United States Patent

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[54] **MULTI-LAYER CENTRIFUGAL WEB FORMER**
7 Claims, 1 Drawing Fig.

[52] **U.S. Cl.** **162/300,** 162/132, 162/303
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[50] **Field of Search** 162/300, 299, 298, 132, 123, 303

[56] **References Cited**

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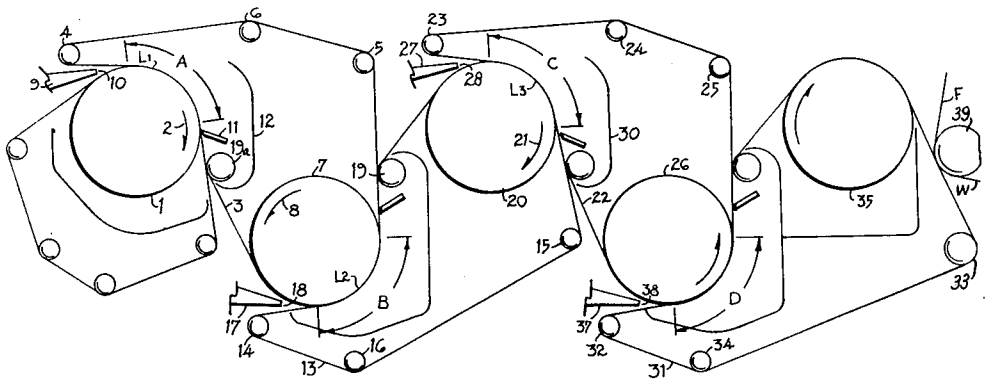
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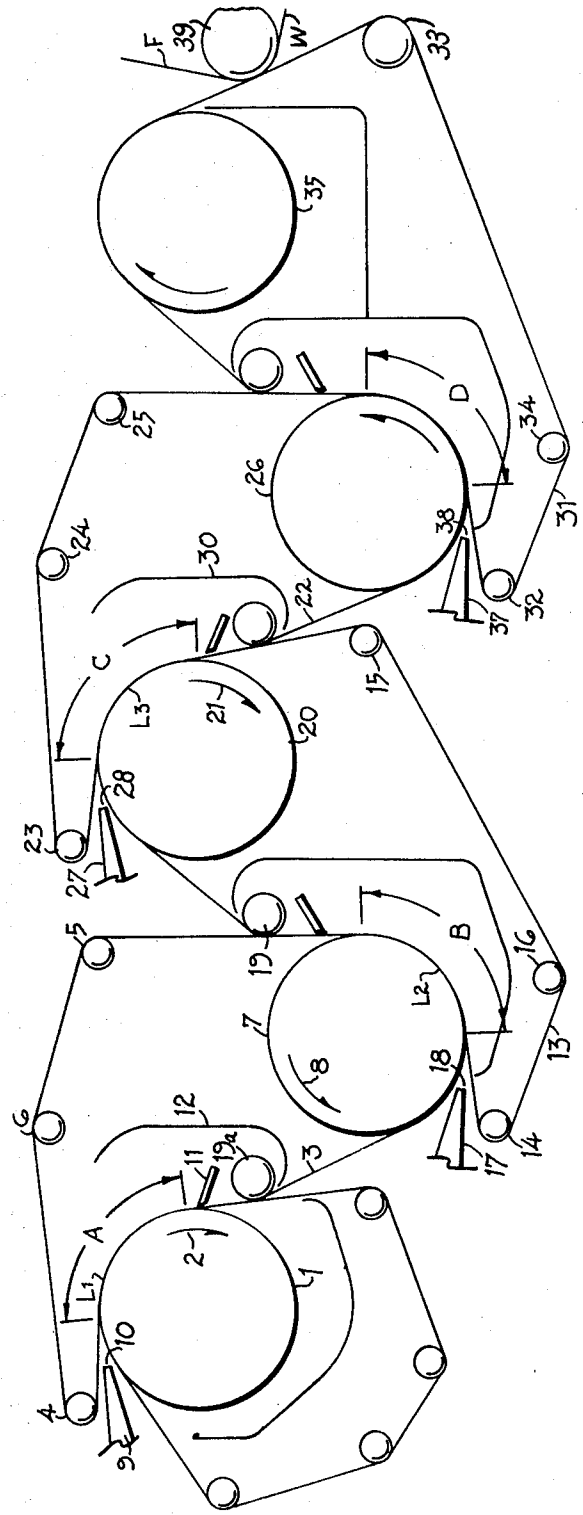
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ABSTRACT: A web-forming machine for forming a web from layers of slurries of suspended fibers, having a looped foraminous belt, a roll on the outside of the belt wrapped by the belt defining a web-forming area, a slurry supplier to supply slurry to the web-forming area, a second roll on the inside of the belt, another belt wrapping the layer on the first belt as it wraps the second roll defining a second web-forming area, and a second slurry supplier to supply slurry to the second area whereby a layer is added to the first layer.





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MULTI-LAYER CENTRIFUGAL WEB FORMER

BACKGROUND OF THE INVENTION

This invention pertains to the art of forming a multilayer web from slurries of suspended fibers, and more particularly this invention pertains to the art of forming multilayer paper, paperboard and similar weblike materials. Specifically, this invention pertains to improvements over the prior art of which the following are examples:

FIG. 2 of U.S. Pat. No. 2,881,670, U.S. Pat. No. 2,881,672, FIG. 6 of Canadian Pat. No. 622,111, an article by R. DeMontiguy, entitled "Through a Glass Darkly" (A discussion of New Sheet Formers), in the October 1966 "Pulp and Paper Magazine of Canada", and other prior art, referred to generally, known to those skilled in the art.

Some problems involved with this prior art are as follows:

Generally, long wires such as those shown in FIG. 2 of U.S. Pat. No. 2,881,670, in U.S. Pat. No. 2,881,672, and in FIG. 6 of Canadian Pat. No. 622,111 present many problems. Initially, in many cases, longer wires cost more per foot than shorter wires. In installation, the wires are difficult to handle because of their large size and weight. After operation, as is well known in the art, wires must be changed frequently because of wear. This necessity creates problems similar to those for installation except not only must a new wire be installed but an old wire must be removed.

Referring in particular to FIG. 2 of U.S. Pat. No. 2,881,670, it will be appreciated that the length of the machine is substantial and a large amount of equipment is used to form a multilayer web. The long length of the machine and the use of a large amount of equipment contribute substantially to the final cost of the machine and the web.

In the apparatus of U.S. Pat. No. 2,881,672, the horizontal runs of the wires and the drainage of the water from pulp through the wires are not entirely satisfactory. As the speed of paper machinery increases, so must the length of the runs because less time is available for water drainage.

The apparatus of FIG. 6 of Canadian Pat. No. 622,111 presents some problems. Suction in each of the forming units acts against the centrifugal force forcing water in the web outward. Also, the drying capacity of each unit is limited because a layer cannot be too dry before it is united with a second layer, or it will not stick to the second layer. For example, the layer formed in the second unit can not be too dry or it will not stick to the layer formed in the first unit, so the second layer must be wet requiring further drying.

The discussion of new sheet formers in the article by R. DeMontiguy presents in detail some of the recent problems in sheet formers but a solution for forming multilayer web is not disclosed.

SUMMARY

It is an object of this invention to provide means to form a multilayer web having short foraminous belts.

It is another object of this invention to provide means to form a multilayer web having the web forming and carrying runs inclined with the horizontal.

It is a further object of this invention to provide means to form a multilayer web having forming areas between a foraminous belt and a cylinder as the belt wraps the cylinder.

It is a still further object of this invention to provide means to form a multilayer web having a tensioned foraminous belt for one side of the curved forming area.

It is an even further object of this invention to provide means to form a multilayer web in a forming area defined by a foraminous belt wrapping a forming cylinder and by forming successive layers in forming areas between two foraminous belts wrapping a forming cylinder where one of the belts is used in the preceding forming area.

With reference to FIG. 2 of U.S. Pat. No. 2,881,670 the machine of the instant invention is shorter and less equipment is used. Since the forming and carrying runs in the instant invention are inclined with the horizontal, the total machine length is less. Also, since the forming area is between a foraminous tensioned belt wrapping a cylinder, less drainage wire length is required because centrifugal force and the pressure of the foraminous belt against the web will cause substantial dewatering.

Referring to U.S. Pat. No. 2,881,672, the problem of a long machine due to horizontal runs is decreased by inclining the runs. Also, the problems of long wires necessary for drainage is decreased by dewatering the layers of the web in a forming area between a foraminous belt and a cylinder.

Comparing the instant invention to FIG. 6 of Canadian Pat. No. 622,111, in the instant invention, suction does not counteract the centrifugal force tending to dewater the web layers and the drying capacity of the instant invention is not limited as it is with the Canadian Patent where the web is dried before it is added to a previous layer.

Other advantages and objects of this invention will become apparent from the following description of preferred embodiments and the claims.

BRIEF DESCRIPTION OF THE DRAWING

The FIG. is essentially a diagrammatic elevational view of an embodiment of the instant invention.

DESCRIPTION OF PREFERRED EMBODIMENT

Generally the preferred embodiment was designed to produce multilayer paper and includes forming rolls **1**, **7**, **20** and **26**, a couch roll **35**, wires **3**, **13**, **22** and **31**, and stock nozzles **9**, **17**, **27** and **37**.

The forming roll **1** rotates in the direction shown by arrow **2**. The wire **3** wraps around the forming roll **1**, as shown. The wire is also supported and guided by rolls **4**, **5**, **6** and **7**. Rolls **4** and **6** may be used primarily to support and guide the wire. Roll **5** is used to create a tension in the wire in a manner well known to those skilled in the art, and roll **7** is a forming roll similar to roll **1**.

The stock nozzle **9** introduces stock **10** to the forming area A, and a web layer, L_1 is formed between the wire **3** and the forming roll **1**, because of squeezing action of the wires and centrifugal force.

Since the wire **3** is in tension, the web layer L_1 will be forced against the forming cylinder **1** and water will be forced from the web layer outward through the wire. The tension may be varied with roll **5** to obtain the desired amount of force. Since the web layer L_1 is confined between the wire **3** and the forming roll **2** in the forming area A, the web layer is forced to change direction. This change of direction creates a centrifugal force on the fibers and water of the web layer, thereby assisting in water removal. The faster the speed of the wire **3** and of the forming roll **2** the greater the centrifugal force will be.

After the water passes through the wire **3**, it is collected in a saveall **12**. Some of the water which is not forced clear of the wire is removed by a doctor **11**; this water flows across the doctor and into the saveall **12**.

The web layer L_1 formed in the forming area is next transported by the continuously moving wire **3** to a forming area B between the wire **3** wrapping the forming roll **7** and the wire **13**, as shown. A transfer roll **19***a* may be conveniently used for this purpose. As before, a stock nozzle **17** introduces stock **18** to the forming area B and a web layer L_2 is added to and becomes an integral part of the web layer L_1.

After the web layer L_2 has been formed and integrated with the web layer L_1, the resultant web is transported away from the forming area B on the wire **13**. A suction or plain roll **19** may be used to insure that the resultant web does not stick to the wire **3**. The wire **3** is supported and guided by the guiding and supporting rolls **14** and **16** and tension may be created in the wire **3** by the tensioning roll **15**. The tension, as before, may be adjusted to obtain the desired amount of dewatering in the forming area B.

The resultant web formed in the forming area B is transported to the web forming area C between the wire **13** wrapping the forming roll **20** and the wire **22**. Stock **28** is introduced to the forming area C by the slurry nozzle **27** and a web layer L_3 is formed and integrated with the previously formed resultant web.

Supporting and guiding rolls **23** and **25** and a tensioning roll **24** are similar to the supporting, guiding and the tensioning roll inside the wire **3**. A doctor **29** and a saveall **30** are also similar. After the resultant web has been formed, it is transported to a forming area D between wire **22** wrapping forming roll **26** and wire **31**. Stock **38** is introduced by the stock nozzle **37**. The resultant web is transported over the couch roll **35** and taken off the wire **31** by the felt F which is pressed against the wire **31** by the pickup roll **39**.

As before, the wire is guided and supported by guiding and supporting rolls **32** and **34** and tension is created by tensioning roll **33**. Suction roll **36** is used to insure transfer and is also similar to suction roll **19**.

It should be noted that the forming rolls **1**, **7**, **20** and **26** may be of different designs such as for example a suction roll, a cylinder mold-type roll or an impervious roll. Roll **1** may be a roll of any type also having an extended wire run trained about it.

The preceding is a description of a preferred embodiment and it should be understood that the invention is not limited to the specific embodiment disclosed, but includes all modifications, changes and alternate constructions falling within the scope of the principles taught by the invention.

I claim:

1. A web-forming machine for forming a multilayer web from a plurality of slurries of suspended fibers, comprising:

a. a first forming roll rotatably mounted;

b. a second forming roll rotatably mounted and spaced from said first forming roll;

c. a first looped foraminous belt having an inside surface and an outside surface, and supported and guided so that said outside surface wraps said first forming roll thereby defining a first forming area, and said inside surface wraps said second forming roll;

d. first slurry supply means to supply slurry to said first forming area whereby a first layer is formed on said first belt;

e. a second looped foraminous belt having an outside surface and an inside surface, and supported and guided so that said outside surface said first belt where said first belt wraps said second forming roll thereby defining a second forming area; and

f. second slurry supply means to supply slurry to said second forming area whereby a second layer is formed and integrated with said first layer on said second belt.

2. The machine as set forth in claim **1** wherein said first forming area includes a convergence area between said first roll and said first belt before said first belt wraps said first roll and a pressure area between said first roll and said first belt as said first belt wraps said first roll, and said first slurry supply means supplies slurry to said first convergence area.

3. The machine as set forth in claim **1** wherein said first roll has a topside and a bottom side, said second roll has a topside and a bottom side, said first roll and said second roll are substantially in a horizontal plane, said first-forming area is on said topside of said first-forming roll, and said second forming area is on said bottom side of said second roll.

4. The machine as set forth in claim **1** wherein said first roll has a topside and a bottom side, said second roll has a topside and a bottom side, said first roll and said second roll are substantially in a horizontal plane, said first-forming area is on said bottom side of said first-forming roll, and said second-forming area is on said topside of said second roll.

5. The machine as set forth in claim **1** further comprising transfer means operatively associated with said belts after a layer is formed thereon.

6. The machine as set forth in claim **1** further comprising:

a. first tensioning means operatively mounted to create tension in said first belt; and

b. second tensioning means operatively mounted to create tension in said second belt.

7. The machine as set forth in claim **1** further comprising:

a. a third-forming roll rotatably mounted and spaced from said first roll and said second roll so that said first roll precedes said second roll along a path and said second roll precedes said third roll along said path, and wrapped by said second belt;

b. a fourth-forming roll rotatably mounted and spaced from said second roll and said third roll so that said second roll precedes said third roll along said path and said fourth roll precedes said third roll along said path;

c. a third-looped foraminous belt having an inside surface and an outside surface and supported and guided so that said outside surface wraps said second belt where said second belt wraps said third roll thereby defining a third-forming area and so that said inside surface wraps said fourth roll;

d. third slurry supply means to supply slurry to said third-forming area whereby a third layer is formed and integrated with said first and second layers on said third belt;

e. a couch roll rotatably mounted and spaced from said third and fourth rolls so that said third roll precedes said fourth roll along said path and said fourth roll precedes said couch roll along said path;

f. a fourth-looped foraminous belt having an inside surface and an outside surface and supported and guided so that said outside surface wraps said third belt where said third belt wraps said fourth roll thereby defining a fourth-forming area and so that said inside surface wraps said couch roll; and

g. fourth slurry supply means to supply slurry to said fourth-forming area whereby a fourth layer is formed and integrated with said first, second and third layers on said fourth belt.