

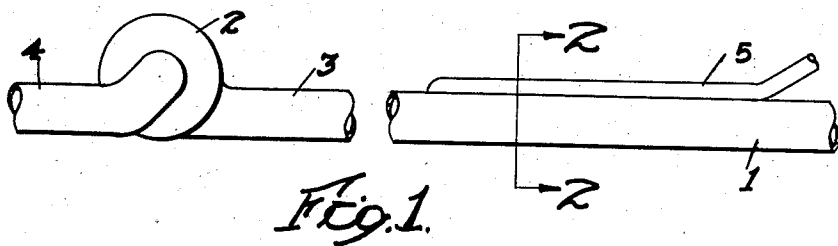
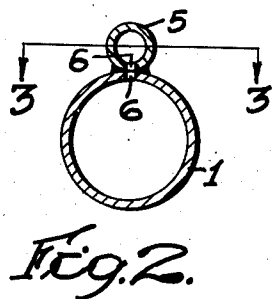
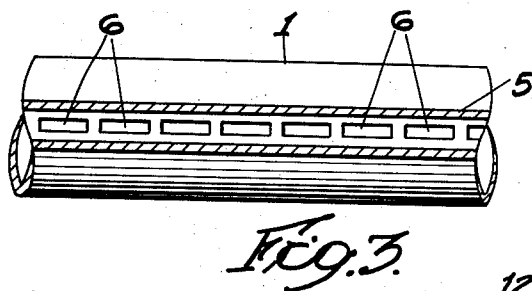
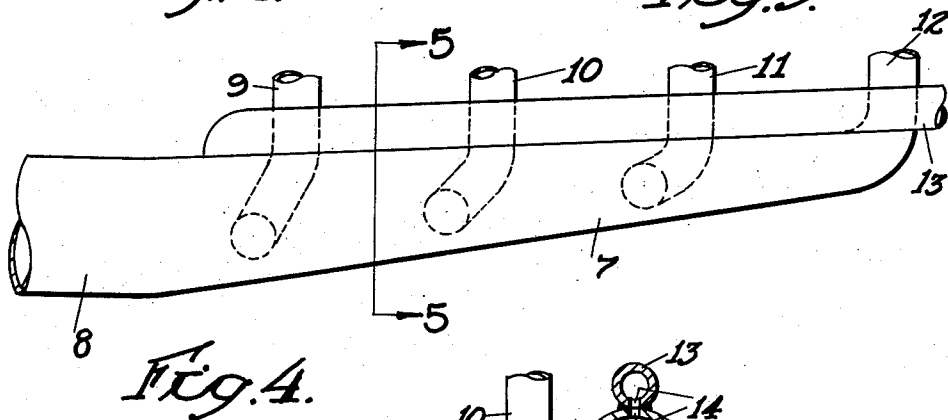
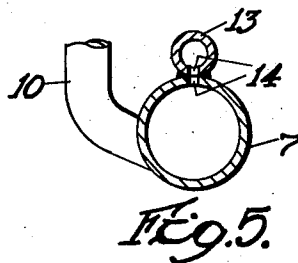
Oct. 7, 1958

A. J. CIRRITO
METHOD AND APPARATUS FOR REMOVING AIR FROM THE
STOCK DISTRIBUTION SYSTEM OF
A PAPER MAKING MACHINE

2,854,895

Filed Feb. 8, 1956

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

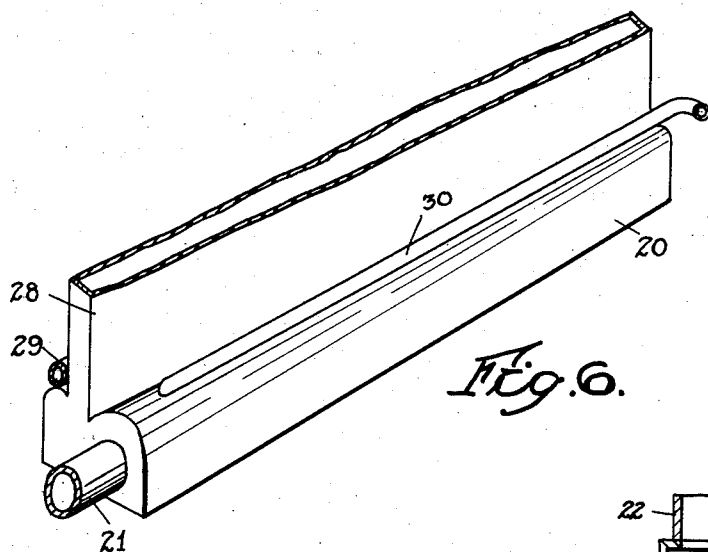


Fig. 6.

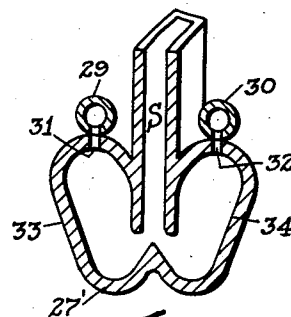


Fig. 11.

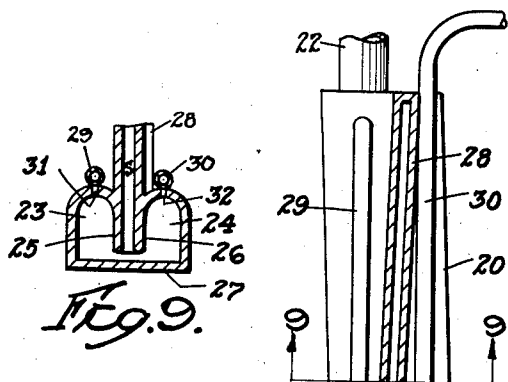


Fig. 9.

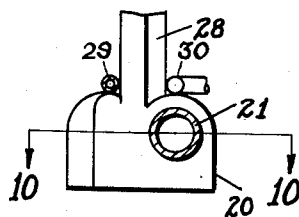


Fig. 8.

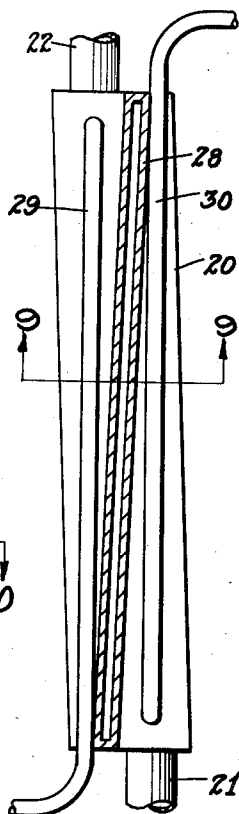


Fig. 7.

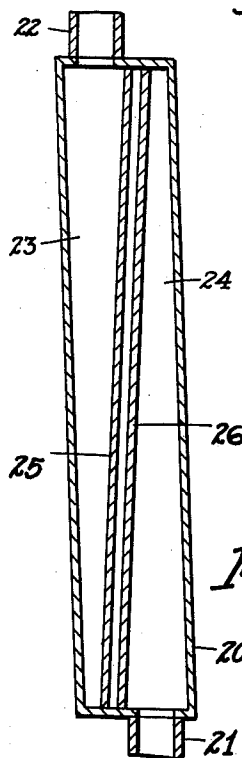


Fig. 10.

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METHOD AND APPARATUS FOR REMOVING AIR FROM THE STOCK DISTRIBUTION SYSTEM OF A PAPER MAKING MACHINE

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Application February 8, 1956, Serial No. 564,236

5 Claims. (Cl. 92-44)

This invention relates to paper making machinery and, in particular, to a method and apparatus for removing air from the stock distribution system of such machinery.

The desirability of removing air from the paper stock is twofold: first of all, it is desirable to eliminate or minimize the formation of air pockets caused by the accumulation, at various points in the system, of air which is trapped in the flowing pulp slurry; secondly, it is even more desirable to eliminate the explosive expansion of air bubbles at or beyond the slice, as the stock moves from a high pressure zone behind the stock nozzle to a zone of atmospheric pressure at the web-forming portion of the machine.

Conventional methods for removing entrapped air from paper stock generally involve a treatment of the stock before it is introduced to the stock-distribution system; such treatment is usually effected either by vacuum or by centrifugal force, although large settling tanks, operating on a long time cycle, may be used where time and space permit. Devices employing either the vacuum or the centrifugal principle are sometimes satisfactory as to their operation, but they are difficult to control and are not entirely reliable. Also, these devices are generally complex and bulky and are, therefore, expensive from the standpoint of installation and operation.

The present invention provides a method and means for removing air from the paper by the use of instrumentalities which are a component part of the stock distribution system; the uniqueness of this method lies in the fact that air can be removed while the stock is flowing in the distribution system, and that no separate treatment of the stock is required.

Therefore, it is an important object of this invention to provide a method and apparatus for removing air from the dilute paper stock while it is flowing in the stock distribution system.

It is a further object of this invention to provide a method and means of the type referred to above which will be simple, compact and inexpensive, and also which will be positive in operation.

Other and further objects and advantageous features of this invention will hereinafter more fully appear in connection with a detailed description of the drawings in which

Fig. 1 is a side elevational view showing the application of my invention to the main stock supply conduit of a stock distribution system.

Fig. 2 is a transverse sectional view along section line 2-2 of Fig. 1.

Fig. 3 is a horizontal sectional view taken along section line 3-3 of Fig. 2 showing a detailed relationship between the main stock supply conduit and the air-bleed device of this invention.

Fig. 4 is a plan view of another embodiment of this invention showing the use of this novel device in conjunction with a multiple pipe manifold.

Fig. 5 is a transverse sectional view taken along section line 5-5 of Fig. 4.

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Fig. 6 is a perspective view of a cross-flow distributor embodying the principle of this invention.

Fig. 7 is a plan view partly in section of the cross-flow distributor shown in Fig. 6.

Fig. 8 is an end view of the distributor shown in Fig. 7.

Fig. 9 is a cross-sectional view of the distributor taken along section line 9-9 of Fig. 7.

Fig. 10 is a horizontal sectional view of the distributor taken along section line 10-10 of Fig. 8.

Fig. 11 is a cross-sectional view similar to Fig. 9 on a slightly larger scale showing a modified form of the cross-flow distributor.

Referring to the drawings in detail, Fig. 1 shows a large stock pipe 1 which receives a supply of dilute paper stock of a consistency suitable for delivery to the forming section of a paper machine. Although the stock pipe 1 is shown as horizontal it is possible to incline the flow slightly upwardly so as to prevent the settlement of fibers on the bottom of the pipe. Any suitable means, such as a gravity feed, may be used to deliver the stock under pressure to the stock pipe 1; however, as shown in Fig. 1, this latter means consists of a fan pump 2 which connects at its discharge end 3 to the pipe 1 and at its inlet end 4 to a source of stock supply (not shown). The stock flowing in stock pipe 1 will be delivered to the entrance portion of a suitable stock distribution system (not shown) where the flow stream will be spread into a wide flat stream in a conventional manner.

An air-bleed pipe 5 is attached to the top of stock pipe 1 for a substantial portion of the latter's length and in a direction parallel to the flow of stock in the pipe 1. As shown in Figs. 2 and 3, a series of aligned slots 6, located at corresponding positions in both pipes 1 and 5 along their juncture, permit flow to take place between stock pipe 1 and air-bleed pipe 5. Although single slots (not shown) could be used, it is preferred to use a series of spaced slots 6 as shown. With the stock flowing in stock pipe 1 at a substantially constant rate, as determined by the requirements of the forming section (not shown) of the machine, there will be a tendency for air bubbles to rise to the top of stock pipe 1; also fibers containing adsorbed air will rise in a similar manner forming a resulting air-rich layer at the top of pipe 1. A large amount of this separation may take place in the stock pipe 1 prior to the start of the air-bleed section. Upon reaching the position where the air-bleed pipe 5 is joined to the stock pipe 1, the stock in the top of pipe 1, including this air-rich layer, will flow through the slots 6 into the air-bleed pipe 5. This air-rich mixture may be discharged at any desired rate of flow from the air-bleed pipe 5 by means of various valves (not shown) into a settling tank (not shown) or a stock-preparation tank (not shown). The remainder of the stock flowing in pipe 1, now substantially depleted of air bubbles and air-carrying fibers, is delivered to the entrance portion of the stock distribution system of the machine.

The flow velocity through slots 6 will be kept sufficiently low to minimize unwanted turbulence. Also since the flow in the air-bleed pipe 5 is substantially parallel with the flow in the stock pipe 1, there will be little or no interference between the two flow streams. The amount of air removed by the above described system can be controlled by suitable regulation at the outflow of pipe 5. Separation of air may be enhanced by increasing the length of pipe 1 from the pump 2 to the position of the first slot 6; also, increasing the length of the air bleed zone itself (i. e., extending the length or number of slots 6) will improve the air-removing propensities of the system.

Figs. 4 and 5 show the application of the same air-bleed principle to a different portion of the stock distribution system. The multiple pipe manifold 7 receives a flow

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of stock from a stock pipe 8 and divides the flow into a plurality of smaller parallel streams by means of the offtakes 9, 10, 11 and 12. The individual streams from these offtakes are flattened and recombined into a single flat stream in a conventional manner (not shown). The cross-sectional area of the manifold is graduated with respect to the number and positions of the offtakes to provide a constant velocity of flow within the manifold 7. An air-bleed pipe 13 is connected to the manifold 7 in a direction parallel to the main flow stream within the manifold. A series of aligned slots 14, similar to the slots 6 of Figs. 2 and 3, provide communication between the air-bleed pipe 13 and the manifold 7 in the same manner as described with regard to the prior figures.

A further embodiment of this invention is shown in Figs. 6 to 10 wherein the air-bleed principle is applied to a cross-flow distributor 20. The basic principle of this type of cross-flow distributor is explained and illustrated in United States Patent No. 2,347,717, issued May 2, 1944, to S. A. Staeger, and is further explained and illustrated in United States Patent No. 2,589,639, issued March 18, 1952, to S. A. Staeger. However, as will appear hereinafter, the structure of the particular cross-flow distributor illustrated herein is somewhat different from that disclosed in the above mentioned Staeger patents. Briefly stated, this cross-flow distributor 20 receives its supply of stock in two opposite directions from two supply conduits 21 and 22 located at opposite ends of the distributor. The flow from the conduits 21 and 22 passes into two oppositely tapered chambers 23 and 24 within the distributor, as best shown in Fig. 10. The inner long sides of chambers 23 and 24 are formed by spaced parallel partitions 25 and 26, respectively, whose lower edges are spaced above the bottom 27 of the distributor 20, as best shown in Fig. 9. Thus, as stock flows into each tapered chamber, a wide flat stream will pass out from each chamber under its respective partition, 25 or 26, and upwardly into an elongated space S that extends between said partitions for their full length. Upward extensions of said partitions above the side walls of this cross-flow distributor 20 provide the long sides of a wide flat flow passage 23 which will conduct the resulting flat stream of flowing stock into the head box (not shown).

As can be best seen in Fig. 9, the tops of chambers 23 and 24 are appropriately rounded. Along the upper ridge of the rounded portions of chambers 23 and 24 a pair of air-bleed pipes 29 and 30, respectively, are attached in the same manner that air-bleed pipe 5 is attached to stock pipe 1 in Fig. 1. Also, communication is provided between chambers 23 and 24 and air-bleed pipes 29 and 30 by means of a plurality of slots 31 and 32, respectively, in the same manner as slots 6 of Figs. 2 and 3. It should be noted that air-bleed pipes 29 and 30 are oriented in opposite directions. As in the case of the prior figures, the air and air-containing fibers flowing in the stock passing into chambers 23 and 24 will rise to the top of the chambers to be conducted therefrom by means of air-bleed pipes 29 and 30. The resulting flow in each air-bleed pipe, 29 or 30, will be in the same direction as the main flow within its corresponding chamber.

Apart from the air-bleed pipes 29 and 30, as described above, the basic difference between the cross-flow distributor employed herein and the cross-flow distributor of the aforementioned Staeger patents is in the way that the flow streams are taken off from the chambers. In the instant distributor, it should be apparent that the flat streams are directed into the elongated space S and passage 23 from the bottoms of the chambers, whereas in the Staeger patents the removal of these streams is at the top. Furthermore, it should be appreciated that the Staeger type of distributor could not be designed to include the novel air-bleed pipes without first changing the method of side stream removal to the method described herein;

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in other words, the air-bleed pipes would not function properly where the side stream removal was at the top of the cross-flow distributor. The feature of removing the side streams at the bottom of the distributor as disclosed herein, which permits the attachment and proper functioning of the novel air-bleed system is not taught or suggested by the Staeger patents.

Fig. 11 is a cross-sectional view similar to Fig. 9 showing a streamlined modification of the cross flow distributor shown in Figs. 6 to 10. In this modification the side walls 33 and 34 are slanted downwardly and inwardly while the bottom 27' of the distributor is appropriately curved to minimize or eliminate the problem of fiber settlement.

In all of the various modifications shown herein, it should be observed that the air-rich layer is separated from the flowing stock stream prior to the spreading thereof; i. e. before the stock stream is spread into a wide flat stream for introduction into the head box or similar flow distributor. Removing the majority of free and adsorbed air prior to spreading results in a more uniform distribution of any remaining air in the stock stream after spreading. It is doubtful that any degree of uniformity could be achieved if an air-bleed device, similar in principle to the invention disclosed herein, were employed on the stock stream after it had been spread.

Other changes apart from those illustrated herein may be made within the spirit of this invention.

I claim:

1. Apparatus for removing an air-rich mixture from a flowing stream of dilute paper stock and for spreading said stock stream into a wide flat effluent for subsequent delivery to the forming zone of a paper making machine comprising a pair of oppositely tapered, substantially horizontal chambers spaced apart in side-by-side relation, the wide ends of said chambers having supply openings therein for providing substantially horizontal flow of stock in opposite directions in said chambers, an elongated horizontal slot in the adjacent side of each of said chambers near the bottom thereof for effecting the outflow from each chamber of a wide flat stream, means between said chambers for combining said wide flat streams into a single wide flat effluent, an air-bleed pipe connected to the top of each chamber along an extended portion of each chamber's length, opposed openings in each pipe and its respective chamber along said extended portion for providing fluid communication therebetween, and means for providing withdrawal of an air-rich mixture from each pipe in a direction substantially parallel with the longitudinal center line of each respective chamber.

2. Apparatus for delivering a wide flat effluent of paper stock to the forming zone of a paper making machine comprising a pair of wide flat vertical sides arranged in parallel relation and spaced apart a short distance from each other, a pair of narrow vertical sides connecting said wide vertical sides across their adjacent edges, said wide sides and said narrow sides defining a substantially vertical stock inlet passageway for delivering said wide flat effluent to said forming zone, a pair of oppositely tapered substantially horizontal chambers connected to said passageway on the opposite wide sides thereof, and extending for the full width of said passageway, the wide ends of said chambers having supply openings therein for effecting substantially horizontal flow of stock in opposite directions in said chambers, each chamber having an elongated horizontal opening adjacent the bottom thereof for connecting each chamber with said passageway, each of said horizontal openings effecting the outflow of a wide flat stream from the side of each chamber into said passageway, said wide flat streams combining in said passageway to form said wide flat effluent, and means for bleeding an air-rich layer of fluid from the top of each chamber along an extended portion of said chamber's length.

3. Apparatus for delivering a wide flat effluent of dilute

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paper stock to the forming zone of a paper making machine comprising a pair of wide flat vertical sides arranged in parallel relation and spaced apart a short distance from each other, a pair of narrow vertical sides connecting said wide vertical sides across their adjacent edges, said wide sides and said narrow sides defining a substantially vertical stock inlet passageway for delivering said wide flat effluent to said forming zone, a pair of oppositely tapered substantially horizontal chambers connected to said passageway on the opposite wide sides thereof, and extending for the full width of said passageway, the wide ends of said chambers having supply openings therein for effecting substantially horizontal flow of stock in opposite directions in said chambers, each chamber having an elongated horizontal opening adjacent the bottom thereof for connecting each chamber with said passageway, each of said horizontal openings effecting the outflow of a wide flat stream from the side of each chamber into said passageway, said wide flat streams combining in said passageway to form said wide flat effluent, an air-bleed pipe connected to the top of each chamber along an extended portion of said chamber's length, each pipe and chamber having opposed slots therein along said extended portion for providing fluid communication between each pipe and chamber, and means for effecting the withdrawal of an air-rich mixture from each pipe in a direction substantially parallel with the direction of flow of stock in each respective chamber.

4. Apparatus for removing an air-rich mixture from a flowing stream of dilute paper stock and for spreading said stock stream into a wide flat effluent for subsequent delivery to the forming zone of a paper making machine comprising a pair of wide flat vertical sides arranged in parallel relation and spaced apart a short distance from each other, a pair of narrow vertical sides connecting said wide vertical sides across their adjacent edges, said wide sides and said narrow sides defining a substantially vertical stock inlet passageway for delivering said wide flat effluent to said forming zone, a pair of oppositely and horizontally tapered substantially horizontal chambers connected to said passageway on the opposite wide sides thereof, and extending for the full width of said passageway, the wide ends of said chambers having supply openings therein for effecting substantially horizontal flow of stock in opposite directions in said chambers, each chamber having an elongated horizontal opening adjacent the bottom thereof for connecting each chamber with said passageway, each of said horizontal openings effecting the outflow of a wide flat stream from the side of each chamber into said pas-

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sageway, said wide flat streams combining in said passageway to form said wide flat effluent, an air-bleed pipe connected to the top of each chamber along an extended portion of said chamber's length, each pipe and chamber having opposed slots therein along said extended portion for providing fluid communication between each pipe and chamber, and means for effecting the withdrawal of an air-rich mixture from each pipe in a direction substantially parallel with the direction of flow of stock in each respective chamber.

5. Apparatus for delivering a wide flat effluent of dilute paper stock to the forming zone of a paper making machine comprising a pair of wide flat vertical sides arranged in parallel relation and spaced apart a short distance from each other, a pair of narrow vertical sides connecting said wide vertical sides across their adjacent edges, said wide sides and said narrow sides defining a substantially vertical stock inlet passageway for delivering said wide flat effluent to said forming zone, a pair of oppositely and horizontally tapered chambers connected to said passageway on the opposite wide sides thereof, and extending for the full width of said passageway, the wide ends of said chambers having supply openings therein for effecting substantially horizontal flow of stock in opposite directions in said chambers, and each chamber having an elongated horizontal opening adjacent the bottom thereof for connecting each chamber with said passageway, each of said horizontal openings effecting the outflow of a wide flat stream from the side of each chamber into said passageway, said wide flat streams combining in said passageway to form said wide flat effluent.

References Cited in the file of this patent

UNITED STATES PATENTS

1,853,849	De Cew	Apr. 12, 1932
2,116,763	Kutter	May 10, 1938
2,193,032	Mackenzie	Mar. 12, 1940
2,255,951	Tomtlund	Sept. 16, 1941
2,347,717	Staeger	May 2, 1944
2,509,267	Goodwin	May 30, 1950
2,589,639	Staeger	Mar. 18, 1952
2,677,991	Goumeniouk	May 11, 1954
2,728,271	Witworth et al.	Dec. 27, 1955

FOREIGN PATENTS

451,905	Great Britain	May 30, 1950
464,219	Canada	Apr. 4, 1950
842,302	Germany	June 26, 1952