May 11, 1971 R. A. BECK 3,578,559

ENDLESS BELT WITH POCKETS FOR COLLECTING WATER DRAINED THROUGH A FOURDRINIER WIRE

Filed Aug. 29, 1969 2 Sheets-Sheet 1

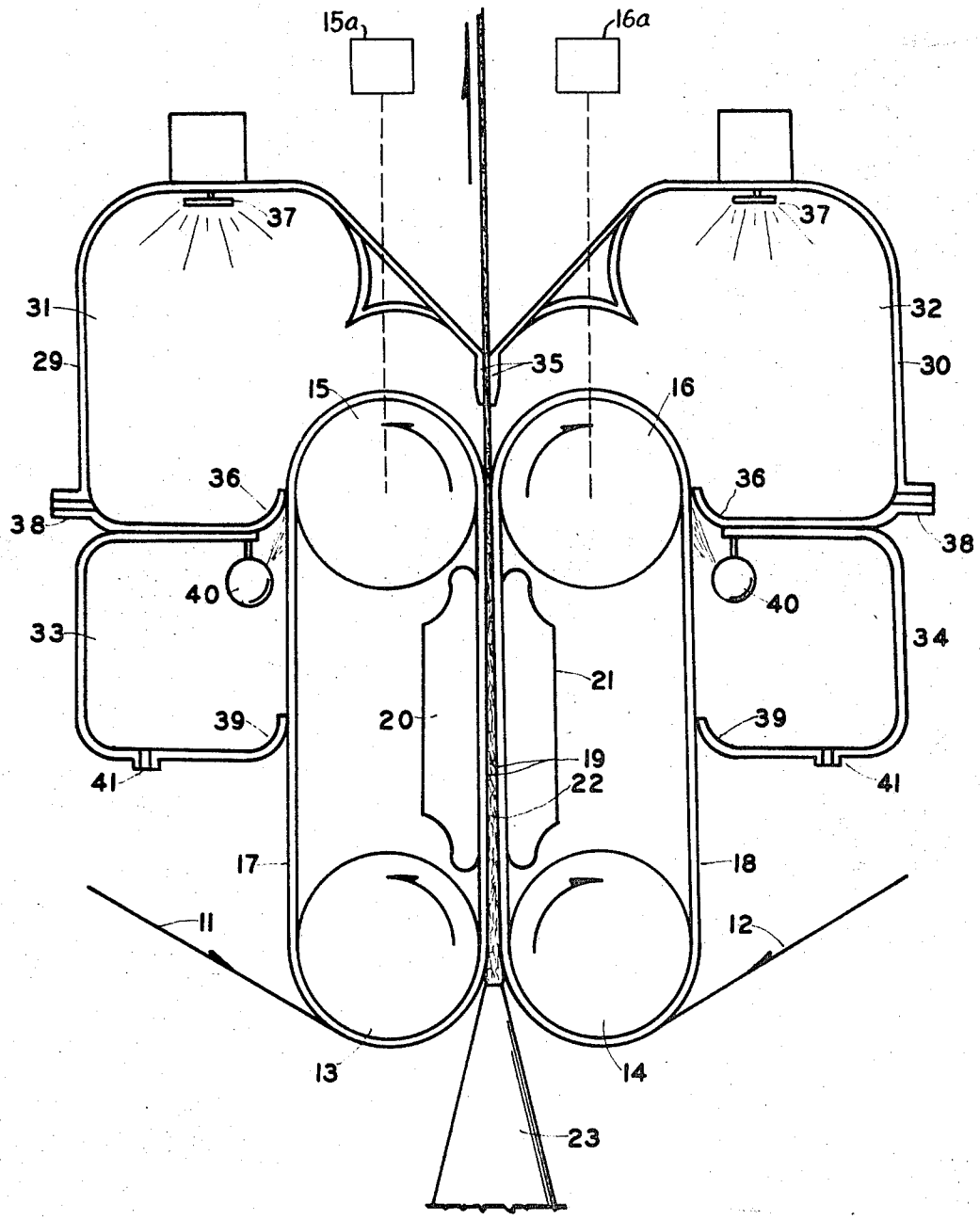


FIG. 1.

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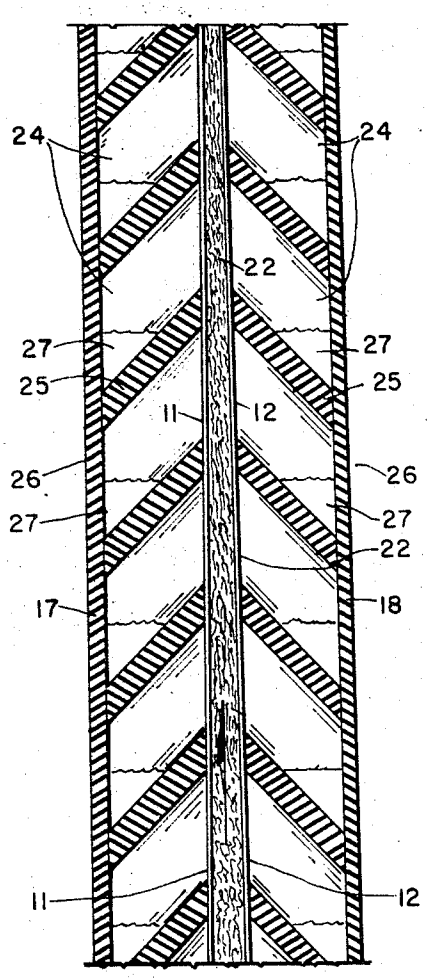


FIG. 2.

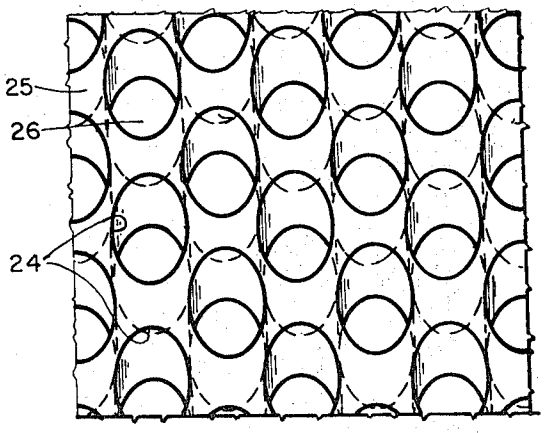


FIG. 3.

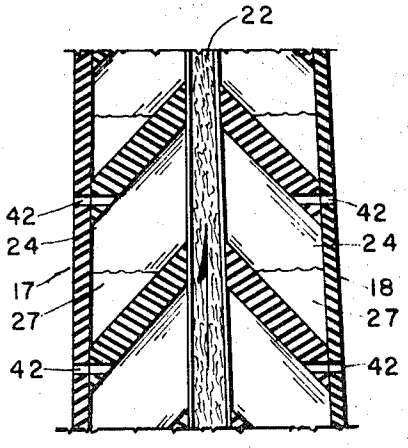


FIG. 4.

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ENDLESS BELT WITH POCKETS FOR COLLECTING WATER DRAINED THROUGH A FOURDRINIER WIRE

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U.S. Cl. 162—303 6 Claims

ABSTRACT OF THE DISCLOSURE

The surface of a paper forming wire opposite the papermaking stock carried thereby runs in contact with a portion of an endless moving drainage belt provided with enclosed pockets which have openings facing an adjacent wire to collect water drained from the stock through the adjacent wire and which are subsequently emptied by gravity along a portion of the belt path remote from the wire. Such apparatus is particularly suitable for use in twin wire vertical formation machines in which a separate drainage belt is provided in contact with each forming wire in close proximity to the headbox slice.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to papermaking machines and more particularly to the initial dewatering of paper stock carried on a moving permeable forming wire or between two such wires.

Brief description of the prior art

In conventional papermaking machines employing a permeable forming wire, a dilute suspension of paper stock is deposited on the surface of the wire opposite the perforated face of a suction box, whereby the initial dewatering of the stock is accomplished by the drainage of excess water through the wire and into the suction box. In a so-called twin wire machine, the stock is carried between the opposed faces of two such wires, each of which may be assoriated with a similar suction box for the same purpose.

Due to the fact that the forming wire is in frictional contact with the perforated face of the suction box while it is being drawn toward the box by the partial vacuum therein, such an arrangement gives rise to considerable frictional drag and therefore promotes rapid deterioration of the wire. Accordingly, it is known to encircle the suction box with an endless perforated traveling belt which runs at the same speed as the wire to support the wire out of direct contact with the perforated box face and thereby to avoid frictional wire abrasion as the water drains into the box through both the wire and the traveling belt.

Because of the initially very high water content of the paper stock, considerable excess water can be drained through the wire by gravity alone. Therefore, in a horizontal Fourdrinier type machine, the partially evacuated suction box may be preceded by an unevacuated similar box, into which the water drains merely by gravity, thereby conserving the power required by the vacuum pumps

associated with the machine. However, in twin wire vertical formation machines in which the stock is deposited between two opposed wires traveling in a generally vertical direction, initial gravitational drainage has not heretofore been practicable inasmuch as gravity simply tends to cause excess water emerging through the vertical wires to run down those wires rather than to drain off the wires into a collecting box or the like.

SUMMARY OF THE PRESENT INVENTION

In accordance with the present invention, the surface of a paper forming wire opposite the papermaking stock carried thereby runs in contact with a portion of an endless moving drainage belt provided with pockets which collect water drained from the stock through the adjacent wire and which are subsequently emptied along a portion of the belt path remote from the wire. Since such drainage belts are operable in a vertical direction, they are particularly suitable for use in twin wire vertical formation machines in which the stock is carried in a vertical direction between opposed forming wires.

Various means for practicing the invention and other advantages and novel features thereof will be apparent from the following detailed description of an illustrative preferred embodiment of the invention incorporated in a twin wire vertical formation machine, reference being made to the accompanying drawings in which like reference numerals denote like elements.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is an essentially diagrammatic elevational view of the portion of a twin wire vertical formation paper machine incorporating a preferred embodiment of the present invention;

FIG. 2 is a cross sectional view corresponding to an enlarged segment of FIG. 1 showing portions of the two forming wires and the corresponding drainage belts at opposite sides of the papermaking stock carried between the wires;

FIG. 3 is a fragmentary view of the face of one of the two drainage belts illustrated in FIGS. 1 and 2; and

FIG. 4 is a cross sectional view corresponding generally to a portion of FIG. 2 to illustrate the provision of the drainage belt water collector pockets with auxiliary air vent openings.

DESCRIPTION OF THE ILLUSTRATIVE PREFERRED EMBODIMENT

The papermaking machine illustrated by FIG. 1 of the accompanying drawings is of the twin wire vertical formation type, comprising two endless forming wires **11** and **12**, in respective guiding engagement with rotatable breast rolls **13** and **14** and with corresponding rotatable guide rolls **15** and **16**. In accordance with the present invention, endless flexible drainage belts **17** and **18** encircle the respective breast rolls and the corresponding guide rolls so that the faces of the adjacent portions of the belts move upwardly in unison. The two wires **11** and **12** enter the open nip between the breast rolls and likewise travel upwardly in contact with the opposed faces of the corresponding portions of the drainage belts. The breast rolls are spaced apart slightly more than are the guide rolls,

thereby causing the wires to converge slightly as they travel upwardly between the correspondingly converging faces **19** of stationary guide shoes **20** and **21** in respective guiding engagement with the back surfaces of the drainage belts **17** and **18** between the breast and guide rolls. Accordingly, dilute papermaking stock **22**, introduced from a hydraulic headbox **23** into the open wire nip established between the breast rolls, is carried upwardly between the wires and is gradually compressed as those wires converge. Due to the synchronism between the longitudinal movement speed of the wires and the drainage belts by means of drive units **15***a* and **16***a*, it will be apparent that no relative motion occurs between the contacting face of the wires and belts, thereby prolonging the life expectancy of the wires.

Referring now to FIGS. 2 and 3 of the drawings, it will be seen that the two drainage belts are substantially identical, each one including a plurality of angularly disposed enclosed water collector pockets **24** which are arranged in a repetitive overall pattern and which are open to the face or upper surfaces of the belts. Preferably, each drainage belt is fabricated of rubber-like material by bonding an angularly perforated relatively thick resilient belt **25** to an imperforate backing belt **26**, but it should be apparent that functionally similar water collector pockets could be provided in an analogous one-piece belt by molding techniques or the like.

As the two wires and the adjacent portions of the corresponding drainage belts move upwardly in unison above the headbox, the gradual compression of the papermaking stock between the wires forces water out of the stock and through the wires into the adjacent downwardly sloped water collector pockets in the drainage belts as shown at numeral **27** in FIG. 2. Collectively, the pockets have sufficient capacity to accommodate the entire water content of the web in accordance with the output capacity of the headbox. Accordingly, all of the water expressed out of the stock as it travels between both the wires and the adjacent portions of the drainage belts is collected in the belt pockets and is carried upwardly therein by virtue of the continuous movement of the belts.

Referring again to FIG. 1, it will be seen that the drainage belts diverge from the wires at guide rolls **15** and **16** as the wires continue to travel upwardly in confronting relation to each other to subsequent dewatering and drying equipment. As each successive longitudinal increment of either belt travels over the corresponding upper guide roll, the water collecting pockets thereof move out of contact with the adjacent forming wire and are inverted so that they slope downwardly toward their open ends as they travel in a downwardly direction along the portions of the belt paths remote from the wire. Consequently, water previously collected in the pockets is partially expelled therefrom by centrifugal force as the pockets pass about the guide rolls and simply drains out of the pockets by gravity due to the inversion of the pockets.

To collect the water discharged from the pockets, symmetrical housings **29** and **30** are provided at opposite sides of the two forming wires to define respective upper chambers **31** and **32** and lower chambers **33** and **34**. The upper chambers enclose the portions of the corresponding belts in engagement with the guide rolls and are sealed by lips **35** and **36** which respectively confront the adjacent forming wires and water collector belts. Since the so-called white water discharged into the upper chamber contains filler material, pigments, fibers, etc., the uper chambers are provided with rotary showers **37** which wash such materials from the belt and from the internal chamber surfaces. Drainage conduits **38** are provided at the bottom of the upper chambers to discharge the white water and shower water into conventional savealls from which the salvaged mixture is subsequently reintroduced into the headbox.

Below the upper chambers, the lower chambers **33** and **34** are similarly sealed by lips **39** closely adjacent the corresponding belt and are provided with high pressure shower nozzles **40** which are directed upwardly into the water collector pockets to wash any remaining fibers or other white water components out of those pockets. These compartments likewise are provided with drainage outlet conduits **41** leading to shower water savealls of the type well known in the papermaking art.

After passing through the two compartments described above, the surfaces of the water collector belts may be wet with clean water, but the pockets are substantially empty and free of fibers or other white water components as the pockets again approach the nip between breast rolls **13** and **14**. Therefore, it will be apparent that the belts operate continuously without interruption as each belt increment collects white water from the paper stock, discharges the collected white water to a saveall and is then cleaned prior to repeating the same sequence of functions.

FIG. 4 illustrates a modification of the collector belts shown in FIG. 2 comprising the provision of the water collector belts with air vent holes **42** extending from each water collecting pocket **24** to the back surface or side of the belt remote from the forming wire. These holes serve to prevent air from being trapped in the pockets in contact with the adjacent forming wire as water is expressed into the pockets. Since each hole is above the uppermost surface of the water carried in the corresponding pocket, it will be recognized that the water collecting and carrying capacity of the belt is in no way diminished by such holes.

The invention has been described in detail with reference to a particular illustrative embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described heretofore and as defined in the appended claims.

I claim:

1. An apparatus for dewatering papermaking stock supported by a longitudinally moving forming wire, said apparatus comprising means for supporting an endless impervious water collector belt for longitudinal movement along a path in which a portion of said belt is in contact with said wire such that said belt's upper face is in contact with the corresponding segment of the lower surface of said wire opposite said stock carried thereby, said belt including means defining a plurality of enclosed water collector pockets which have openings facing generally upwardly in communication with said corresponding segment of said lower surface of said wire to collect water delivered by gravitational drainage from said stock through that segment of said wire, said means for supporting said belt functioning to allow said pockets to be inverted for gravitational drainage along a portion of said belt remote from said wire.

2. An apparatus according to claim **1** in which said collector belt comprises an endless loop of flat flexible impervious material, said collector pockets being disposed in a repetitive pattern and angularly sloped relative to said forming wire.

3. An apparatus according to claim **1** including means for venting air from each of said collector pockets through the side of said belt remote from said forming wire.

4. An apparatus according to claim **1** including chamber means for receiving water gravitationally drained from said collector pockets at said remote portion.

5. The invention defined by claim **1** including washing means for washing said collector pockets of said belt with clean water at said position remote from said wire.

6. A dewatering apparatus for use in a vertical formation paper machine including a pair of endless forming wires, means supporting said wires for longitudinal movement with adjacent relatively vertical segments thereof in confronting relation to each other, drive means for moving said wires longitudinally so that said segments thereof travel in unison, and headbox means for provid-

ing papermaking stock between said segments of said wires, said dewatering apparatus comprising:

a pair of endless impervious water collector belts, means supporting said water collector belts for longitudinal movement with first portions thereof in respective facial contact with the corresponding relatively vertical segments of said wires opposite said stock carried therebetween and with second portions thereof remote from said wire, and means defining a plurality of enclosed collector pockets with openings disposed to face in said belts generally upwardly in communication with said opposite faces of said wires along the said vertical portions thereof to collect water delivered from said stock through those segments of said wires and to face generally

downwardly along said second portions of said belts remote from said wire to discharge such water from said pockets by gravitational drainage.

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U.S. Cl. X.R.

162—203, 354