REINFORCED HEADBOX FOR PAPER MACHINE

FIG-1

FIG-2

FIG-3

FIG-4

FIG-5

FIG-6

FIG-7

FIG-8
ABSTRACT OF THE DISCLOSURE

A paper machine headbox assembly especially adapted for use as a secondary headbox incorporates a multiple tube assembly unit which connects the stock supply chamber with the slice assembly and which serves also as the main structural element for reinforcing the headbox assembly and supporting the slice lip assembly with respect to the forming wire of the paper machine. A stock supply header is built into the headbox so that it also functions as a structural element as well as a header.

BACKGROUND OF THE INVENTION

A secondary headbox for a Fourdriner paper machine is utilized to apply a layer of paper making stock on top of the layer previously applied to the wire by the primary headbox. The secondary headbox is therefore supported at its ends above and in spanning relation with the wire, and for optimum results, the slice lip assembly and the supply passage thereinto should be kept as uniform and as straight as possible. The loads and stresses effective on the headbox in use produce a definite tendency toward sagging, particularly on paper machines of substantial width, and it is difficult with conventional prior art constructions to obtain sufficient reinforcement to overcome these loads and stresses.

The parent application of which this case is a continuation-in-part discloses a headbox assembly wherein the stock supply chamber is connected with the slice assembly by means of a tube assembly unit defining a plurality of separate and parallel passages of relatively small individual cross-sectional flow area for delivering the stock from the supply chamber directly to the outlet passage defined by the slice lips.

The present invention is particularly concerned with the provision of a secondary headbox assembly incorporating a similar multiple tube assembly unit which not only performs the stock supply function noted above, but which also serves as the major structural element for reinforcing the headbox assembly, particularly in the vicinity of the slice assembly, in order to maintain uniformly straight discharge flow conditions across the entire width of even a relatively wide paper machine.

SUMMARY OF THE INVENTION

The present invention provides a headbox assembly which is especially adapted for use as a secondary headbox because of the high degree of rigidity which it achieves in those portions of the headbox establishing the discharge flow conditions of stock onto the wire. More specifically, the headbox of the invention incorporates a stock supply chamber and a slice assembly which are interconnected by a multiple tube assembly unit composed of separate and generally parallel passageways of relatively small individual cross section which are rigidly secured together in such manner as to establish a beam-like structure.

The tube assembly unit in the secondary headbox of the invention has essentially the same operational function as in the above parent application in that it establishes essentially uniform flow distribution of the stock to the slice assembly. It accomplishes this function by its controlling effect on the stock flow therethrough, but in addition, it possesses sufficiently high physical strength and rigidity to resist the stresses and loads which tend to produce sagging and variable flow areas in the corresponding portions of conventional secondary headboxes.

Thus it forms the major structural reinforcing element of the headbox for supporting the slice lip assembly itself, and assures that there will be minimum sagging and/or variation of the slice lip opening even on a headbox which must span a forming wire of substantial width, such as 300 inches or more.

Another distinguishing characteristic of the secondary headbox of the invention, particularly for use on relatively wide paper machines, lies in the novel manner in which the cross flow supply header for furnishing the stock to the supply chamber serves also as a supplemental reinforcing and supporting element for the headbox assembly as a whole. In particular, the invention provides a secondary headbox wherein the cross flow header is directly supported on the tube assembly unit, and a wall common to the header and to the supply chamber is provided with perforations through which the stock flows into and through the supply chamber to the multiple passageways of the tube unit. On headboxes for wide paper machines, the piping connected to the supply header also provides a supporting function for the headbox as a whole.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a view generally in vertical section showing a secondary headbox constructed in accordance with the invention and mounted in operative relation above the forming wire of a Fourdriner paper machine;

FIG. 2 is an enlarged fragmentary section on the line 2—2 of FIG. 1;

FIG. 3 is a view similar to FIG. 2 showing a modified construction of the tube unit;

FIG. 4 is a view similar to FIG. 1 showing another form of headbox in accordance with the invention;

FIG. 5 is a view similar to FIG. 1 showing still another form of a headbox in accordance with the invention;

FIG. 6 is an enlarged fragmentary section on the line 6—6 of FIG. 5;

FIG. 7 is a fragmentary view showing a modification of the headbox of FIG. 5; and

FIG. 8 is a view similar to FIG. 2 showing a third modification of the construction of the tube unit.

DESCRIPTION OF PREFERRED EMBODIMENTS

FIG. 1 shows the headbox assembly 10 positioned as a secondary headbox above a fragment of the forming wire W of a Fourdriner paper machine on which there is assumed to be a layer of fiber previously applied thereto from a primary headbox. The headbox assembly 10 comprises four main components, which are the crossflow stock supply header 11, the supply chamber 12, a tube
assembly unit 13 defining a multiplicity of small parallel passages leading from chamber 12, and the slice assembly 15 which receives the stock from the tube assembly 13 and delivers it to the forming wire.

The lower slice lip 42 and a brace 43 connected at its other end to the chamber 12. The upper slice lip 44 is provided with a hinged mounting 45 extending along the forward edge of the upper wall member 40.

The lower slice lip 42 is secured to the forward end of the lower wall member 41 and a brace 43 connected at its other end to the chamber 12. The upper slice lip 44 is provided with a hinged mounting 45 extending along the forward edge of the upper wall member 40.

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ventional practice if the velocity of the stock as it enters the larger end of the outlet passage 64 is of the order of 1 to 2 feet per second. For the same wire speed, preferred results are obtained in the practice of the invention if the tube assembly 13 has an aspect ratio in vertical section as effective flow area as the larger end of the passage defined by walls 40 and 41 into which it discharges. In other words, the tube assembly 13 should provide approximately 50% open area so that the flow velocity therethrough is approximately twice that in the larger end of the outlet passage, and the multiple separate streams of stock through the tubes is therefore decelerated by approximately 50% as these streams merge in the larger end of the outlet passage and are then again accelerated as they approach the outlet slot defined by lips 42 and 44.

The figure of 50% as used in the preceding paragraph does not appear to be critical but rather an approximate value. As illustrative of the range which the 50% figure typifies, for a wire speed of 1300 feet per minute, satisfactory results have been obtained with a flow velocity through the tubes of 7.5 feet per second which dropped to 3.0 feet per second at the larger end of the outlet passage. For a wire speed of 1500 feet per second, the comparable figures are 8.6 and 3.5 feet per second. It will also be apparent that these figures will vary for different basis weights at the same wire speed, but the ratio of velocity in the tubes to the velocity at the larger end of the outlet passage will remain of the same general order.

The length of the individual tubes in the tube assembly unit 13 does not appear to be critical but does have practical limitations. For example, these tubes should be long enough for the pulsations of the rotor 26 to die out and for the multiple streams to assume parallel flow characteristics. In practice, each of the individual tubes should therefore have a length which is at least six times its inner diameter, but there appears to be no theoretical reason for materially increasing the lengths of the tubes beyond this value, and satisfactory results have been obtained with the individual tubes of ½ inch inner diameter and with the unit 13 approximately 12 inches in length.

The tube assembly 13 is advantageously constructed of multiple individual tubes or sheets brazed together as described to form a rigid honeycomb structure. Comparable results in operation can be obtained if this section of the assembly is fabricated by drilling a solid block of metal suitable plastic so long as the other requirements discussed herein are met. One of the major advantages provided by this construction derives from its strength in vertical section, particularly as compared with a conventional open slot or throat connection to the slice, which renders both itself and the slice lips subject to distortion in withstanding the substantial pressures of the headbox under conditions of high speed paper machine operation. In contrast, the honeycomb section of the invention assures constant effective flow area to the slice across the entire width of the paper machine.

The headbox assembly 10 is practical for use as a primary headbox, but it offers special advantages as a secondary headbox because of its comparatively simple and lightweight but strong and rigid construction. The tube assembly 13 contributes multiple advantages in a secondary headbox apart from its major function in delivering stock to the slice, especially from the standpoint of dust. Each of the individual tubes should therefore be compared with a conventional open slot or throat connection to the slice, and which further contributes to uniformity of sheet formation by assuring that the effective flow area from the supply chamber to the slice assembly will remain uniform across the entire width of the machine under conditions.

FIG. 4 shows another form of headbox assembly 70 in accordance with the invention which is in some respects similar to the assembly 10 and is especially adapted for use as a secondary headbox. The tube assembly unit 71 in FIG. 4 is somewhat L-shaped in section but otherwise corresponds in structure and function to the unit 13, and it similarly conducts stock to the slice assembly 72 having therein a perforated roll 77 which corresponds in location and function to the rotor 26. The lower slice lip 80 is supported by and projects from the lower casing member 81 of the tube assembly unit 71. The inclined upper slice lip 82 has its hinged mounting 83 on the forward end of the upper casing member 84 of tube assembly unit 71.

Advantage is taken of the L-shape of tube assembly unit 71 to provide support for the supply header 88, which is supported in part by the casing member 84 and communicates with the bottom of supply chamber 75 through a common perforated wall 89. A hollow beam assembly 90 extends the full length of the headbox immediately forward of the header 88, and its front wall forms the support for the adjusting screws 91 for the upper slice lip 82, these screws being carried by a beam 94 which is adjustably mounted on the beam 90 by jacks 95 as shown.

The headbox assembly 70 offers advantages similar to the headbox 10 for use as a secondary headbox and it is also similarly usable as a primary headbox. Its tube assembly 71 offers comparable advantages of strength in supporting a substantial portion of the weight of the assembly, and it also demonstrates that it is not essential to the invention that the tube assembly be straight. FIGS. 5 and 6 show another form of secondary headbox assembly 100 which is generally similar to the headbox assemblies 10 and 70 in comprising, as main components, a cross flow supply header 101, a supply chamber 102, a tube assembly unit 103, and a slice assembly 105. The chamber 101 through which the cylindrical bottom portion 106 which is connected with the unit 103, and a rotor 107 is mounted for rotation in chamber 102 concentrically with the curved wall portion 106.

The tube assembly unit 103 is of individually different construction from those previously described, and it comprises multiple individual tubes 110 of cylindrical section spaced from each other in the pattern shown in FIG. 6 and connected at their opposite ends to end plates 111 and 112 of relatively heavy section. Satisfactory results have been obtained with individual tubes 110 having an outer diameter of .675 inch and a wall thickness of .028 inch, and with the end plates 111 and 112 each of at least one inch thickness, the individual tube 110 being of varying thickness due to the fact that its end surface facing the chamber 102 is cylindrically concave on the same center and radius as the curved chamber wall portion 106. The tubes 110 are readily secured to the plates 111 and 112 by expanding the ends of the tubes into correspondingly sized and aligned holes in the plates, and top and bottom cover plates 114 and 115 are welded or otherwise secured to the edge surfaces of the end plates 111 and 112.

The headbox construction shown in FIG. 5 is particularly suitable for paper machine having a web width, such as within a range of 100 inches. For such headboxes, the tube unit 103 provides such substantial reinforcement and support for the slice assembly that it is unnecessary to place significant reliance on the header 101 for reinforcement. It is accordingly shown as a tubular tapered pipe mounted on and connected with the front wall of the chamber 102 and extending from the top of the headbox 10. The slice assembly 105 is of essentially the same construction already described in connection with FIG. 1. The lower slice lip 120 is welded or otherwise secured to the forward lower end of the tube assembly unit 103 and has a suitably braced connection 121 to the rear wall of the supply chamber 102. The upper slice lip 122 has a hinged connection 123 on the forward upper end of the tube assembly 103, and a wall 125 forms a bracing con-
nection extending upwardly from the hinge 123 to a combination upper wall and footwalk 126. The assembly 130 which supports the adjusting screws 131 for the upper slice lip is mounted on the wall 125 for adjustment by means of the jacks 132.

FIG. 7 shows a fragment of a headbox of the same construction as that in FIGS. 5-6 with the exception that it embodies a cross flow supply header 140 arranged similarly to the headers in FIGS. 1 and 4, in that it is supported on and in reinforcing relation with the tube unit 103 and has a perforate wall 141 common to itself and the supply chamber 102. The headbox construction of FIG. 7 is accordingly particularly well adapted for use as a secondary headbox on a relatively wide paper machine where the additional reinforcing and supporting action provided by the header in combination with the tube unit has advantages in resisting any tendency of the headbox assembly as a whole to sag between its supported ends.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A headbox comprising:
   (a) means defining a chamber connected to extend transversely of a papermaking machine,
   (b) a stock supply header,
   (c) means interconnecting and providing fluid communication between said chamber and said stock supply header,
   (d) a slice assembly including a pair of slice lips converging toward each other in a direction toward the forming section of said papermaking machine and defining a stock discharge outlet for directing papermaking stock to said forming section,
   (e) a tube assembly unit providing reinforcement for said headbox and inclunding a pair of spaced, relatively thick plates having aligned holes therein and a multiplicity of tubes having their opposite ends received in said holes,
   (f) one of said plates being secured to said chamber with the holes in said plate in communication with said chamber,
   (g) the other of said plates being secured to said slice assembly with the holes in said other of said plates in communication with said stock discharge outlet, and
   (h) a rotor mounted in said chamber adjacent said one of said plates.

2. A headbox comprising:
   (a) means defining a chamber connected to extend transversely of a papermaking machine,
   (b) a stock supply header extending coextensively with said chamber,
   (c) said chamber and said stock supply header having a common perforated wall to place said chamber and said stock supply header in fluid communication.
   (d) a slice assembly including a pair of slice lips converging toward each other in a direction toward the forming section of said papermaking machine, and defining a stock discharge outlet for directing papermaking stock to said forming section,
   (e) means defining a plurality of relatively small passages extending from said chamber to said discharge outlet,
   (f) said passages defining means and said stock supply header extending transversely of said papermaking machine in contiguous and reinforcing relationship to each other, and
   (g) a rotor mounted in said chamber adjacent said passage defining means.

3. A headbox as defined in claim 2 wherein said passage defining means comprises a plurality of separate tubes secured together over at least the major portion of their length to define a generally honeycomb structure.

4. A headbox as defined in claim 2 wherein said passage defining means comprises a solid block of material having a plurality of openings formed therein.

5. A headbox as defined in claim 2 wherein the end of said tube defining means connected to said chamber is curved to form a surface generally parallel to the periphery of said rotor.

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