

[72] Inventor **Donald B. De Noyer**
 Beloit, Wis.
 [21] Appl. No. **832,911**
 [22] Filed **June 13, 1969**
 [45] Patented **Dec. 7, 1971**
 [73] Assignee **Allis-Chalmers Manufacturing Company**
 Milwaukee, Wis.

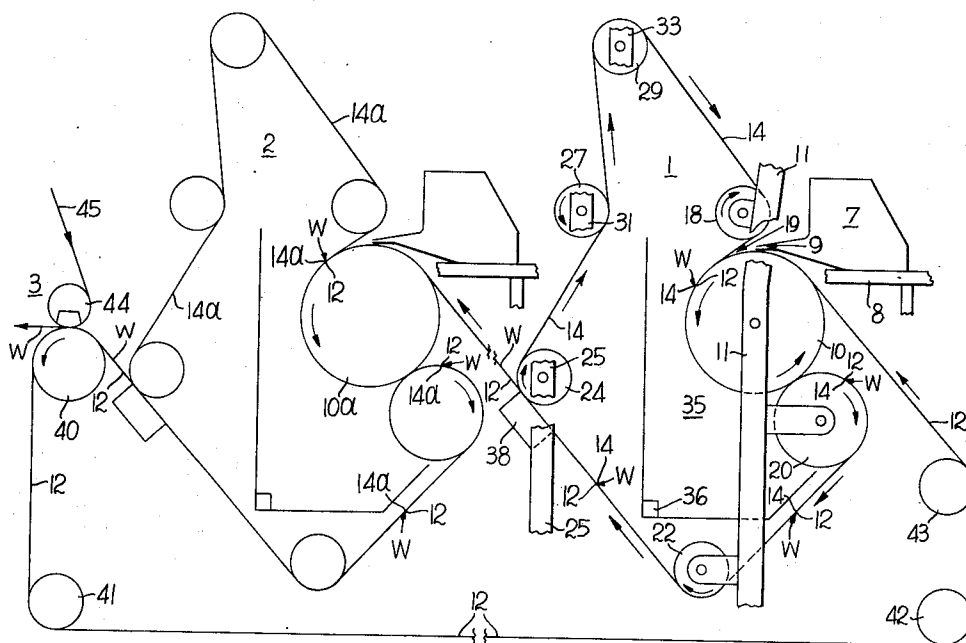
3,311,533 3/1967 Montizny et al. 162/303 X
Primary Examiner—S. Leon Bashore
Assistant Examiner—Alfred D'Andrea, Jr.
Attorneys—Arthur M. Streich, Robert B. Benson and John P. Hines

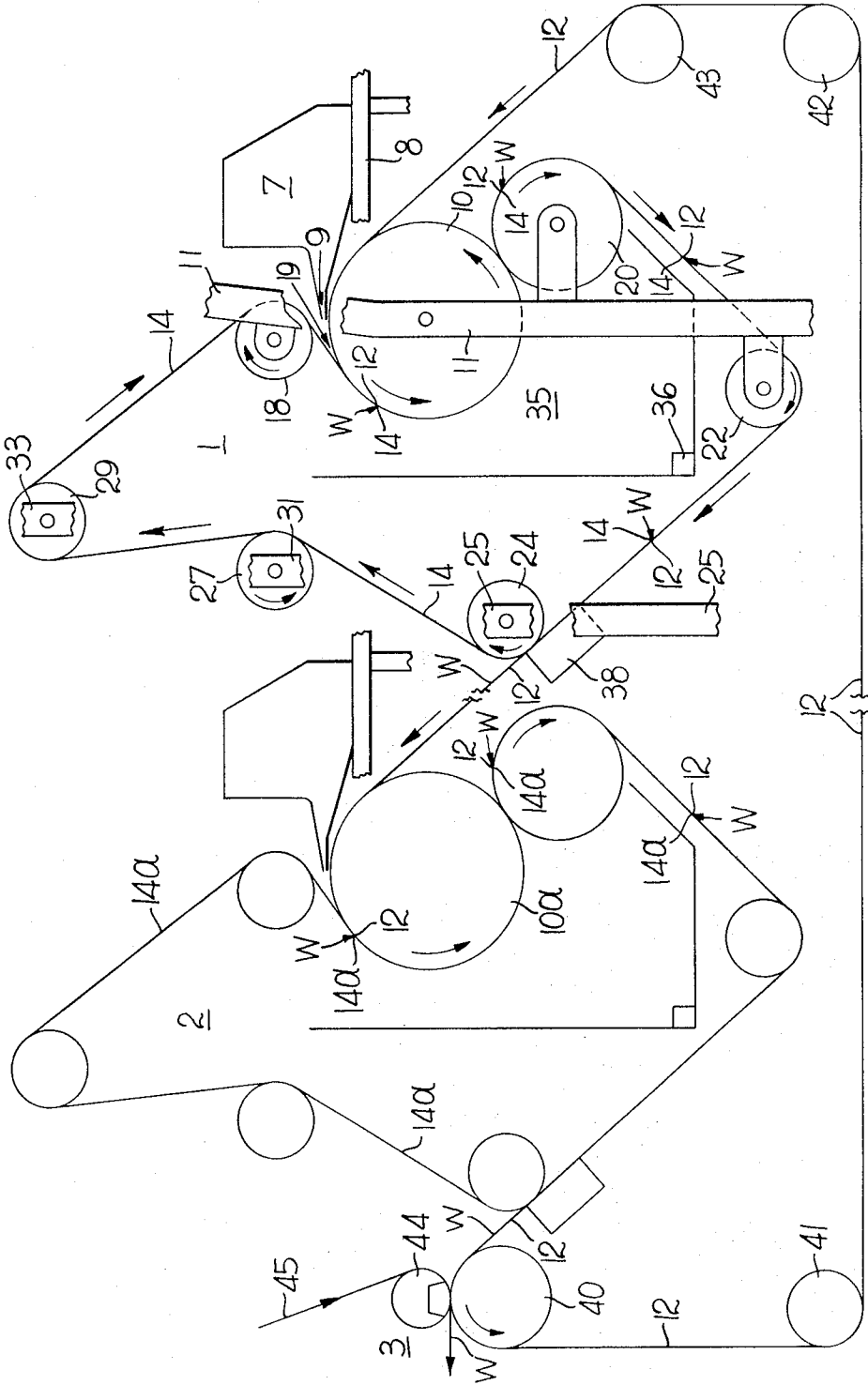
[54] **MULTILAYER PAPERMAKING MACHINE WITH IMPERVIOUS ROLL WEB FORMER**
 6 Claims, 1 Drawing Fig.

[52] U.S. Cl. **162/299,**
 162/303, 162/304
 [51] Int. Cl. **D21h 1/06**
 [50] Field of Search 162/123,
 133, 203, 300, 303, 304, 318, 357, 217, 317, 298,
 132, 299

[56] **References Cited**
UNITED STATES PATENTS
 3,224,928 12/1965 Lee et al. 162/203 X
 3,262,841 7/1966 Embry 162/203 X
 3,400,045 9/1968 Graham 162/317
 3,531,371 9/1970 Jordansson et al. 162/300 X

ABSTRACT: A portion of a papermaking machine is disclosed having several web-forming units in series for making heavy or multilayer paper. Each forming unit includes a head-box mounted above an impervious forming roll for discharging pulp into a nip between a pair of belts coming together and lapping a down turning side of the forming roll. Both belts may be wire fabrics or, preferably, one belt is a felt fabric making contact with the forming roll and the other belt is a wire and arranged radially outward of the felt. The pulp is formed into a web sandwiched between the radially inner felt and radially outer wire and water is squeezed from the pulp web outwardly through the wire. At the bottom of the forming roll the felt is located over the web and wire, and the felt-web-wire is removed from the forming roll and turned downwardly away from the forming roll and inverted to place the wire and web on top of the felt. The wire is lifted from the web and looped back to the forming roll while the web remains on top of the felt and is carried thereby through successive similar forming units for applying additional layers of pulp to the web.





Inventor
Donald B. DeDoyere
By *William M. Strick*
Attorney

MULTILAYER PAPERMAKING MACHINE WITH IMPERVIOUS ROLL WEB FORMER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a paper machine in which pulp stock is directed by a headbox in a generally tangential direction at a forming roll, into a nip between two fabric belts (which may be, for example, one wire fabric and one felt fabric or both belts may be wire fabrics) and both of the belts with pulp therebetween lap the forming roll.

2. Description of the Prior Art

Prior art patents relating to web formation on forming rolls are of perhaps six types.

The first type, and apparently the earliest of such machines to be developed, involves a pervious cylinder (sometimes called a cylinder mold) that rotates partly submerged in a vat containing pulp, and a layer of pulp is brought up from the vat on the revolving mold. U.S. patents that illustrate typical machines of that type include U.S. Pat. Nos. 206,106 and 206,107 of 1878; U.S. Pat. No. 1,578,729 of 1926; and U.S. Pat. No. 3,216,891 of 1965.

The second and apparently next type of such machines to appear, involve a pervious cylinder with pulp jetted thereon from such as a headbox. U.S. patents that illustrate typical machines of that type include U.S. Pat. No. 1,856,081 of 1932 (see FIG. 4); and U.S. Pat. No. 2,162,097 of 1939.

A third type of such machines involves a pervious cylinder part of which is lapped by a single belt in contact with part, but not all, of the outer surface of the cylinder. Patents that illustrate typical machines of that type include U.S. Pat. No. 2,365,658 of 1944; U.S. Pat. No. 2,995,186 of 1961; U.S. Pat. No. 2,473,269 of 1949; U.S. Pat. No. 2,929,448 of 1960; U.S. Pat. No. 3,018,825 of 1962; U.S. Pat. No. 3,132,990 of 1964; U.S. Pat. No. 3,311,533 of 1967; and British Pat. No. 1,019,449 of 1966. This latter patent, British Pat. No. 1,019,449 shows how such machines are applied to making relatively heavy or multilayer paper.

A fourth type of such machines involves a pervious cylinder part of which is lapped by a pair of belts between which pulp is formed into a web while lapping the cylinder. U.S. patents that illustrate typical machines of that type include U.S. Pat. No. 3,056,719 of 1962 (FIG. 2); U.S. Pat. No. 3,150,037 of 1964; and U.S. Pat. No. 3,201,305 of 1965 (FIG. 3).

A fifth type of such machines involves an impervious cylinder part of which is lapped by a single belt. Typical machines of that type are illustrated in FIG. 1 of U.S. Pat. No. 3,056,719 and FIG. 1 of U.S. Pat. No. 3,201,305; and U.S. Pat. No. 3,397,112 of 1968.

A sixth type of such machines involves an impervious cylinder part of which is lapped by a pair of belts forming pulp into a web therebetween while lapping the impervious cylinder. U.S. patents that illustrate typical machines of that type include U.S. Pat. No. 1,875,075 of 1932; U.S. Pat. No. 2,167,440 of 1939; U.S. Pat. No. 3,201,305 (FIG. 2) and U.S. Pat. No. 3,224,928 of 1965; U.S. Pat. No. 3,326,745 of 1967; and U.S. Pat. No. 3,378,080, U.S. Pat. No. 3,378,435 and U.S. Pat. No. 3,400,045 of 1968.

SUMMARY OF THE INVENTION

Among the objects of the present invention is that of providing a new and improved machine of the aforesaid sixth type, having a web forming unit which will achieve the intensive dewatering of pulp which takes place with pulp between a wire and felt coming together and lapping a forming roll and:

- a. the newly formed web is transported away from the forming unit on the top surface of a transporting belt;
- b. after removal from the forming roll the belts and web are turned to cause both centrifugal force and gravity to accelerate water out of the web and to impel the web toward the transporting belt which will carry the web away from the forming station;

c. the web-forming unit is such that several units can be arranged in series to make heavy or multiply paper, with the web being continuously supported on the top surface of the transporting belt for receiving additional layers of pulp thereon; and

d. which is operative with either one wire fabric belt and one felt fabric web-transporting belt or with both belts being wires or wirelike fabrics.

According to a preferred embodiment of the present invention, a web-forming unit is provided with a headbox or other pulp-discharging device mounted above an impervious forming roll for discharging pulp into a nip between a pair of belts coming together and lapping a down turning side of the forming roll. Both belts may be wire fabrics or, preferably, one belt is a felt fabric making contact with the forming roll and the other belt is a wire or wirelike fabric having interstices therethrough, and the wire is arranged radially outward of the felt. The pulp is formed into a web sandwiched between the radially inner felt and radially outer wire and water is squeezed from the pulp web outwardly through the wire. At the bottom of the forming roll the felt is located over the web and over the wire, and the felt-web-wire is removed from the forming roll and turned downwardly away from the forming roll and inverted to place the wire and web on top of the felt as the web is carried away from the forming unit. The wire is thereafter lifted from the web and looped back to the forming roll while the web remains bottom supported and top exposed on top of the felt. A plurality of such units may be provided in series with the felt being an endless loop extending through each such unit in the manner described, to continuously carry and guide the web formed by the first unit to and through the other units which apply additional layers of pulp to the web.

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 pair of web-forming units of a papermaking machine according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing a portion of a papermaking machine is shown for forming fiber and water pulp into a web of heavy paper, paperboard or multilayer paper. A first-stage web-forming unit 1 is provided for forming an initial web W, and a final-stage forming unit 2 is provided for depositing a final layer of pulp on top of a wet web formed in such as the first-stage forming unit 1. In a commercial installation several intermediate-stage forming units (not shown) may be arranged in series between the first- and final-stage units here identified with the reference numerals 1 and 2. A typical commercial installation may have seven stages each comprising a forming unit substantially identical to the units 1, 2 shown in the drawing. At the web outrun end of the final-stage forming unit 2, a pickup press 3 is provided to pick up and transport the web W to a press section and drying section of the papermaking machine, both of which may be of conventional design and construction for heavy or multilayer paper such as will be formed by a series of forming units such as the units 1, 2.

Referring to the first-stage web-forming unit 1 shown in drawing, a headbox 7 mounted on support structure 8, has a slice opening 9 for discharging and directing fiber and water pulp along a generally tangential path toward a top portion of a forming roll 10 mounted on support structure 11 to rotate in the direction indicated by an arrow. A first endless loop fabric belt 12 is arranged and guided by means which will be described later, to lap the down-turning side of forming roll 10. The first belt 12 extends through each forming unit and at the pickup press 3 turns and is returned back to the first-stage unit. The forming roll 10 of unit 1, the forming roll 10a of unit

2 and the forming roll for units intermediate units 1 and 2 (and not shown) are all therefore within the continuous and endless loop of the first belt 12.

A second endless loop fabric belt is provided for each forming unit. This second belt is identified by reference number 14 in unit 1 and reference number 14a in unit 2. The second belt 14 is arranged and guided by means which will be described later, to lap the downward-turning side of forming roll 10 covered by the first belt 12. Thus the second belt 14 is on top of and radially outward of the portion of the first belt 12 which laps forming roll 10.

Belts 12 and 14 may both be wire fabrics or synthetic materials, made in a continuous loop with interstices therethrough for draining water from a fiber-water pulp. It may be preferable in some installations however, that only the second belt 14 be a wire or other fabric, with interstices therethrough, and the first belt 12 preferably be a felt fabric comprising a multitude of randomly oriented interlocked matted fibers so that the first belt 12 has no discernible interstices therethrough.

Although forming roll 10 is within the loop of the first belt 12, forming roll 10 is not within the loop of the second belt 14; and a first, a second, and third means are provided within the loop of the second belt 14 for guiding the second belt 14 to lap the portion of forming roll 10 covered by the first belt 12 and such means will now be described. The first guiding means within the loop of the second belt 14 comprises a first turning roll 18 mounted on support structure 11 in parallel-spaced alignment with forming roll 10 to guide second belt 14 tangentially toward roll 10 to define a nip 19 between first belt 12 and second belt 14. The second guiding means within the loop of belt 14 comprises a second turning roll 20 and a third turning roll 22. The second turning roll 20 is mounted on the support structure 11 in parallel alignment with forming roll 10, below a portion of the underside of forming roll 10, to press the first belt 12, web W and second belt 14 against a portion of the underside of forming roll 10. The third turning roll 22 is mounted on support structure 11 in spaced parallel alignment with the second turning roll 20. Turning roll 22 is spaced below turning roll 20 and roll 22 may be ahead of roll 20 with reference to the direction of the movement of the web W therebetween, as indicated by arrows. The third guiding means comprises a fourth turning roll 24 mounted on support structure 25 in parallel-spaced alignment with the third turning roll 22. Turning roll 24 may be spaced above turning roll 22 and roll 24 is ahead of roll 22 with reference to the direction of the movement of the web W therebetween, as indicated by arrows. A pair of tensioning rolls 27, 29 are adjustably supported by support structures 31, 33, with roll 29 within the loop of belt 14 and roll 27 outside the loop of belt 14.

A save-all 35, supported by support structure 11, is arranged in the space above turning roll 22, between turning rolls 20 and 24, and below turning roll 10 to collect water pressed from pulp between belts 12 and 14 turning on forming roll 10. A drain 36 is provided in save-all 35 to evacuate and drain the save-all. A suction box 38, supported by support structure 25, is arranged beneath the belts 12, 14 and web W between roll 22 and roll 24, and with at least a portion of the suction box 38 extending beneath turning roll 24.

In the operation of forming unit 1, a dilute pulp stock having from about one-half percent to 1½ percent fibers dispersed in 99½ percent to 98½ percent water, is discharged from slice opening 9 in headbox 7, into the nip 19. As the belts 12, 14 come together on the impervious forming roll 10, with pulp between the belts, water is squeezed from the pulp and flows radially outward through belt 14 to fall into save-all 35 while the dewatered pulp forms a web of fibers. The belts 12, 14 and web therebetween are drawn by turning roll 20, against the downward-turning side of forming roll 10 and move downwardly and underneath roll 10 thereby combining an upward pressing force with a downward centrifugal force and gravitational force to accelerate water, from the pulp, flowing

through belt 14 to save-all 35. When the belts 12, 14 and web therebetween arrive at turning roll 20 the belt 12 (preferably a felt) is over the web W and over belt 14 (which is a wire or wirelike fabric). At roll 20 the belts and web are inverted to place belt 14 over the web W and over the belt 12, and the belts and web are led from roll 20 by roll 22 along a downwardly directed path to roll 22 where they are turned and led by roll 24 along an upwardly directed path to roll 24. As the belts 12, 14 and web W turn on roll 22 an upward pressing force again combines with centrifugal force and gravitational force to accelerate water from web W, this time downwardly through belt 12.

When belts 12, 14 and web W pass between roll 24 and suction box 38 belt 14 is turned upwardly from web W and belt 14 is guided back to the first turning roll 18, with the tensioning rolls 27, 29 therebetween acting to properly tension the entire loop of belt 14. Suction box 38 is located to insure that web W remains on belt 12 which continuously supports and carries the bottom-supported and top-exposed web W to the forming roll (such as roll 10a) of each succeeding forming unit (such as forming unit 2). The intermediate-stage units (not shown) and the final-stage unit 2 may all be constructed and may operate as has been described for the first-stage unit 1. As the belt 12 bottom carries web W from the final-stage unit to the pickup press 3, the belt 12 is turned by a turning roll 40 and subsequent turning rolls 41, 42 and 43 to return to the forming roll 10 of the first-stage forming unit 1. At the pickup press assembly 3, a suction pickup roll 44 within a loop of a pickup felt 45, lifts the web W off belt 12 for transport through a press section which may be of conventional design and construction and forms no part of the present invention. Although the described apparatus may more often than not be operated with belt 12 being a felt and belt 14 being a wire, the apparatus is operable with both belts being wires or wirelike fabrics.

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 are defined as follows.

1. A papermaking apparatus for making paper of multiple deposits of pulp, having a plurality of forming units arranged in series and comprising:

- a. a single first endless loop fabric belt;
- b. a second endless loop fabric belt for each unit having interstices therethrough for draining water from a fiber and water pulp in contact therewith;
- c. a forming roll for each unit for rotation in a predetermined clock reference direction about a horizontal axis, each said forming roll being arranged within the loop of the first belt and with one portion of the first belt in lapping contact with at least a downwardly turning portion of the surface of each forming roll;
- d. first guiding means for each unit arranged within the loop of the second belt for each unit to guide a portion of each second belt to lap the said one portion of the first belt in contact with the forming roll of each unit and define a nip therewith in each unit;
- e. a means for each unit for jetting fiber and water pulp into each nip for dewatering the pulp and forming a web thereof between the belts coming together around each forming roll;
- f. second guiding means for each unit arranged within the loop of the second belt for each unit to guide in each unit both the second belt, a portion of the first belt aligned therewith and the web therebetween from the nip along at least a portion of each forming roll beneath its said horizontal axis with the first belt there being on top of the web and the second belt for each unit being beneath the web, and thereafter turn both belts and the web therebetween away from the forming roll to invert the

belts and web to place the first belt beneath the web and the second belt on top of the web; and

g. third guiding means for each unit arranged within the loop of the second belt for each unit and spaced from the second guiding means of each unit in the direction of movement of the second belt to guide the second belt upwardly away from the web and back to the first guiding means for each unit and present the web in a position with its bottom supported on top of the first belt and top surface exposed as the first belt carries the web from one of the units to the next unit in the series.

2. An apparatus according to claim 1 in which each first guiding means comprises a first turning roll spaced above the forming roll of each unit; each second guiding means comprises a second turning roll arranged to press the first belt, the web and the second belt against a portion of the underside of the forming roll of each unit, and a third turning roll spaced below each second turning roll to direct the belts and web along a downward path from the second turning roll to the third turning roll; and each third guiding means comprises a fourth turning roll guiding the belts and web to turn around at least a portion of the underside of the third turning roll in each unit with centrifugal force thereby being imparted to supplement gravitational force tending to accelerate water pressed out of the web as the belts and web turn on the third turning roll in each unit.

3. An apparatus according to claim 1 in which each first guiding means comprises a first turning roll spaced above the

forming roll of each unit; each second guiding means comprises a second turning roll arranged to press the first belt, the web and the second belt against a portion of the underside of the forming roll of each unit, and a third turning roll spaced below each second turning roll to direct the belts and web along a downward path from the second turning roll to the third turning roll; and each third guiding means comprises a fourth turning roll spaced above the third turning roll in each unit, to direct the belts and web in each unit along an upwardly directed path from the third turning roll to the fourth turning roll with centrifugal force thereby being imparted to supplement gravitational force tending to accelerate water pressed out of the web as the belts and web turn on the third turning roll in each unit.

4. An apparatus according to claim 2 in which a save-all is arranged in each unit in the space above the third turning roll, between the second and fourth turning rolls, and below the forming roll to collect water pressed from the pulp as the belts turn on the forming roll.

5. An apparatus according to claim 1 in which a suction box is provided in each unit beneath the belts and web between the second and third guiding means, and with at least a portion of the suction box extending beneath the third guiding means.

6. An apparatus according to claim 2 in which a suction box is provided in each unit beneath the belts and web between the third and fourth turning rolls, and with at least a portion of the suction box extending beneath the fourth turning roll.

* * * * *

30

35

40

45

50

55

60

65

70

75