

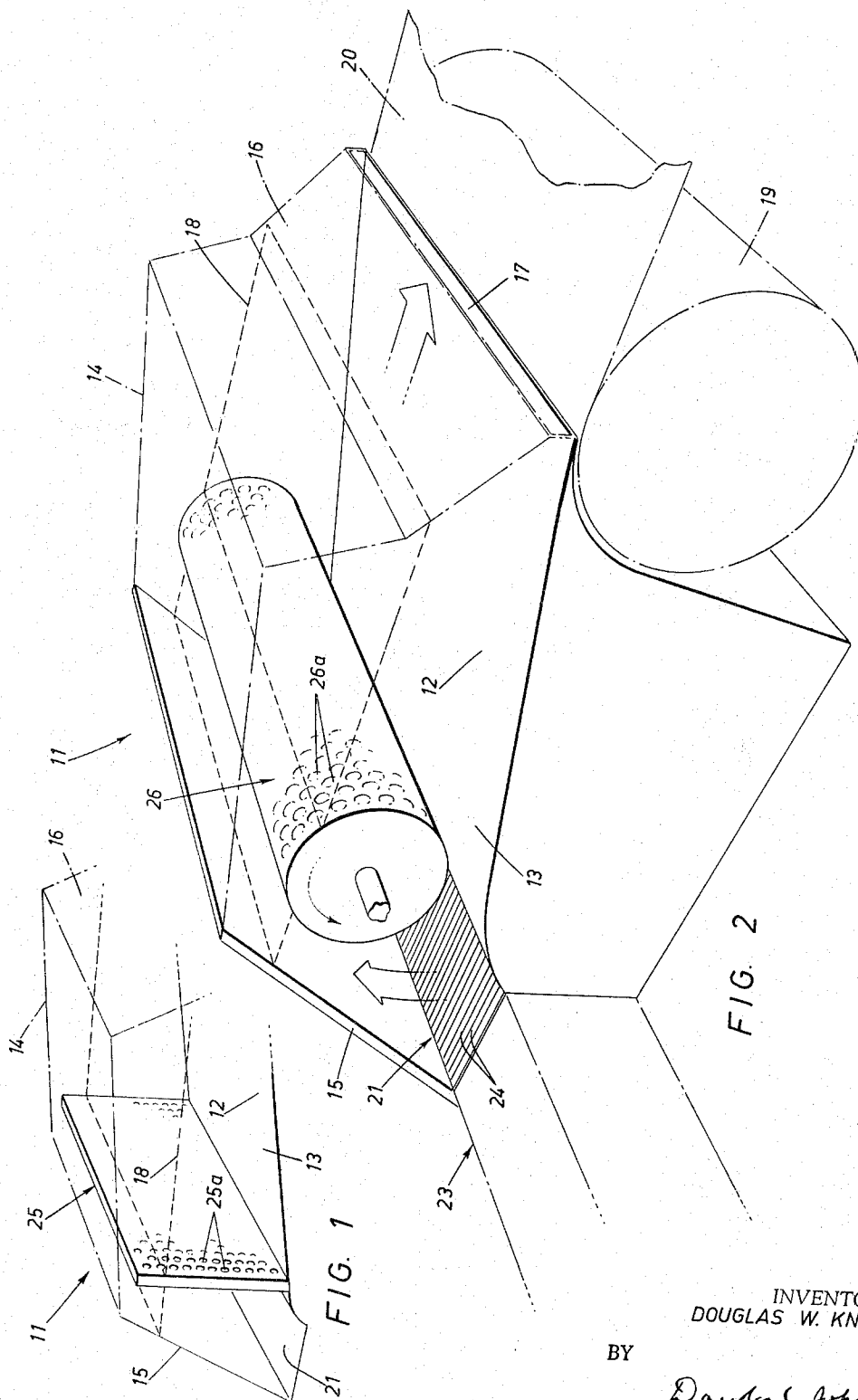
April 25, 1967

Filed Sept. 29, 1964

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FLUID FLOW DISTRIBUTION DEVICE IN A SIDE  
ENTRY INLET HEADBOX FOR PAPERMAKING

3,316,144

2 Sheets-Sheet 1



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1

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## FLUID FLOW DISTRIBUTION DEVICE IN A SIDE ENTRY INLET HEADBOX FOR PAPERMAKING

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Filed Sept. 29, 1964, Ser. No. 400,262

Claims priority, application Canada, July 21, 1964, 907,661

2 Claims. (Cl. 162—343)

This invention relates to fluid flow distribution devices and, in particular, to an improved stock inlet or head box positioned adjacent to the wire of a paper making machine. In a stock inlet for a paper machine the slice or outlet to flow the stock on to the forming surface of the machine in a form of a sheet having even thickness across the width of the surface of the sheet of stock should be free from secondary flows which will deviate from the desired directional flow relationship with the movement of the forming surface.

Various attempts have been made in the past to obtain uniform distribution of the stock to the head box, the most successful to date being that described in U.S. Patent 2,929,449, in which a rotating or stationary vessel having an inlet and outlet, together with perforations along its length which communicate with the head box, is provided with an internal wall compartment operated to progressively restrict the diameter of its flow along its length to keep the pressure of the feed through the perforations relatively constant. While this arrangement has been successful in achieving an even feed stock to the head box which communicates with the slice, problems of flocculation and secondary flow have occurred in the stock in the head box which have reduced considerably the effect of uniform distribution achieved by the arrangement already described in U.S. Patent 2,929,449.

The problems of obtaining uniformity of flow in the head box are particularly difficult to solve with medium or low speed paper machines as compared with high speed paper machines because the latter may accelerate stock to almost 30 times the velocity whereas in a slow speed machine the acceleration ratio is only about 5 or 6. It is recognised that the slice acceleration has a strong stabilizing effect on any flow irregularities approaching the jet but on the slow machines this effect is much less pronounced. Furthermore, in high speed machines variations in the level of the stock supply system have little effect, but with low speed machines having a total slice head of 20 to 30 inches the detrimental effects are considerably magnified.

The type of paper product, of course, has an influence on the consistency of the stock and since moderate speed machines are used for fine papers with a stock which has clay and certain other materials added, it has been the practice to use baffles in the head box to produce uniformity. Unfortunately, the mixing action to ensure good dispersion of clays also creates a problem of high flocculation with the result that a relatively coarse grain is produced in the sheet. The mixing action, of course, is the result of the secondary flows generated in the passes by the flow of stock cornering under the baffle, but this results in a series of boils in the pond which is evidence of secondary flows. Furthermore, a floc forming tendency is also noted in the dead zones caused by a flow break-away in certain regions of the baffle.

It is an object of the invention to provide a head box which assures uniformity of flow to the slice and the elimination of flocculation of the stock.

FIGURE 1 is a diagrammatic representation of one embodiment of the invention;

FIGURE 2 is a diagrammatic representation of another embodiment of the invention;

2

FIGURE 3 is a diagrammatic representation of a further embodiment of the invention;

FIGURE 4 is a cross section taken on the lines 4—4 in FIGURE 3;

FIGURE 5 is an enlargement of the cross section of the preferred shape of the grid illustrated in FIGURE 4.

As shown in the embodiment of the invention and as illustrated more particularly in FIGURES 1 and 2, the head box, generally denoted by the numeral 11, comprises a bottom wall or floor 12, opposed side walls 13 and 14, a back wall 15 and a front wall 16. The forward end of the floor 12 with the lower part of the opposed side walls 13 and 14 and the lower part of the front wall 16 form an outlet or slice 17 which extends the width of the floor 12, the slice 17 being below the surface 18 of the stock in the head box 11. A breast roll 19 is positioned adjacent the slice 17 to support the forming wire platform 20.

The floor 12 is secured to the back wall 15 by a perforate wall 21 which extends across the width of the floor 12. The perforate wall 21 communicates with the outlet 22 of a stock supply vessel, generally denoted by the numeral 23, which is preferably of the type described in U.S. Patent 2,929,449, in which case the perforations in the wall 21 may be of the type described in that patent. However, in the preferred embodiment shown in FIGURES 1, 2 and 3 of the invention the perforations are provided by series of spaced apart grids 24 secured in position through attachment of their corresponding ends to the floor 12 and the back wall 15, the grids 24 being orientated in planes parallel to the sides 13 and 14 of the box 11; by way of example and not by way of limitation the spacing between each grid 24 is about  $\frac{3}{16}$ ". Also preferably as illustrated in FIGURE 4 the lower edge of each of the grids 24 is tapered upwardly in the direction of flow of the stock in the stock supply vessel 23, the angle of the taper being between 10 and 20°. With this construction it has been found that a stable flow behaviour is developed over a wide flow range and fibre stapling is avoided because the stock supply flow sweeps across the nose of each of the grids 24.

The direction of flow in the stock supply vessel 23 is turned upward by the grids 24 into the head box 11, after which it is again turned in the direction towards the slice 17. It is a particular feature of the invention that this last change of direction is effected, as shown in FIGURE 1, by sloping the back wall 15 upwards in a direction toward the front wall 16; furthermore, a second perforate wall 25 is secured to the floor 12 of the head box 11 adjacent the forward end of the perforate wall 21, the second perforate wall 25 extending above the surface 18 of the stock in the head box 11. By way of example and not by way of limitation the perforations 25a in the second perforate wall 25 constitute about 50% of the wall surface area. The sloping back wall 15 and the second perforate wall 25 provide a tapered up-pass which spreads the stock vertically throughout the depth of the pond in the head box 11.

In a further embodiment of the invention shown in FIGURE 2, a hollow roll 26 is substituted for the second perforate vertical wall 25, the surface of the roll 26 being provided with evenly spaced perforations 26a to provide for flow of the stock through the roll 26 towards the slice 17. Again by way of example and not by way of limitation the perforations 26a in the roll 26 constitute about 50% of the surface area. The combination of the sloping back wall 15, the perforate hollow roll 26 provide a restricted up-pass in the head box 11 for spreading the stock vertically throughout the depth of the pond. As illustrated in FIGURE 3 provision is made to rotate the perforate roll 26 in a direction counter to that of the direction of the flow of stock upwards through the grids

3 and the resistances provided by the perforate roll 26 and the grid 24 ensures stability which is further helped acceleration of the stock in the pond due to rotation of the perforate roll 26. The sloping back wall 15 also acts to prevent settlement of the fines and the shear created in the pond also inhibits flocculation.

In the further embodiment illustrated in FIGURE 3 the perforate roll 26 is mounted in eccentrics so that its position relative to the floor 12 and the sloping back wall 15 can be adjusted. Hence, as the roll 26 is moved forward the sloping back wall 15 more stock is forced through the bottom of the roll 26 and as the roll 26 is moved away from the end wall 15 more flow to the top of the pond is achieved. Furthermore, the gap between the perforate roll 26 and the floor 12 may be increased with the result that a gush of stock under the roll 26 can be created to prevent the settlement of fines.

It is a further feature of the head box 11 that the floor 2 slopes upwardly towards the slice 17 in relation to the surface 18 of the stock in the head box 11. This provides a second taper or restriction with respect to the flow and the stock is uniformly and suitably spread both across the machine and throughout the depth of the head box 11 with the avoidance of dead zones.

In the embodiment illustrated in FIGURE 1 the top of the head box 11 is open, but as illustrated in FIGURE 3, a top wall 28 may be provided to close the head box 11 and permit the introduction of air pressure through a suitable device, generally denoted by the numeral 29, located in the top wall 28. This provides a means for accelerating the stock so that the head box 11 can be used for high speed machines; on the application of sufficient pressure the speed of the stock leaving the slice 17 will correspond with the speed of travel of the wire 20 co-operating with the slice 17. The application of pressure through the top wall 28 also assists in stopping surges of the stock in the box 11 as well as permitting increases in static head on small machines to permit them to operate successfully at a high speed.

While certain embodiments have been illustrated and described for the purpose of disclosure, it will be understood that the invention is not limited thereto, but contemplates such modifications and other embodiments as may be utilized without departing from the invention.

I claim:

1. In a side entry tapered manifold stock inlet to a headbox, a distributor plate comprising a series of grids positioned transversely of the elongated entry connecting the stock inlet to the headbox and positioned in planes substantially parallel with the opposed side walls of the headbox, the lower edge of each said grid being tapered upward, in a direction substantially parallel to the flow of stock thereby when in operation.

2. In a side entry tapered manifold inlet to a headbox, a distributor plate comprising a series of grids positioned transversely of the elongated entry connecting the stock inlet to the headbox and positioned in planes substantially parallel with the opposed side walls of the headbox, the lower edge of each said grids being tapered upward at an angle between 10 degrees and 20 degrees.

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