single ply paper, with stock being supplied only to the headbox **55** and not to either of the headboxes **40** and **44**. Additionally, there may be instances in which all three headboxes will be used, particularly if it is found desirable to deliver additional liquid to the zone where the sheets on the two wires first come into contact. This additional liquid may be white water or paper making stock, since the headbox **55** can be used to deliver stock for forming a center ply between the sheets already present on wires **10** and **20**.

While the methods and forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise methods and forms of apparatus, and that changes may be made therein without departing from the scope of the invention.

What is claimed is:

1. The process of producing multi-ply paper which comprises the steps of:

a. continuously advancing reaches of a pair of looped forming wires toward each other along substantially linear paths,

b. turning said wires downwardly at the adjacent ends of said paths and directing said downwardly turned wires into closely spaced relation along converging paths defining a merging zone,

c. depositing paper making stock on each of said linear wire reaches for drainage of the liquid therethrough during travel thereof along said paths and formation of a paper sheet on each said wire reach,

d. controlling the drainage of liquid through said wire reaches to a rate sufficient to maintain the consistency of said sheets in a low range of approximately 5 to 12% as said sheets are carried by said wires into said merging zone, and

e. alternately suppo rting each of said wires at spaced locations along said merging zone while maintaining both of said wires under tension such that at each said location the unsupported said wire can move as required to maintain pressure on said low consistency sheets causing the adjacent surface portions of said low consistency sheets to merge with each other while the liquid in said sheets is extruded through said wires.

2. The process as defined in claim **1** wherein said drainage controlling step is carried out by retarding the drainage of liquid through said linear wire reaches.

3. The process as defined in claim **1** wherein the consistency of said sheets as they approach said merging zone is not substantially greater than is required to retain said sheets on said wires throughout said turning step.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,915,791 Dated October 28, 1975

Inventor(s) Eric C. Langdon

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the first page, in item "[63]" change "1973" to --1972--.

Column 1, line 7 change "1973" to --1972--.

Signed and Sealed this

twenty-third Day of *March 1976*

[SEAL]

Attest:

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Attesting Officer

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