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Parker, deceased et al.

[11] **3,853,697**

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[54] **PAPERMAKING MACHINE HEADBOX WITH AN UPWARDLY INCLINED SLICE CHAMBER PORTION, AN ARCUATE PORTION, AND A DOWNWARDLY INCLINED PORTION AND CONTAINING FLEXIBLE TRAILING MEMBERS**

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[51] **Int. Cl.** **D21f 1/02**

[58] **Field of Search** 162/336, 343, 344, 347, 162/380, 340

[56] **References Cited**

UNITED STATES PATENTS

2,728,272	12/1955	Hisey	162/347 X
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3,607,625	8/1973	Hill et al.	162/343
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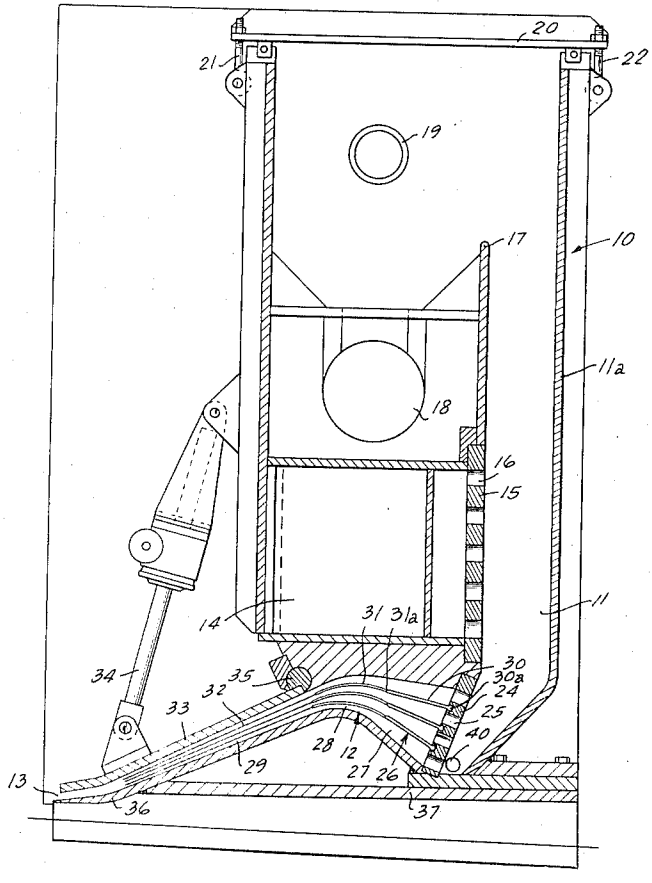
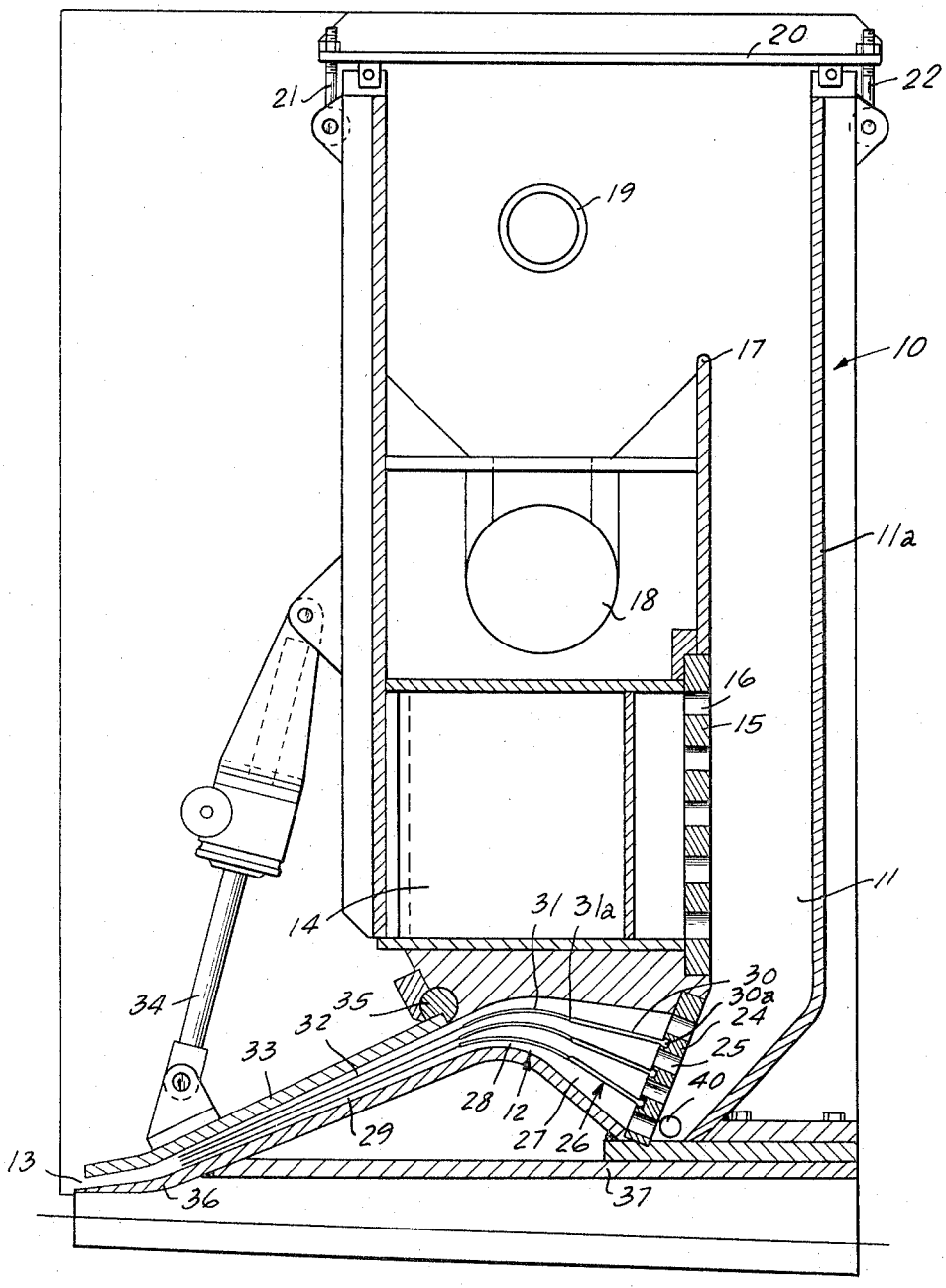
[57] **ABSTRACT**

A headbox construction for delivering stock to a forming surface with the headbox having a chamber leading to a slice chamber with a slice opening and the slice chamber being located and shaped so as to have a first upwardly inclined portion supplied from the headbox chamber through a plate with openings. The slice chamber further has a second arcuate portion and a third downwardly sloping tapered portion leading to the opening. The arcuate portion provides a transition from the upwardly inclined to the downwardly inclined portions, and the headbox decreases in cross-section throughout its length and is provided with rigid trailing elements in the first two portions having flexible self-supporting trailing elements in the third portion.

11 Claims, 1 Drawing Figure

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PAPERMAKING MACHINE HEADBOX WITH AN UPWARDLY INCLINED SLICE CHAMBER PORTION, AN ARCUATE PORTION, AND A DOWNWARDLY INCLINED PORTION AND CONTAINING FLEXIBLE TRAILING MEMBERS

BACKGROUND OF THE INVENTION

The present invention relates to improvements in paper making machines and more particularly to an improved headbox construction which utilizes the concept of having a plurality of trailing cross-machine extending elements in the slice chamber, but is constructed to eliminate the tendency toward accumulations of air which have occurred in this type of mechanism.

The concept of providing trailing elements in a slice chamber is shown and described in U.S. Pat. No. 3,607,625. The structure of the arrangement of this patent is designed to eliminate certain problems inherent in supplying stock to the forming surface in a fourdrinier making machine. A major difficulty in achieving uniform formation of paper is the natural tendencies of the fibers to flocculate. An objective of fourdrinier machine designs is to disperse fiber networks during flow through the headbox and during distribution onto the forming surface to prevent such networks from forming during the period of sheet formation. Dispersion of the fiber network is presently achieved by generating turbulence such as through the use of rectifier rolls and other means. Dispersing activity to prevent networks also occurs on the fourdrinier forming surface and is an important supplement to the turbulence generated in the headbox.

A limitation in general headbox design has been that the means for generating turbulence in fiber suspensions in order to disperse them has achieved comparatively large scale turbulence. With the devices for creating such turbulence, it is possible to develop small scale turbulence only by increasing the intensity of the turbulence generated. Thus, the turbulence energy is transferred naturally from large to small scale and the higher the intensity, the greater the rate of energy transfer, and hence, the smaller scale of turbulence sustained. Detrimental effects also result from high intensity large scale turbulence in the form of large waves and free surface disturbance developed on the fourdrinier forming surface. Thus, a general rule of headbox performance has been that the degree of dispersion and level of turbulence in the headbox discharge were closely correlated, i.e., the higher the turbulence, the better the dispersion.

The unique concept of providing individual flow channels in a slice chamber, which is achieved by the structure of the above U.S. Pat. No. 3,607,625 has solved many of the problems of obtaining small scale turbulence and avoiding flocculation. Certain commercial designs embodying the flexible trailing elements must be constructed so that with the long trailing elements, there is a tendency to accumulate air and become "dirty" with long use.

It is an object of the present invention to provide an improved headbox mechanism which achieves improved fine scale turbulence and resultant diminishment of flocculation, but which is constructed so as to avoid the accumulation of air with prolonged use.

A further object of the invention is to provide an improved headbox construction with a slice chamber

shaped and constructed for improved distribution of stock to the slice opening. A further object of the invention is to provide an improved headbox and slice chamber construction which has a simplicity of design allowing for low cost construction, and which attains ease of maintenance and clean-up.

A further object of the invention is to provide a headbox and slice chamber of compact design and small size which will obtain structural integrity and ease of shipment and removal for wire change.

Other objects, advantages and features, as well as equivalent structures which are intended to be covered hereby, will become more apparent with the teaching of the principles of the invention in connection with the disclosure of the preferred embodiment in the specification, claims and drawings, in which:

DESCRIPTION OF THE DRAWINGS

The single FIG. of the drawings is a somewhat schematic side elevational view in section of a headbox constructed and operating in accordance with the principles of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The construction includes a headbox **10** which receives stock from the usual supply means including fan pumps or the like. The stock enters the headbox and is directed to flow into a headbox chamber **11** and to thereafter flow into a slice chamber **12** to exit out a slice opening **13** onto a paper machine forming surface, such as a fourdrinier wire.

The stock enters the headbox being supplied to a tapered chamber **14** extending across the machine for uniform flow. The flow then passes through a plate **15** having perforations **16** therethrough to maintain uniformity of distribution and turbulence in the stock. The stock enters the headbox chamber **11** which is formed between the rear wall **11a** of the chamber and a baffle **17** having an upper skimming edge for removing froth and the like from the stock slurry. The froth which flows over the top edge of the baffle **17** may be removed through a lateral opening **18.** The chamber above the baffle **17** is pressurized with air through a suitable air inlet **19.** The top of the headbox is closed by removable cover **20** held in place by toggle bolts **21** and **22.**

The stock from the chamber **11** flows into the slice chamber **12** through a support plate **24** which has flow openings **25** formed therein. The stock flow first enters a first portion **27** of the slice chamber **12.** This first portion **27** is inclined upwardly and leads to a second curved portion **28.** The portion **28** provides a transition between the first portion **27** and a third portion **29** which is tapered and slopes downwardly toward the slice opening **13.**

The first portion **27** of the slice chamber provides an upward component of flow and is sufficiently large so that the mean velocity of stock flow is relatively low, i.e., the channel thickness or height is relatively large. As the mean velocity increases due to the channel thickness becoming less, the slice chamber is shaped to cause the stock to sweep in a curvature changing its course from an upward flow to a downward flow. It is this curved transition from a relatively slow upward sweep to a downward sweep, through the curved section **28,** which tends to purge or remove the air which

would otherwise accumulate along trailing elements **26** which are located in the slice chamber.

The trailing elements are related in construction and position to the slice chamber and have a first nonflexible portion **30** in the first portion **27** of the chamber. These portions **30** are rigid and are positioned in the direction of flow to divide the chamber into flow channels between them. The elements **30** extend continuously in a cross-machine direction and are mounted on their upstream ends by ball and socket mountings which support them in operation and which permit ready removal for replacement and servicing. The ball and socket mountings are in the form of enlarged ends **30***a* on the trailing elements **30** which slide sideways into grooves in the plate **24.**

The ends **30***a* provide a pivotal mount for the rigid trailing members **30.** This permits the rigid trailing members **30** to respond, or in other words to be self-positionable, responsive to hydraulic flow. In some instances this mount may be rigid, but a pivotal support is preferred.

Attached to the downstream ends of the first portions **30** of the trailing elements are second portions **31.** These second portions are also rigid and are curved to conform to the curvature of the second portion **28** of the slice chamber. These curved sections are of plastic, such as Lexan or other materials. They can be made by the extrusion process and are thus readily available at any length at relatively low cost. The second portions **31** of the trailing elements are suitably attached to the heavier first portions **30** such as by welding or cementing or other suitable connection.

A preferred embodiment is to attach the curved trailing portions **31** to the first portions **30** by a flexible attachment such as a ball and socket joint. The portions **31** and the portions **30** will then be free to pivot relative to each other, and the ball and socket joint will be located at position **31***a*.

At the downstream ends of the second portions **31** are third portions **32** which are flexible trailing elements. These third portions are located in the third portion **29** of the slice chamber. The third portions **32** are flexible with their downstream ends unattached and are constructed to be self-positionable so as to be solely responsive to forces in the stock flowing in the chamber portion **29.** A plastic is chosen for the construction of these portions **32** which has a specific weight close to that of the stock, so that their weight is not a factor in their floating position within the tapered portion of the slice chamber. While the portions **32** are preferably continuous across the width of the machine, they may be divided into strips with each strip being flat and narrow, or the strips may be in the form of divided filaments which are round or have other cross-sectional shapes, and in effect, act as trailing strands within the chamber section **29.**

The slice chamber has a floor portion **36** which is shaped to provide the increasing velocity sweeping flow pattern above described. The roof of the slice chamber has a downstream portion **33** which is pivotally mounted at **35** to control the width of the slice opening. For this purpose, a jack **34** is attached to the roof portion **33** to raise or lower it.

When the stock enters the slice chamber **12** from the headbox chamber **11,** it descends vertically so that it can begin its upward travel in the sweeping path of movement. In order to empty the headbox during servicing, there is a drain opening **40** placed in advance of the slice chamber at the lowermost part of the headbox chamber **11.**

We claim as our invention:

1. In a headbox for delivering stock to a forming surface, the headbox having a chamber leading to a slice chamber with a slice opening, the improvement comprising:

top and bottom slice walls defining a slice chamber therebetween with the slice chamber having a first upwardly inclined portion, a second arcuate portion leading upwardly and then downwardly, and a third tapered portion leading to the opening;

thin planar continuous cross-machine extending trailing elements having a rigid planar portion anchored at their upstream ends in said first portion of the slice chamber, a nonflexible portion curved in the direction of said second portion and located therein, and a third portion in the tapered chamber being flexible with the downstream ends unattached and constructed to be self-positionable as to be solely responsive to forces exerted thereon by the stock flowing toward the slice opening;

and support means in said first portion of the headbox with the upstream ends of the trailing elements anchored thereto.

2. In a headbox for delivering stock to a forming surface, the headbox having a chamber leading to a slice chamber with a slice opening constructed in accordance with claim **1**:

wherein said support means on which the trailing elements are supported at their upstream ends is a perforate plate extending across the opening to the slice chamber.

3. In a headbox for delivering stock to a forming surface, the headbox having a headbox chamber leading to a slice chamber having a slice opening constructed in accordance with claim **1**:

wherein the headbox chamber extends vertically downwardly and opens laterally into the slice chamber.

4. In a headbox for delivering stock to a forming surface, the headbox having a headbox chamber leading to a slice chamber having a slice opening constructed in accordance with claim **1**:

wherein the slice chamber continually narrows from the first portion to the slice opening.

5. In a headbox for delivering stock to a forming surface, the headbox having a headbox chamber leading to a slice chamber having a slice opening constructed in accordance with claim **1**:

and including means forming a drain opening in the headbox chamber immediately in advance of the slice chamber and at the base thereof.

6. In a headbox for delivering stock to a forming surface, the headbox having a chamber leading to a slice chamber with a slice opening constructed in accordance with claim **1**:

wherein said rigid portion of the trailing element is anchored by a pivotal mount at its upstream end.

7. In a headbox for delivering stock to a forming surface, the headbox having a headbox chamber leading to a slice chamber having a slice opening, the improvement comprising:

top and bottom slice walls dfining a slice chamber therebetween with the slice chamber extending up-

wardly and then downwardly toward the slice opening;

a plurality of trailing elements positioned within the chamber supported at their upstream ends with their downstream ends unattached whereby the stock tends to avoid the accumulation of air in the slice chamber;

and support means in the slice chamber with the upstream ends of the trailing elements attached thereto.

8. In a headbox for delivering stock to a forming surface, the headbox having a headbox chamber leading to a slice chamber having a slice opening constructed in accordance with claim **7.**

wherein the upwardly extending portion is of a greater size than the downwardly extending portion so that the speed of stock flow increases.

9. In a headbox for delivering stock to a forming surface, the headbox having a headbox chamber leading to a slice chamber having a slice opening constructed in accordance with claim **7**:

wherein the first portion curves upwardly and turns to join the downwardly curving second portion and the trailing elements are correspondingly curved with the curved portions being rigid.

10. In a headbox for delivering stock to a forming surface, the headbox having a headbox chamber leading to a slice chamber having a slice opening constructed in accordance with claim **7**:

wherein said trailing elements have a first rigid portion and a downstream flexible portion attached at their upstream ends only and the flexible portions constructed to be self-positionable and solely responsive to forces exerted thereon by the stock flowing toward the slice opening.

11. In a headbox for delivering stock to a forming surface, the headbox having a headbox chamber leading to a slice chamber having a slice opening constructed in accordance with claim **7**:

including means for adjusting the position of the roof of the slice chamber so as to change the size of the slice opening and the trailing elements are removably positioned within the slice chamber.

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