June 27, 1967 W. H. BURGESS, JR., ETAL 3,328,236

BUNCHED TUBE APPROACH TO A HEADBOX OF A PAPERMAKING MACHINE

Filed June 22, 1964 5 Sheets-Sheet 1

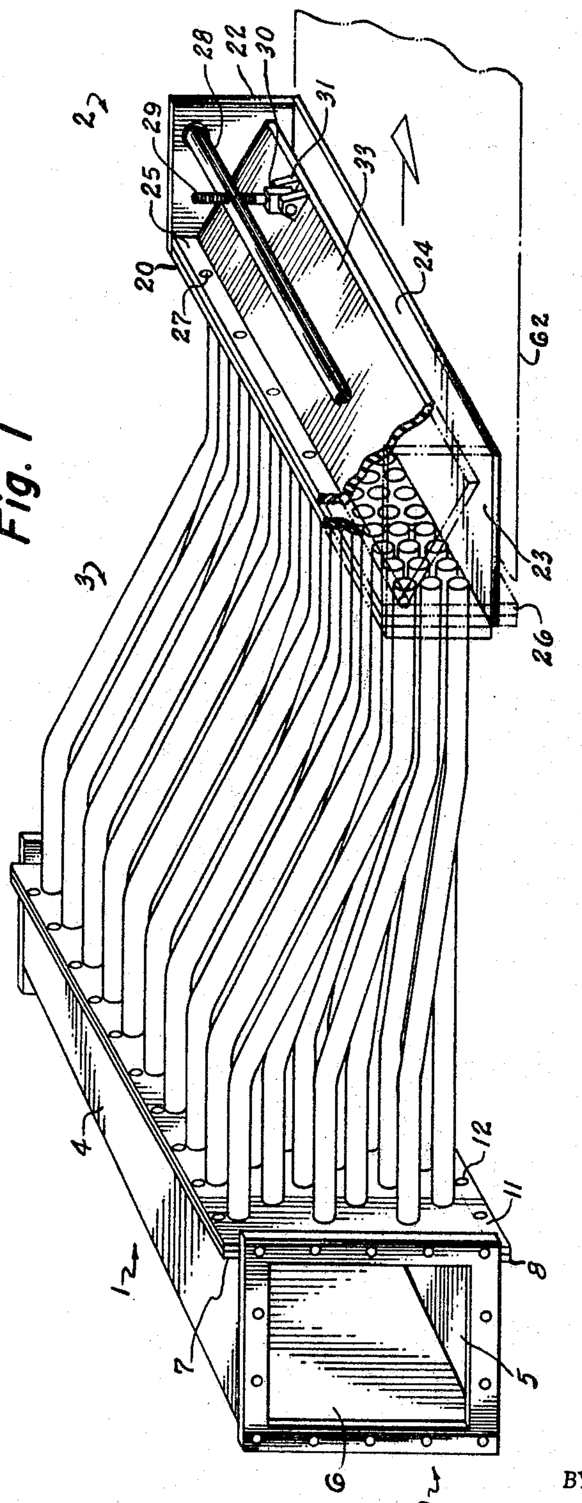

Fig. 1

Fig. 15

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BUNCHED TUBE APPROACH TO A HEADBOX OF A PAPERMAKING MACHINE

Filed June 22, 1964 5 Sheets-Sheet 2

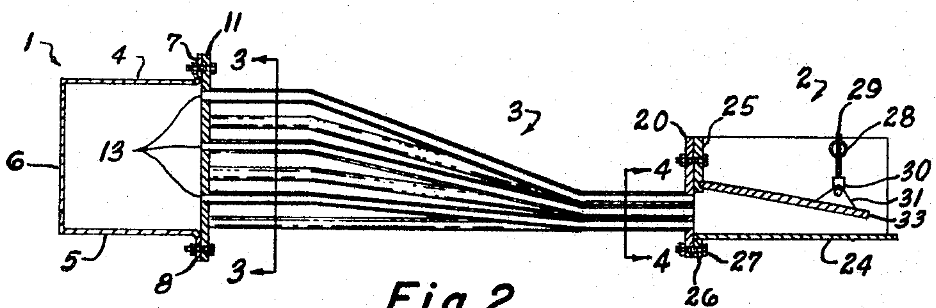

Fig. 2

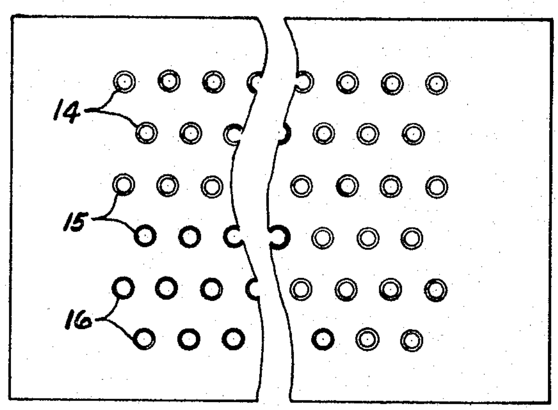

Fig. 3

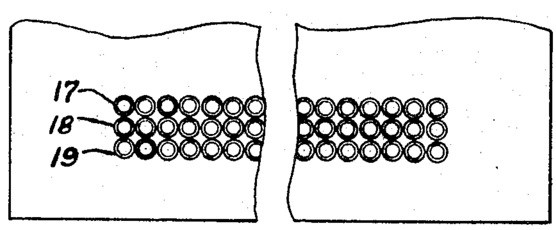

Fig. 4

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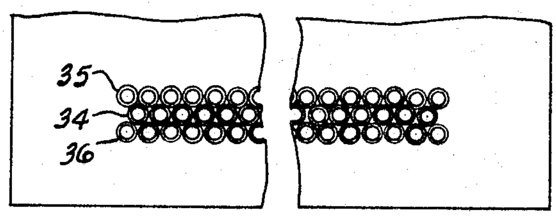

Fig. 5

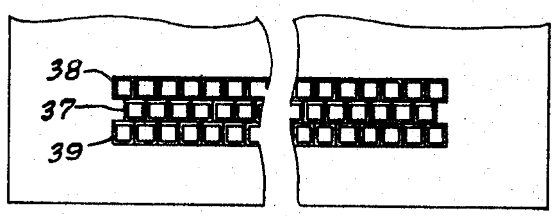

Fig. 6

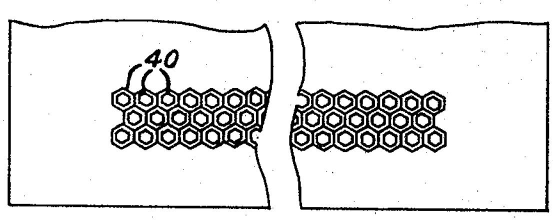

Fig. 7

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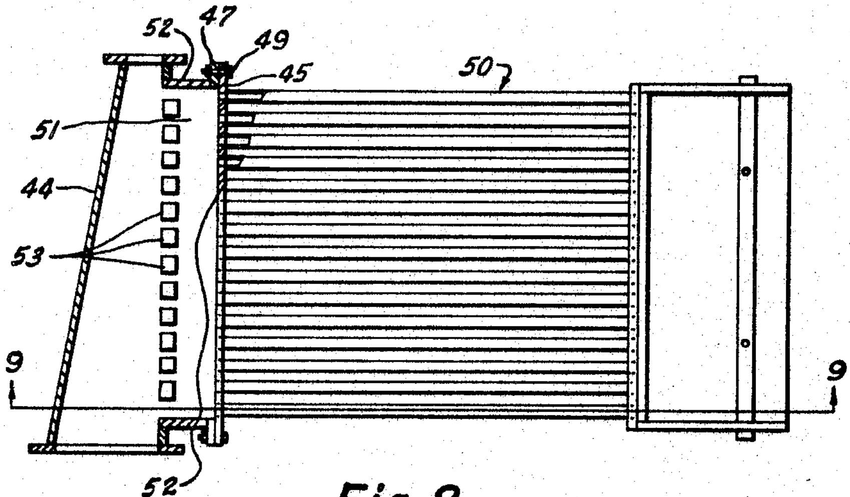

Fig. 8

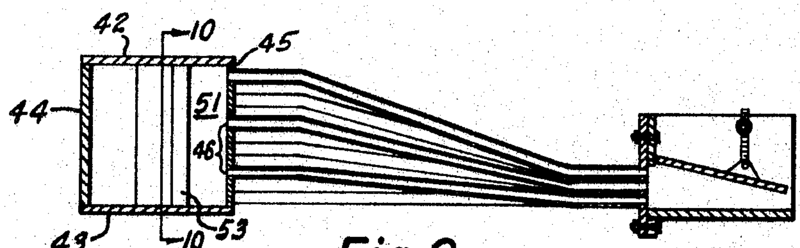

Fig. 9

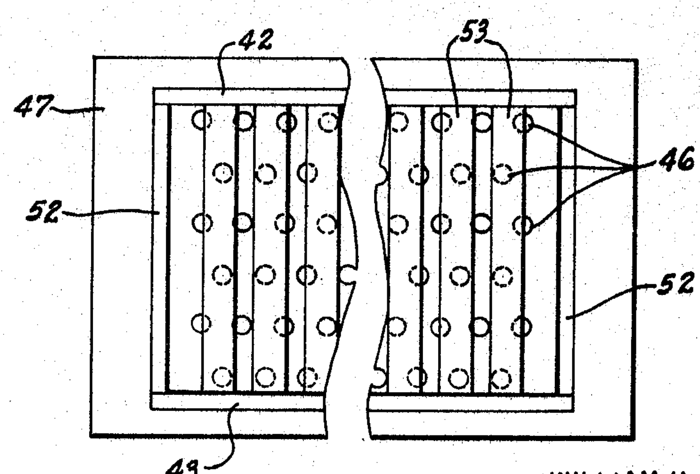

Fig. 10

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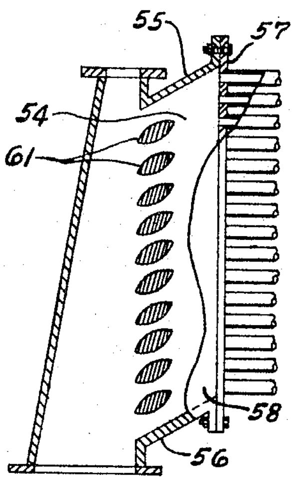

Fig. 11

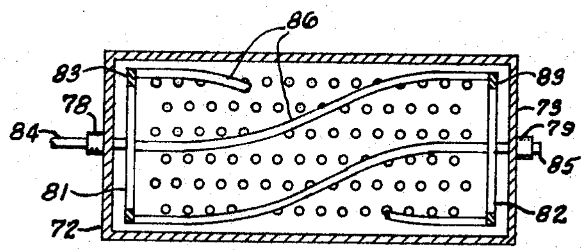

Fig. 13

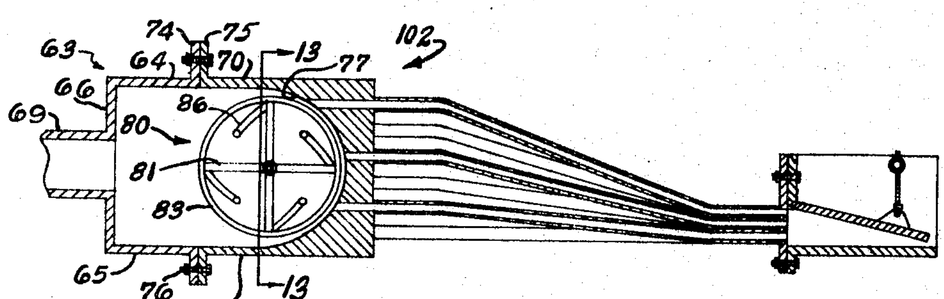

Fig. 12

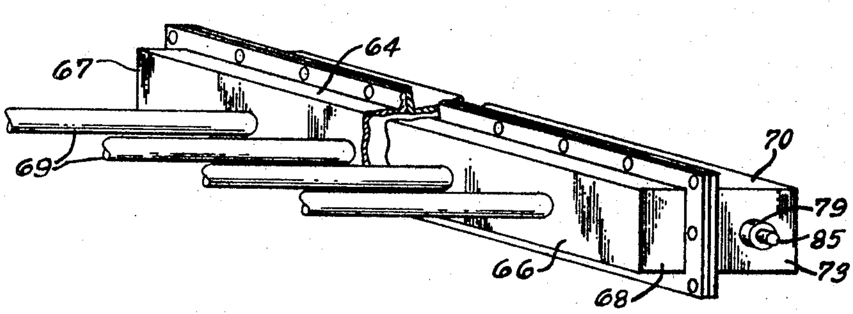

Fig. 14

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United States Patent Office

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3,328,236

BUNCHED TUBE APPROACH TO A HEADBOX OF A PAPERMAKING MACHINE

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Filed June 22, 1964, Ser. No. 376,699
18 Claims. (Cl. 162—342)

The present invention relates to a novel apparatus for delivering a dilute fiber suspension to the forming member of a papermaking machine or similar, non-woven fibrous web forming device.

As is well known to those skilled in the art, the function of such apparatus, generally referred to as headboxes, is to transform the flow of a dilute fiber suspension, or stock, approaching the forming member to a uniform, stable jet for deposition on the forming member while maintaining the fiber dispersion within the stock as uniform as possible. Because of difficulties encountered, however, the jet delivered to the forming member often is unstable; exhibiting cross flows, localized velocity differentials, and excessive turbulence. Additionally, the consistency of the stock delivered often varies; containing lumps and other evidence of non-uniform fiber dispersion. As a result, the web laid may have a blotchy formation and contain variations of weight and caliper, both longitudinally and transversely thereof.

The present invention seeks to overcome these difficulties of prior art headboxes and permit the formation of a homogenous, uniform, fibrous web by controlling the characteristics of the jet delivered to the slice.

More specifically, the present invention prevents the formation of cross flows and other flow irregularities by immediately confining the flow as it leaves the supply manifold to a plurality of smaller, controlled streams and then maintains this condition throughout the system to the slice assembly where the smaller streams may be ejected to form a single, compound jet.

While the compound jet so produced is substantially homogenous in character, the flow from each tube is nonetheless, relatively stable with respect to the flow from adjacent tubes. Therefore, if complete interreaction between the smaller streams is desired, the present invention also provides means for obtaining a more thorough blending of adjacent streams at the tube outlets.

As a further feature of the present invention, means are provided whereby the flow paths of the smaller streams are maintained free from obstructions which might occur as the result of the buildup of fiber and/or foreign material deposits at the stream inlets. This means may taken the form of a static design or alternatively, incorporate a rotating member positioned adjacent the stream inlets.

Additionally, because of its unique construction, the headbox of the present invention is compact and easily arranged to suit the space requirements of a particular installation as well as being inherently, structurally stronger than prior art headboxes of, for example, the vat type.

These and other features and advantages of the invention will become apparent from the following detailed description wherein:

FIGURE 1 is an oblique view of an embodiment of the invention;

FIGURE 2 is a sectional view, in elevation, of the embodiment of FIGURE 1;

FIGURE 3 is a view taken on line 3—3 of FIGURE 2 and showing the arrangement of the tubes adjacent the manifold;

FIGURE 4 is a view taken on line 4—4 of FIGURE 2 and showing the arrangement of the tubes adjacent the slice assembly;

FIGURE 5 is a view similar to FIGURE 4 but showing a slightly different arrangement of the tubes;

FIGURES 6 and 7 are sectional views similar to FIGURE 5 but showing alternate configurations of the tubes;

FIGURE 8 is a plan view, with portions removed, showing an embodiment of the invention incorporating means for preventing tube obstructions;

FIGURE 9 is a sectional view of the embodiment of FIGURE 8 taken on line 9—9 of FIGURE 8;

FIGURE 10 is a sectional view taken on line 10—10 of FIGURE 9;

FIGURE 11 is a view similar to FIGURE 8 showing an alternate embodiment of means for preventing tube obstructions;

FIGURE 12 is a sectional view of an embodiment of the invention incorporating rotating tube-cleaning means;

FIGURE 13 is a sectional view taken on line 13—13 of FIGURE 12;

FIGURE 14 is a perspective view of the inlet conduits, manifold and inlet plate of the embodiment of FIGURE 12; and

FIGURE 15 is a perspective view showing the configuration of a tube used in the headbox of the present invention for obtaining jet intermixing.

Referring to FIGURES 1 and 2 of the drawings, there is shown a headbox constructed in accordance with the principles of the present invention and including a manifold **1**, a slice assembly **2**, and a plurality of small diameter tubes **3**, leading directly from the manifold to the slice assembly.

The manifold, as seen in FIGURES 1 and 2, may be of more or less conventional construction and is shown as being of substantially rectangular cross-section and extending transversely of the bank of tubes **3**. From FIGURES 1 and 2 it will be noted that manifold **1** includes top and bottom walls **4** and **5**, respectively, a sidewall **6**, and outwardly extending flanges **7** and **8**, extending along the forward edges of top and bottom walls **4** and **5**, respectively. Manifold **1**, it will be noted, tapers from a relatively large dimension adjacent its inlet end **9** to a smaller dimension adjacent its outlet end **10**. In this manner, the pressure and velocity of the stock at all points along the length of the manifold may be maintained substantially constant; thereby enhancing the uniformity of flow through the individual tubes **3**. Adjacent the outlet end **10** of the manifold **1**, an adjustable valve (not shown) may be provided to regulate the flow through the outlet end of the manifold. Therefore, if it is desired to increase the velocity of the flow to the manifold without increasing the velocity or total flow through the tubes, the supply rate to the inlet end of the manifold my be increased and the valve controlling the flow through the outlet end of the manifold opened an amount sufficient to account for this increased flow. The velocity in the manifold will thereby be increased; but since the additional flow causing the increase will be accommodated through the increased opening of the outlet end valve, the total flow through the tubes **3** will be unaffected. In this manner, if the tube inlets exhibit a tendency to become plugged by fibers or debris in the system, they can, in effect, be flushed without disturbing the rate of flow through the tubes themselves. Of course, if it were desired to increase the velocity through the tubes **3** as well as the manifold **1**, the outlet end valve setting could be held constant while the flow rate to the manifold was increased.

Extending between top and bottom wall portions **4** and **5** of the manifold **1**, an inlet plate member **11** is provided attached to outwardly extending flanges **7** and **8** of the manifold **1** by means of bolts, rivets or the like, as at **12**. Inlet plate member **11** has a plurality of apertures **13** formed therein and tubes **3** are attached to plate member **11** with their sidewalls each surrounding one of the apertures **13**; thereby placing the tube in fluid communication with the interior of the manifold. Tubes **3**, as shown in FIGURES 1–4, may extend from the manifold **1** in substantially parallel relationship to one another for a first portion of their length, then converge to form a juxtaposed, parallel arrangement adjacent the slice assembly. More specifically, the tubes may be arranged adjacent the manifold in a plurality of pairs of horizontally extending rows **14**, **15** and **16**, with each of the tubes extending in spaced relation to each of the others. The tubes then begin to converge intermediate their lengths, until each of the double rows of tubes **14**, **15** and **16** has merged to form the three, single, juxtaposed rows **17**, **18** and **19** shown in FIGURE 4.

As the tubes approach the slice assembly **2**, they are terminated at an outlet plate member **20** having a series of apertures formed therein to receive the ends of the tubes **3**. Slice assembly **2**, as best seen in FIGURES 1 and 2, includes upstanding sidewalls **22** and **23**, a bottom wall **24**, and a short backwall **25**. Extending from the lower rear edge of bottom wall **23** a flange member **26** is provided and outlet plate member **20** is bolted thereto and to backwall **25** by means of bolts, rivets or the like, as at **27**. Extending across the slice assembly, and journaled at its ends in the upstanding sidewalls **22** and **23**, is a support member **28**. Extending through support member **28** at spaced intervals therealong, screw threaded rods **29** are engaged by the threads of threaded apertures formed in the rod **28**. Rods **29**, at their lower end, are journaled in blocks **30** which in turn are pivotally received by pivot mounts **31**. Hingedly attached to the backwall **25** of the slice assembly, a movable slice lip **33** is provided to complete the slice assembly. It will thus be apparent that upon rotation of the screw threaded rods **29** by means of suitable tools, handles or the like, slice lip **33** will be caused to move upwardly and downwardly and thereby vary the opening of the slice.

In operation, stock is received from a suitable source and flows into the tapered manifold **1** through its inlet end **9** towards its outlet end **10**. As the flow passes through the manifold, portions of the flow are tapped off through the apertures **13** formed in inlet plate member **11** to form a plurality of small diameter streams. These smaller streams are then immediately confined in the relatively small diameter tubes **3** and remain in this condition until they are ejected at the slice assembly.

As in most headbox construction, the turning of the flow from the manifold towards the slice results in a tendency of the turned stock to flow at an angle to the flow through the manifold. That is, parallel to neither the intended, redirected flow, nor the manifold flow but at some angle therebetween. In conventional headboxes, this tendency results in the establishment of cross flows, which, one established, may be carried through the headbox to the slice where they may seriously disrupt proper web formation. In the headbox of the present invention, however, as the flow passes from the manifold **1**, it is immediately confined in the small tubes **3** and maintained in this confined state throughout its entire travel to the slice where it is deposited on the forming member **62** as a compound jet. In this manner, cross flows resulting from the turning of the stock are substantially dampened out during travel through the tubes, and thence, once a substantially linear flow is established, this flow is maintained throughout the system by means of the continuous tubes **3**. It will thus be seen, that any tendency for the establishment of localized flows in other than the desired direction is effectively and finally eliminated.

While the total confinement of the flow through the headbox from the manifold to the slice provides a slice jet of uniform direction, the use of tubes in this manner serves another function of equal importance. As noted

previously, one purpose of a headbox is to maintain the fibers uniformly dispersed throughout the suspension as it flows to the slice. In prior art headboxes, attempts have been made to achieve this condition by the use of explosion chambers, mixing zones, rectifier rolls and the like, with varying degrees of success. With the headbox of the present invention, however, the necessity of these expedients is eliminated and complete fiber dispersion nevertheless attained. This results because the use of a plurality of comparatively small diameter tubes permits the establishment of a fine scale turbulence in each tube which is sufficient to maintain the fibers well mixed, but is not great enough to cause appreciable flow irregularities. Thus, through the proper selection of the tube diameter and stock velocity, the flow through each tube and hence, the entire flow, may be maintained in a fully turbulent condition throughout the travel from the manifold to the slice without the danger of formation of tranquil regions, standing eddies and other undesirable flow characteristics.

While a particular arrangement and cross-sectional shape for the tubes has been described above for purposes of illustration, it will be apparent that variations thereof are practically unlimited. Thus, although the tubes are shown in FIGURE 4 as arranged in vertically stacked horizontally extending rows, it will be apparent that the rows of tubes may be internested as shown in FIGURE 5. In this manner, although round tubes are used, the offsetting of inner row **34** relative to top and bottom rows **35** and **36** allows the jets to be ejected at the silce in more intimate relationship. As noted above, the cross sectional shape, as well as the arrangement of the tubes, may be varied in an infinite number of ways. Thus as shown in FIGURE 6, the tubes may assume a rectangular or square cross-section shape and be arranged in either vertically stacked relation, as in the embodiment of FIGURE 4, or with the center row **37** offset inwardly of the top and bottom rows **38** and **39**. Another possible arrangement is, as seen in FIGURE 7, with the use of a polygonal tube. As shown in FIGURE 7, hexagonally cross sectioned tubes **40** are ideally suited for the internested relationship shown.

Since the stock flowing through the system of the present invention is essentially a forced suspension of solids, there exists a tendency for the fibers to staple out upon obstructions to flow. While in most instances this problem can be obviated by proper inlet configuration and control of stock velocities through the system, additional means may often be used to great advantage to alleviate this problem. Thus, for example, where the velocity of the stock through the system must be kept fairly low, there will be a tendency for the fibers suspended in the stock to accumulate between or adjacent to inlets of the tubes. If this occurs, the resulting fiber accumulations may pass as lumps through the tubes to the web forming surface. This, of course, results in lumps in the finished web which are easily separated from the web and results in holes. On the other hand, the fiber accumulations may cause blockage of one or more of the tubes adjacent their inlet ends and destroy the homogeneity of the compound slice jet. To remedy these problems, means may be provided as shown in FIGURES 8–10, which creates an area of high turbulence adjacent the inlet ends of the tubes **3**, and thereby prevents the accumulation, to any appreciable extent, of either fiber bundles or debris on the land areas between the apertures in the inlet plate.

As seen in FIGURES 8–10, a manifold **41** is provided, similar to the manifold **1**, and having top and bottom wall portions **42** and **43** with a sidewall portion **44** extending therebetween. Also extending between the top and bottom walls **42** and **43**, and in spaced relation to sidewall **44**, an inlet plate member **45** is provided having a series of apertures **46** formed therein. As in the case of the previously described embodiments, the inlet plate member may be bolted to upstanding flanges 47 by means of bolts or the like 49. Tubes 50 are also provided, with an inlet end of each tube overlying an aperture 46 in the inlet plate and the tubes extending downstream to the slice assembly with those portions of their length adjacent the slice assembly arranged in parallel juxtaposed relationship. In the instant embodiment, however, means are provided, as noted previously, to subject the inlet plate member 45 to a cleaning action to maintain the tubes 50 free of obstructions. This means may take the form of a chamber 51 formed by the top and bottom wall portions 42 and 43 of manifold 41 and extension walls 52 closing off the ends of the chamber. A series of rods 53 are mounted, extending between the top and bottom wall portions 42 and 43 in spaced relationship to each other, to provide openings therebetween. It will thus be seen that as the stock flows through the manifold 41, a portion thereof is tapped off and passes between rods 53 to impinge on the land areas between the apertures 46 with considerable pressure. At the same time the flow around rods 53 causes the formation of low pressure areas within the chamber immediately behind the rods. Through a combination of these two factors, the stock in the chamber 51 is maintained in a constant state of agitation and fiber accumulations effectively eliminated.

Referring now to FIGURE 11 of the drawings, another embodiment of the present invention designed to suppress the formation of fiber accumulations is therein shown. As seen in FIGURE 11, a cleaning chamber 54 is provided defined by end walls 55 and 56, an inlet plate member 57, a top wall portion 58, and a bottom wall portion. In contrast to the embodiment of FIGURES 8–10, however, in the present embodiment the end walls 55 and 56 extend at an angle to the general direction of flow through the cleaning chamber 54. Additionally, the rods 61 stationed across the entrance to the cleaning chamber 54 are vane shaped, in contrast to the rectangularly-shaped rods 53 of FIGURE 8. It will be apparent that with the embodiment of FIGURE 11, any tendency of the fibers to accumulate on the surfaces of the rodlike members 61 themselves, is apreciably decreased. More importantly, however, although the cleaning chamber 54, as in the case of cleaning chamber 51, provides an area of high turbulence therewithin, it will be noted that because of the vane shape of the rod members 61, the general, overall flow direction is at an angle to the upstream surface of the inlet plate member 57. It will thus be apparent, that any fibers that tend to adhere to the land areas between the apertures in the plate member will be continually urged across the surface of the inlet plate member and eventually washed through one of the apertures formed therein.

Referring now to FIGURES 12–14 of the drawings, another embodiment of the present invention is disclosed which is particularly adaptable for use with a rotatable, mechanical cleaning means for the inlet ends of the tubes. As seen in FIGURE 14, this construction may comprise a manifold 63 having top and bottom walls 64 and 65, respectively, a sidewall 66 and end walls 67 and 68. In fluid communication with the interior of the manifold 63 are a plurality of fairly large diameter conduits 69 attached to sidewall 66 of the manifold. An inlet plate member 102 is also provided having top and bottom extensions 70 and 71 and sidewall extensions 72 and 73. Both manifold 63 and inlet plate member 102 may be provided with peripheral, co-extensive flange members 74 and 75, respectively, which may be joined by means of bolts, rivets or the like as at 76. As in the case of previously described embodiments, the flow through the inlet plate member is immediately confined in a plurality of small streams by means of the small diameter tubes and maintained in this confined state until ejection at the slice assembly. In the present embodiment, however, the upstream side of the inlet plate member is provided with an arcuate, rather than planar, surface and means are provided adjacent this surface for continually subjecting the apertures through the inlet plate member to a cleaning action. Thus, as seen in FIGURES 12 and 13, inlet plate 102 is provided with a substantially semi-cylindrical rear surface 77 and mounted on the inlet plate member by means of bearing 78 and 79 is a rotatable cleaning device 80. Member 80 includes spiders 81 and 82 carrying shafts 84 and 85; with each spider spanning a ring member 83. Attached to and extending between the ring members 83 are a plurality of elongated rods 86 which may be arranged in helical fashion as shown. It will be apparent that the shaft member 84 of the cleaning means 80 may be engaged by a suitable source of power and the entire cleaner mechanism rotated in a manner such that the helically extending rods 86 are caused to pass in paths along the curved surface of the inlet plate member. In this manner, not only is an area of turbulence generated adjacent the inlet plate member, but the passage of each of the rods past the surface 77 will create an area of negative pressure in its wake. Thus, through the turbulence effect the tendency for fiber build-up on the surface 77 is at least considerably reduced; while the cyclic application of a suction force to the apertures formed in the inlet plate by the passage of the rods past surface 77, serves to unblock any of the openings which may have become plugged.

While in the embodiment just described the manifold 63 is fed through its sidewall 66 by means of a plurality of relatively large diameter conduits 69, it will be apparent that an end flow manifold, as in the previously described embodiments, might also be used to advantage. Additionally, although the rods 86 are shown as extending in a helical direction between the supporting rings 83, it will be apparent that they may also extend linearly across the inlet plate. It may also be noted that the cross-sectional configuration of the rods 86 may be varied. Thus bars of rectangular or other noncircular shapes may be used, as well as foil shapes such as those disclosed in the patent to Martindale, 2,835,173.

Regardless of the type of cleaning means utilized, if any, it will be noted that in all cases the flow must still eventually pass through the fairly small diameter tubes. Therefore, irrespective of any irregular flow patterns which may be established upstream of the tube inlets, such irregularities are subsequently eliminated by passage through the tubes and a uniform jet delivered to the slice assembly.

As the jets leave the outlet plate there is some tendency towards intermixing. This results from the slight expansion the jets experience when they are no longer confined by the small diameter tubes and from the slight differences in velocities and pressures in each of the tubes which are likely to occur in practice. For the most part though, the jets are comparatively stable with respect to one another and little intermixing will normally occur. Therefore, if further or more complete intermixing of the jets is desired, the present invention provides means whereby this may be conveniently accomplished.

As seen in FIGURE 15, and as noted previously, the tubes interconnecting the manifold and the slice may be of other than circular cross-section. Since any means which serves to disrupt the normal inter-jet stability at the slice and causes the jets to deviate from their parallel flow paths will also serve to promote inter-jet blending, these non-circular tubes may be used to great advantage by twisting them about their longitudinal axis. Thus, tube 99, of substantially square cross-section, is shown with its sidewalls twisted through an angle of 90° from its inlet end 100 to its outlet end 101. In this manner, a spiral velocity component is imparted to each of the jets and inter-jet blending thereby increased. While a square tube twisted through an angle of 90° is shown for purposes of illustration, it will, of course, be apparent that other non-circular shapes and degrees of twist may be used within the scope of the present invention.

It is often desirable in forming non-woven, fibrous webs to lay the web in a series of layers. In this way a multiply web may be formed having a base layer of cheaper stock with one or both surfaces thereof covered by a finer quality stock for such purposes as, for example, improving printability. In forming webs of this type, conventional practice is to utilize a series of secondary headboxes suspended over the web forming surface with each headbox depositing the type of stock desired for a particular ply. Because prior art headboxes generally include a large, liquid-filled vat or chamber, the suspension of these headboxes over the forming surface invariably presents problems of designing a satisfactory support system. The headbox of the present invention, however, because of its unique construction, requires little or no additional support structure and hence, is ideally suited for use as a secondary headbox. Thus, rather than a large, liquid-filled vat or chamber to convey the stock from the manifold to the slice, the present headbox uses a plurality of tubes which are essentially self-supporting and, as a unit, inherently structurally stronger. Additionally, since the tubes need not extend in parallel relationship throughout their lengths, the manifold may be disposed to suit the space requirements of the particular installation. Thus, in addition to its use as a primary headbox, the present headbox is well adapted for use as a secondary unit.

From the foregoing it will be apparent that applicants have devised a system for delivering a dilute fiber suspension to a forming member which is compact and simple in construction yet effectively eliminates both flow irregularities and non-uniformities of fiber dispersion and provides great flexibility in both operation and adaptability to particular installations. While certain specific embodiments have been described for purposes of illustration, it will be apparent that many features thereof, such as the number of tubes and rows of tubes and the arrangement and spacing thereof, may be modified within the scope of the invention as defined by the appended claims.

We claim:

1. Headbox apparatus of the type described comprising:
(a) An elongated manifold having a top wall portion, bottom wall portion and sidewall portion,
(b) an inlet plate member extending between and attached to said top and bottom wall portions in spaced relation to said sidewall portion,
(c) said inlet plate member having portions defining a plurality of apertures therethrough,
(d) a plurality of tubes extending from said inlet plate member with the inlet end of each of said tubes overlying one of said apertures, and
(e) a slice assembly including a rear wall and upper and lower slice lips converging away from said rear wall to define a generally triangular space and outlet slot,
(f) said tubes terminating at and forming a portion of said rear wall of said slice assembly in direct fluid communication with said triangular space, with said tubes extending upstream from said slice assembly in parallel, juxtaposed relationship for at least a portion of their lengths.

2. The apparatus of claim 1 wherein:
(a) Said manifold is substantially rectangular in cross-section, and
(b) said manifold is tapered from its inlet to its outlet end.

3. The apparatus of claim 1 wherein:
(a) Said tubes extend from said inlet plate member in a plurality of pairs of rows with each row in a pair of rows staggered with respect to the other, and
(b) each of said pairs of rows of tubes converges intermediate the length of said tubes to form a single row at said slice.

4. The apparatus of claim 3 wherein:
(a) Those portions of said tubes extending from said slice assembly in parallel, juxtaposed relationship are nested in offset relation with respect to each other.

5. The apparatus of claim 4 wherein:
(a) Said tubes are polygonal in cross-sectional configuration.

6. The apparatus of claim 5 wherein:
(a) Said tubes are twisted about their longitudinal axes.

7. The apparatus of claim 1 wherein:
(a) Means are located intermediate said sidewall portion and said inlet plate member for maintaining said tubes free from obstructions.

8. The apparatus of claim 7 wherein:
(a) Said means comprises a plurality of rod members extending between said top wall portion and said bottom wall portion with each of said rods arranged in spaced relation to each other.

9. The apparatus of claim 8 wherein:
(a) Said rod members are substantially rectangular in cross-section.

10. The apparatus of claim 8 wherein:
(a) Said rod members are substantially vane-shaped in cross-section with the apices of said vanes directed at an angle to said inlet plate member.

11. The apparatus of claim 7 wherein:
(a) Said means comprises a rotating assembly positioned adjacent said inlet plate member.

12. The apparatus of claim 11 wherein:
(a) Said rotating assembly includes a plurality of elongated members mounted for movement in curved paths in close proximity to one surface of said inlet plate member.

13. The apparatus of claim 12 wherein:
(a) Said one surface of said inlet plate member is substantially semi-cylindrical in shape, and
(b) a plurality of conduits are in fluid communication with said manifold along said sidewall thereof.

14. Headbox apparatus of the type described comprising:
(a) An elongated manifold of substantially rectangular configuration,
(b) said manifold being tapered throughout its length,
(c) said manifold including a sidewall and a top and bottom wall extending from the upper and lower edges, respectively, of said sidewall,
(d) an inlet plate member extending between said top and bottom walls and attached to said top and bottom walls along their edges opposite said sidewall,
(e) said inlet plate member having portions thereof defining apertures therethrough with said apertures arranged in a plurality of pairs of spaced horizontally extending rows,
(f) apertures in adjacent rows being offset with respect to each other,
(g) a plurality of elongated tubes attached to said inlet plate member with an inlet end of each of said tubes overlying one of said apertures,
(h) said tubes extending from said inlet plate member in parallel, spaced relation for a first portion of their lengths,
(i) said tubes extending from said inlet plate member in converging relation for a second portion of their lengths adjacent said first portion,
(j) a slice assembly,
(k) an outlet plate member extending across the back of said slice assembly and secured thereto,
(l) said outlet plate member having portions defining a plurality of apertures therethrough,
(m) said outlet plate member apertures being arranged in a plurality of juxtaposed, horizontally extending rows,
(n) said tubes being attached to said outlet plate member with an outlet end of each of said tubes overlying one of said outlet plate member apertures, and
(o) said tubes extending from said outlet plate member to said second portion of their lengths in parallel, juxtaposed relation.

15. The apparatus of claim 14 wherein:
(a) Said tubes are polygonal in cross-section, and
(b) said tubes are twisted about their longitudinal axes.

16. The apparatus of claim 14 wherein:

(a) A plurality of vane-shaped rod members extends between said top and bottom walls,
(b) said vane-shaped rod members being arranged in a row extending in spaced relation to said inlet plate member and said sidewall, and
(c) the apices of said vane-shaped rod members extend at an angle to said inlet plate member.

17. Headbox apparatus of the type described comprising:
(a) An elongated manifold,
(b) said manifold having a top wall portion, a bottom wall portion and a sidewall portion joining said top and bottom wall portions,
(c) a plurality of conduits having fluid communication with said manifold through said sidewall portion,
(d) an inlet plate member,
(e) said inlet plate member having a front surface, a substantially semi-cylindrical rear surface and sidewall extensions,
(f) said inlet plate member extending between said top and bottom wall portions of said manifold in spaced relation to said sidewall portion and having a plurality of apertures formed therein,
(g) a rotating cleaning assembly,
(h) said cleaning assembly including a pair of ring members,
(i) said ring members being arranged in spaced, parallel relationship to each other with each of said ring members situated adjacent one of said sidewall extensions and said semi-cylindrical rear surface,
(j) a spider spanning each of said ring members,
(k) a shaft mounted on each of said spiders and extending through an adjacent sidewall extension,
(l) a plurality of elongated rods mounted on and extending between said ring members,
(m) a plurality of tubes attached to said front surface of said inlet plate member with an inlet end of each of said tubes overlying an aperture in said inlet plate member, and
(n) a slice assembly including a rear wall and upper and lower slice lips converging away from said rear wall to define a generally triangular space and outlet slot,
(o) said tubes terminating at and forming a portion of said rear wall of said slice assembly in direct fluid communication with said triangular space with said tubes extending upstream from said slice assembly in parallel juxtaposed relation to each other for at least a portion of their lengths.

18. Headbox apparatus of the type described comprising:
(a) A plurality of tubes relatively small cross section,
(b) a manifold of large cross section relative to said tubes,
(c) each of said tubes, at one end thereof, being in fluid communication with said manifold and extending therefrom,
(d) a foraminous forming member, and
(e) a slice assembly extending transversely of said forming member in spaced relationship thereto including a rear wall and upper and lower slice lips converging away from said rear wall to define a generally triangular space and outlet slot,
(f) each of said tubes terminating at and forming a portion of said rear wall of said slice assembly in direct fluid communication with said triangular space at their end opposite said one end,
(g) said tubes extending away from said slice assembly in parallel, juxtaposed relationship to each other for at least a portion of their lengths.

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