United States Patent

Newsom et al.

[15] **3,637,460**

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[54] DEWATERING APPARATUS

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[52] **U.S. Cl.** **162/352,** 162/374

[51] **Int. Cl.** **D21t 1/52**

[58] **Field of Search** 162/352, 353, 354, 374, 363, 162/364, 252

[56] **References Cited**

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Paper Week, Sept. 19, 1966 Vol. 2, No. 38 Advertisement " New Huyck Vacu-Foil Unit," p. 27.

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[57] **ABSTRACT**

This invention relates to dewatering devices for use in the forming section of papermaking machines. A preferred embodiment comprises an enclosure, the top of which is open to the underside of the forming medium with which it is associated, at least one of the sidewalls of which has a concave lower portion extending into an upturned lip, thereby forming a pocket in which effluent drawn through the forming medium will collect and a second member coextensive with, and having a portion spaced from and within, said concave portion to form a channel that will provide a means for discharging excess effluent from the pocket while keeping the pocket at least partially filled with effluent so as to maintain a seal between the inside of the enclosure and the surrounding air.

6 Claims, 3 Drawing Figures

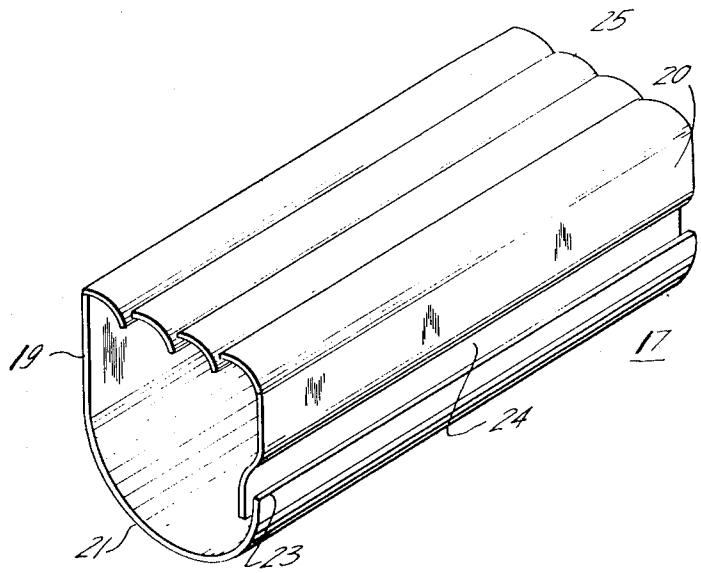
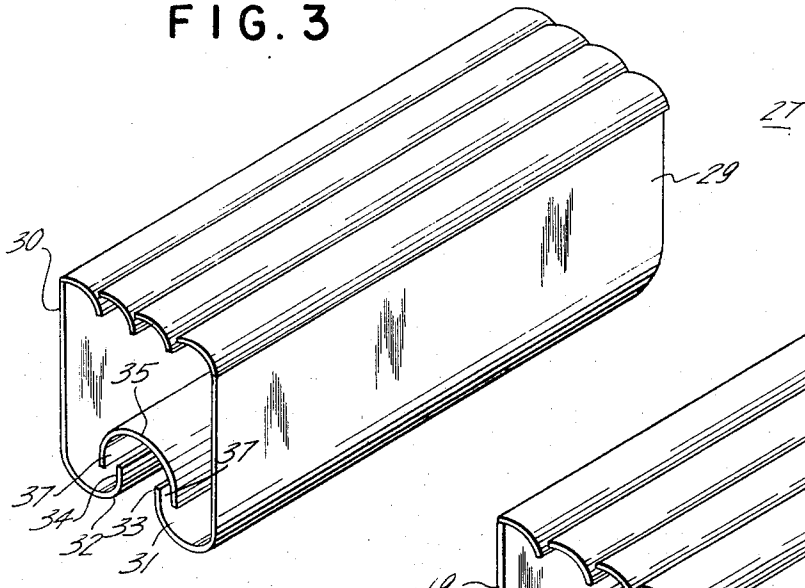


FIG. 3



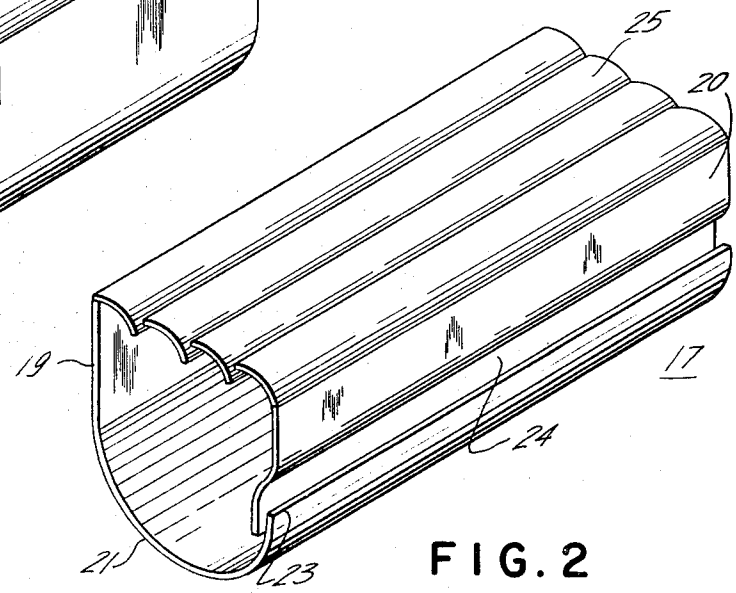


FIG. 2

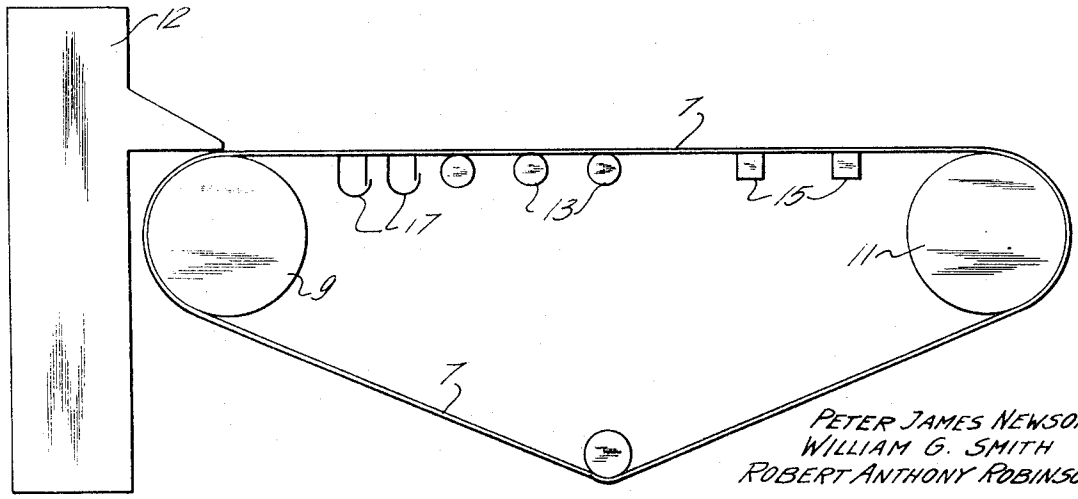


FIG. 1

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DEWATERING APPARATUS

The present invention relates to dewatering devices and more specifically to vacuum-operated and/or vacuum-augmented dewatering devices for use in the forming section of papermaking machines.

In the operation of a typical papermaking machine such as the Fourdrinier machine, an aqueous suspension of fibers is deposited on a moving forming medium in order to form a web of paper or paperlike material, such as pulp, board, and the like. It becomes necessary to drain large amounts of water from the web during the forming stage in order to produce a uniform, self-supporting, coherent web or paperlike structure having sufficient structural integrity to withstand the rigors of further processing.

It is further desirable to dewater the web during the forming stage as the cost of removing water in the forming section of the papermaking machine is much less than the cost of removing water in either the press or dryer sections of the paper machine. Until recently, table rolls and/or suction boxes were generally utilized to achieve such water extraction. However, the disadvantages of such devices, in terms of their adverse effects on the quality of formation of the web, and wear on the forming medium, etc., are by now well known in the papermaking arts. Recent advances in the papermaking art have shown that stationary hydrodynamic units such as shown in U.S. Pat. No. 2,928,465—Wrist, of either straight or curved blade configuration, may be used to increase the dewatering rate in the forming section of a papermaking machine, and to improve the quality of the web formed thereby. Further, it has been found highly advantageous to augment the dewatering action of these stationary hydrodynamic units, commonly referred to as hydrofoils, with a vacuum, the result being an increase in the amount of water removed from the sheet.

In a vacuum-augmented hydrofoil arrangement, the vacuum applied to the hydrofoil unit is relatively low, on the order of between 4 to 12 inches of water, and a so-called "dropleg" may be utilized as a means for inducing the vacuum and/or providing a vacuum seal, the vacuum seal preventing air from entering the box on the top of which the hydrofoils are positioned, thereby relieving the induced vacuum. A dropleg is a standpipe which projects downward from the vacuum box into a catch pan, the end of the dropleg extending below the normal level of water in the catch pan so that the water provides a seal between the internal portion of the vacuum box and the atmosphere. One example of such a standpipe arrangement, although not utilized in a hydrofoil unit, is shown in U.S. Pat. No. 2,893,486—Marti.

However, such standpipe arrangements are cumbersome and awkward. They require large lengths of standpipe for satisfactory operation and large areas are needed for installation of the catch pans. Further, some difficulty arises in modifying existing paper machines so that they may accommodate such installations. Most important, such dropleg pipes make it extremely difficult, if not impossible, to change forming mediums on the papermaking machine without first completely removing the dropleg assembly from the machine.

Therefore, one object of the present invention is to provide a papermaking machine in which it is possible to change forming mediums without completely removing the drainage devices.

Another object of the present invention is to provide a vacuum-operated dewatering unit which eliminates the necessity of a dropleg and separate catch pan.

Another object of the present invention is to provide a vacuum-augmented hydrofoil unit which eliminates the necessity of a dropleg and separate catch pan.

Still another object of the present invention is to provide an improved vacuum-augmented hydrofoil unit having an integral vacuum seal.

A further object of the present invention is to provide a hydrofoil unit having an integral vacuum seal extending in a direction transverse to the path of travel of the forming medium, i.e., the cross-machine direction, and whose capacity for discharging effluent increases as does the size of the hydrofoil unit.

A preferred embodiment of the present invention includes a vacuum-operated unit having oppositely disposed sidewalls which extend transverse to the path of travel of the forming medium (i.e., in the cross-machine direction) and end walls which enclose the unit. At least one of the oppositely disposed sidewalls has a concave lower portion which provides means for collecting water and stock (hereinafter referred to as the "effluent" which is drawn out of the furnish and through the forming medium. The sidewalls are configured so as to form at least a single channel which extends transverse to the path of travel of the forming medium, (i.e., in the cross-machine direction) and which is open to the atmosphere, the channel providing means for discharging from the unit excess collected effluent. By maintaining the channel at least partially filled with effluent, an integral vacuum seal is provided which prevents air from entering the unit and disrupting the subatmospheric conditions therein. By orienting this integral vacuum seal in the cross-machine direction, a vacuum unit is provided whose capacity for discharging effluent varies in proportion to the capacity of the unit to remove water and stock from the furnish.

Additional objects and advantages of the present invention together with a better understanding thereof may be had by referring to the following detailed description of the present invention together with the accompanying drawings.

FIG. 1 is a simplified view of a typical Fourdrinier papermaking machine;

FIG. 2 is a projected view of a vacuum-augmented hydrofoil unit, with the end wall removed in order to facilitate discussion of the device, constructed in accordance with the principles of the present invention;

FIG. 3 is a projected view of an alternate embodiment of the present invention, again with the end wall removed.

Referring now to FIG. 1, there is shown a forming medium 7 made from wire, synthetic material or a combination thereof, as are well known in the art. The forming medium 7 is mounted for continuous movement, by conventional drive means (not shown), over a breast roll 9 and a couch roll 11. The furnish, an aqueous suspension of fibers from which a paper or paperlike web is to be formed, is deposited from a head box 12 onto the moving forming medium 7 as the forming medium 7 travels about the breast roll 9 toward the couch roll 11. This fibrous suspension is dewatered as it travels between the breast roll 9 and couch roll 11, after which the web, by now made self-supporting to some extent, is passed to the press section (not shown) of the papermaking machine to be further dewatered.

Means are provided for dewatering the aqueous suspension in the forming section and include table rolls 13, suction boxes 15 and/or hydrofoil units 17 disposed beneath the forming medium 7 and preferably in contact with the underside of the forming medium 7.

Turning now to FIG. 2, there is shown the specific construction of one embodiment of a dewatering means made in accordance with the present invention. There is shown a vacuum-augmented hydrofoil unit 17 including oppositely disposed sidewalls 19 and 20 which are coextensive with one another and which extend transverse to the path of travel of the forming medium 7, that is, in the cross-machine direction. One sidewall 19 has a generally concave lower portion 21 extending to an upturned lip 23; the concave portion 21 providing an area in which effluent drawn through the forming medium 7 may be pocketed. The second sidewall 20 extends downward from the upper portion of the hydrofoil unit 17 with the lower portion of the second sidewall 20 being overlapping with the upturned lip 23 of the first sidewall 19 and being spaced therefrom a short distance so as to form a passageway or channel 24 in the hydrofoil unit through which excess effluent may be discharged and in which effluent may stand or collect. In order for the latter object to be achieved, it will become readily apparent that the lower portion of

sidewall 20 must extend inside the upturned lip 23 so that effluent can collect in the channel 24 and form the requisite seal.

The upper portion of the hydrofoil unit 17 includes a suitable frame (not shown as such are old and form no part of the present invention) on which hydrofoil blades 25 or the like are mounted. For purposes of discussion, several individual hydrofoil blades are shown as being mounted on the unit 17; however, it should be noted that any number of blades may be utilized without departing from the scope of the present invention. It should also be noted that the configuration of the blades may be slightly angled, curved, or of any other configuration depending upon the nature and purpose of the paper to be formed.

In the operation of the hydrofoil unit shown in FIG. 2, a small vacuum, on the order of between 4 to 12 inches of water, is applied to the unit 17 by suitable means (not shown). Effluent is withdrawn from the web through the forming medium 7 and is collected in the pocket portion 21 of the unit 17, excess effluent being discharged from the pocket through the channel 24. Since the channel 24 will be maintained at least partially filled with collected effluent throughout its cross-machine direction, the inside of the hydrofoil unit 17 will be sealed from the atmosphere, except for openings occurring at the upper portion of the unit 17 through which the vacuum is applied to the web. Such a construction eliminates the cumbersome dropleg and catch pan previously used, and provides an integral vacuum trap for the hydrofoil unit.

If the channel 24 is oriented in the cross-machine direction, it can be seen that the capacity of the unit for handling effluent can be made to vary with the size of the unit. As large installations may require high-speed operation, large amounts of effluent can be handled by the unit without affecting machine speed, thus maintaining maximum efficiency of operation.

Turning now to FIG. 3, there is shown an alternate embodiment of the present invention. Specifically, there is shown a hydrofoil unit 27 including oppositely disposed sidewalls 29 and 30 each of which extend transversely of the path of travel of the forming medium 7. Each of the sidewalls has respectively a concave lower portion 31 and 32, each of the concave portions extending to an upturned lip 33 and 34 respectively. A transverse member 35, either integral with or connected to the end walls (not shown) and preferably made from the same substance as the unit, is coextensive with the sidewalls 29 and 30 and is positioned above the upturned lips 33. Lateral edges 37 of the transverse member 35 project downward into the concave or pocket portions of the sidewalls 29 and 30 so as to be overlapping with, yet spaced from the upturned lips 33. This is done in order to form a passageway or channel between the lateral edges 37 of the transverse member and the upturned lips 33 whereby the effluent may collect to provide an integral seal and through which excess effluent may be discharged.

With such an arrangement, the additional advantage of a further control of the amount of effluent discharged by the unit is obtained. Again, it is important that the orientation of the integral seal or vacuum trap be in the cross-machine direction so that the capacity of the unit 27 may be varied depending on the size of the unit.

It can also be seen that the present invention is not limited to a hydrofoil unit and it can readily be applied to a suction box and other vacuum-operated and/or augmented devices. It will be obvious to those skilled in the art that various changes and modifications may be made to the present invention without departing from it in its broader aspects. Therefore, it is the intention of the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What we claim as new and novel and desire to secure by Letters Patent of the United States is:

1. In a dewatering unit for use in the forming section of a papermaking machine, said unit being disposed below the forming medium, said unit having oppositely disposed sidewalls extending transverse to the direction of travel of the forming medium and end walls connecting said sidewalls, at least one of said sidewalls having a concave lower portion extending to an upturned lip forming a pocket in which effluent drawn through the forming medium is collected, a member coextensive with one of said sidewalls and having a portion spaced from said upturned lip and disposed within said concave portion to form a channel therebetween, said channel providing means for discharging excess effluent from said pocket, said channel, when said unit is in use, being at least partially filled with effluent so as to maintain a seal between the inside of said unit and the surrounding air.

2. A dewatering unit as described in claim 1 wherein said coextensive member comprises an extension of the other one of said oppositely disposed sidewalls.

3. A dewatering unit for use in the forming section of a papermaking machine, said unit being disposed below the forming medium and having an upper surface in contact with the undersurface thereof, said unit having oppositely disposed sidewalls extending transverse to the direction of travel of the forming medium and end walls connecting said sidewalls, one of said sidewalls extending in a generally downward direction and having a generally concave lower portion extending into an upturned lip portion, said concave portion providing a pocket for collecting effluent drawn through the forming medium, the other of said sidewalls extending in a generally downward direction, the lower portion of said other sidewall being overlapped with a portion with said upturned lip and spaced therefrom so as to form a channel therebetween, said channel providing means for discharging excess effluent and said channel, when in use, being partially filled with effluent so as to provide a seal and prevent atmospheric pressure from entering said unit.

4. A dewatering unit as described in claim 3 wherein the surface in engagement with the forming medium includes at least one hydrofoil blade.

5. A dewatering unit as described in claim 3 wherein said unit is a suction box, said surface in engagement with the forming medium comprising a surface having more than a single opening through which a vacuum is applied to the forming medium.

6. A dewatering unit for use in the forming section of a papermaking machine, said unit being disposed below a forming medium and having an upper surface in contact therewith, said unit having oppositely disposed sidewalls extending transverse to the path of travel of the forming medium and end walls for connecting said sidewalls, each of said sidewalls having a concave lower portion providing a pocket in which effluent drawn through the forming medium is collected, each of said concave portions extending into an upturned lip, said unit further including a transverse member extending between said end walls and disposed between said sidewalls, said transverse member having downwardly directed lateral edges which extend into the concave lower portions of said sidewalls, said lateral edges being overlapped with and spaced from said upturned lips so as to form a channel between each, said channels providing means for discharging excess effluent from said unit, said channels also, when in use, being at least partially filled with effluent so as to provide a seal between said sidewalls and said transverse member.

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