Feb. 5, 1946. L. J. BOETTINGER 2,394,509

HEAD BOX SLICE FOR PAPER MAKING MACHINES

Filed May 3, 1943 2 Sheets-Sheet 1

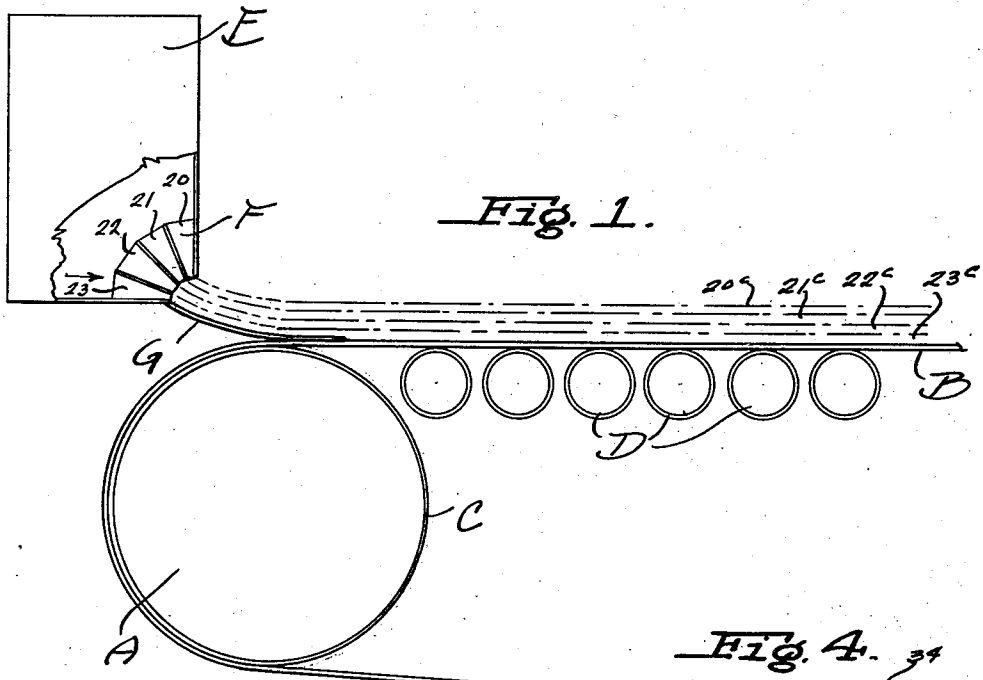


Fig. 1.

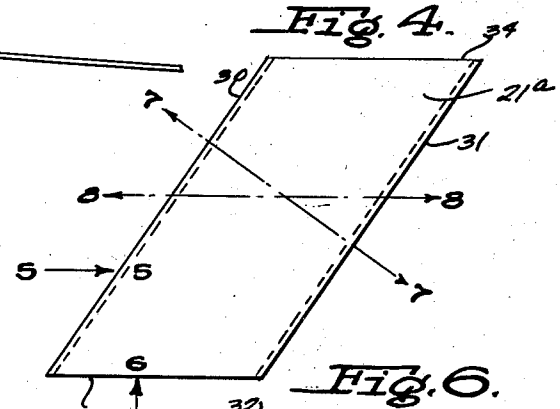


Fig. 4.

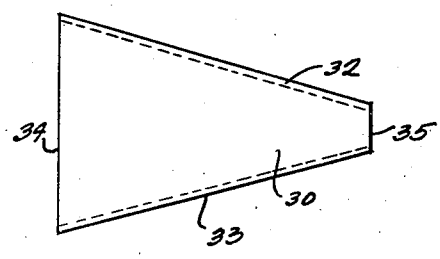


Fig. 5.

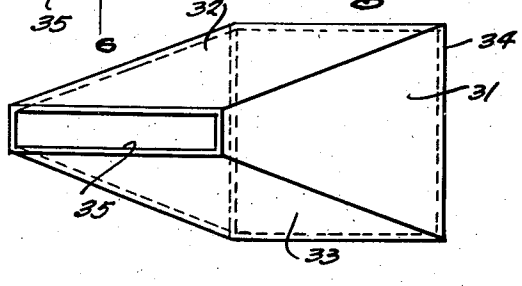


Fig. 6.

INVENTOR.
Leo J. Boettinger.

BY Lemmon, Allmon & Lemmon
ATTORNEYS.

Feb. 5, 1946. L. J. BOETTINGER 2,394,509

HEAD BOX SLICE FOR PAPER MAKING MACHINES

Filed May 3, 1943 2 Sheets-Sheet 2

Fig. 2.

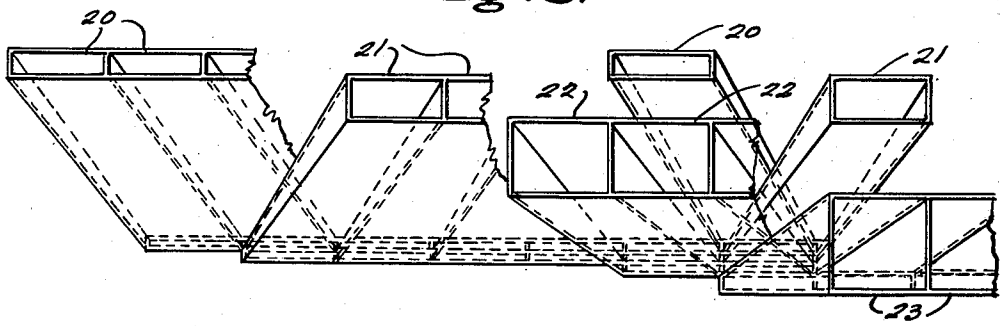


Fig. 3.

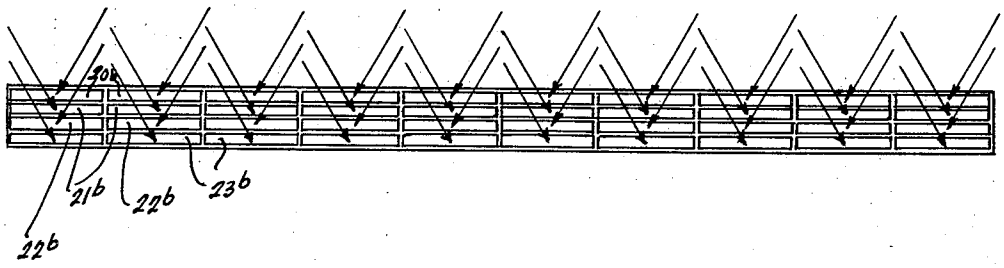


Fig. 7.

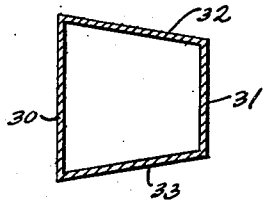


Fig. 8.

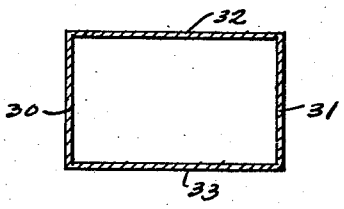
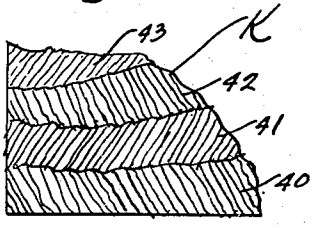


Fig. 9.



INVENTOR.
Leo J. Boettinger.
BY Lancaster, Allwine and Rommel
ATTORNEYS.

Patented Feb. 5, 1946

2,394,509

UNITED STATES PATENT OFFICE

2,394,509

HEAD BOX SLICE FOR PAPERMAKING MACHINES

Leo J. Boettinger, Sartell, Minn.

Application May 3, 1943, Serial No. 485,509

4 Claims. (Cl. 92—44)

This invention relates to improvements in means for selectively controlling and regulating the flow of paper stock to the table wire of a paper machine.

A further object of this invention is the provision of means for controlling the flow of paper stock in a paper machine so as to produce increased tear strength (in the resultant paper) in the direction of stock flow.

A further object of this invention is the provision of improved means for flowing paper stock onto the table wire of a paper machine, such as a Fourdrinier paper machine in controlled layers with the fibres of the layers arranged in acute angular relation to each other.

A further object of this invention is the provision of an improved slice for the head boxes for Fourdrinier paper making machines.

A further object of this invention is the provision of an improved method for paper stock flow onto the breast roll of paper making machines, such as a Fourdrinier machine.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts thruout the several views,

Figure 1 is a rather diagrammatic fragmentary side elevation of the head stock end of a Fourdrinier paper making machine, showing an improved slice.

Figure 2 is a fragmentary perspective view showing the arrangement of ducts of the improved slice; the view being taken looking in the direction of the arrows shown in Figure 1 of the drawings.

Figure 3 is a diagrammatic view showing the stock outlet end of the improved slice; the arrows shown in the view designating the direction of flow of the paper stock to the outlet ends of the various ducts of the improved slice.

Figure 4 is a plan view of one of the improved ducts.

Figure 5 is a side elevation of one of the ducts; the view being taken substantially looking in the direction of the line 5—5 shown in Figure 4 of the drawings.

Figure 6 is another view of the improved duct; the view showing the duct in perspective looking in the direction of the line 6—6 shown in Figure 4 of the drawings.

Figures 7 and 8 are cross sectional views taken thru the duct substantially on their respective lines shown in Figure 4 of the drawings.

Figure 9 is a fragmentary view of paper formed upon the improved machine showing the manner in which the fibres will lie in acute angular relation to each other in the different layers of the paper.

In the drawings, wherein for the purpose of illustration is shown only a preferred embodiment of the invention, the letter A may generally designate a paper making machine, preferably of the Fourdrinier type. It includes a table wire B of the endless belt type supported at one end upon a breast roll C and along the length of its top flight by means of the usual table rolls D. A head box E having an improved slice or nozzle construction F is provided for feeding the paper stock onto the apron G, from whence it flows in the usual manner onto the table wire B.

The broad principle of the improved slice F is the provision of a plurality of ducts at different levels adapted to receive the paper stock and direct its flow so that the fibres of the paper stock at different levels are obliquely arranged. This produces paper having a longitudinal tear strength equal to the transverse tear strength thereof.

For the accomplishment of the above, I provide a first series of ducts 20 at one level; a second series of ducts 21 therebelow at another level; a third series of ducts 22 at another level therebelow, and a fourth series of ducts 23 at another level therebelow. It will be noted that the slice F as shown in Figure 1 is so positioned that these ducts in cross section in a vertical plane are arranged in the form of a fan with the nozzle or outlet ends of the ducts 20 uppermost. The ducts 20, 21, 22 and 23 are all of the same general form but the passageways of the ducts 21 and 23 are arranged in flow lines in acute angled relation with respect to the flow lines of the other series of ducts 20 and 22, as can clearly be seen from Figures 2 and 3 of the drawings.

The wall construction for the formation of the ducts is important only insofar as the ducts shall have passageways of the construction shown in the drawings. The same partition walls may be used for adjacent ducts, and as before mentioned such is unimportant except that with such an arrangement conservation of space is provided. Therefore, no further reference will be made to the wall construction except to define the individual construction of each of the ducts. In Figures 4, 5, 6, 7 and 8 is shown a typical duct, which may be designated as 21^a. It consists of

parallel side walls 30 and 31 and upper and lower complementary walls 32 and 33 disposed in convergent relation from the entrance opening 34 of the duct passageway to the duct outlet opening 35. The walls 32 and 33 are of course preferably disposed in equi-angular relation with respect to the center plane of the passageway of the duct. This arrangement of the walls 30—33 provides a wedge-shaped passageway measured longitudinally of the duct. The duct is obliquely formed, with the planes of the entrance and discharge openings in parallel relation, but in obtuse angular relation with respect to the center line of the duct passageway between the walls 30 and 31, as shown in Figure 4. Thus, the duct construction may be appropriately termed, as to the shape of the passageway, a truncated oblique wedge.

The number of layers of stock fibres fed by the slice will suit different conditions. However, in the drawings it is shown that four of the series of the ducts are provided; the uppermost and the third series of ducts having their flow lines in the same direction, which of course is oblique to the line of movement of the table wire B. The flow lines of the second and fourth series are also oblique to the travel of the table wire B, but in lines in acute angled relation with respect to the flow lines of the passageways of the series of ducts 20 and 22, as is clearly shown in Figures 2 and 3 of the drawings. It will thus be seen that the fibres of the paper stock are deposited upon the breast roll and ultimately upon the table wire in superposed layers with the fibres of the paper stock of the uppermost and third layers acuately arranged to the fibres of the second and fourth layers. This produces paper, as shown at K in Figure 9 of the drawings where the lines 40 may designate the fibres which are produced in the paper by the paper stock flowing thru the ducts 23; the lines 41 designate the fibres from the paper stock flowing thru the ducts 22; the lines 42 designate the fibres of the paper stock flowing thru the ducts 21 and the lines 43 designate the fibres of the paper stock flowing from the ducts 20. Of course the paper K is not actually formed of superposed divisible layers, as shown in Figure 9, but the fibres in the sheet of paper are arranged in this general nature, altho the layers are bonded together as will be well understood by those skilled in the art to which this invention relates.

Referring to Figure 3 of the drawings, the numerals 20^b designate the stock outlet openings for the ducts 20; 21^b designating the stock outlet openings for the passageways of the ducts 21; 22^b designating the stock outlet openings for the passageways of the ducts 22; and, 23^b designating the stock outlet openings for the passageways of the ducts 23. It will be noted that the series of outlet openings 20^b are uppermost. These duct passageways will deposit fibres in the upper layer of the paper stock traveling on the breast roll and table wire; the numerals 20^c, 21^c, 22^c and 23^c, designated in Figure 1 of the drawings, representing the different layers of the paper stock as deposited upon the table wire by the series of duct outlet openings 20^b, 21^b, 22^b and 23^b respectively. The arrows shown in Figure 3 designate the direction of flow of the paper stock thru the ducts towards the duct outlet openings, and it will be noted that travel of paper stock in the ducts having outlet openings 20^b and 22^b is in the same direction. The travel of paper stock thru passageways of the ducts having outlet openings 21^b and 23^b is in acute angled relation to the travel of the stock in the ducts 20^b and 22^b aforesaid. It will be noted that the ducts are arranged in oblique relation to the line of travel of the paper stock belt.

Due to the truncated oblique wedge formation of the passageways of each of the ducts, the speed of the stock is accelerated from the inlet end of each duct towards the outlet end, due to the restriction of the stock flow towards the outlet end. There is not any lateral restriction and this causes the fibres suspended in the stock to arrange themselves parallel to the line of flow and thus producing the superposed angular fibre arrangement in the different layers of the paper stock, as designated in the above description and in the drawings.

In order to provide a uniform longitudinal tear coefficient, it is preferred to provide an "even" number of series of ducts, that is, an "even" number of layers of the paper stock fed by the slice to the breast roll, altho an "uneven" number of such layers may be provided if found desirable.

Various changes in the shape, size and arrangement of parts of the invention, and in the formation of duct design and in the steps of the method of controlling the flow of the fibres may be made to the invention as herein shown and described, without departing from the spirit of the invention or the scope of the claims.

I claim:

1. In a head box construction for paper making machines the combination of a head box, a slice in the lower longitudinal corner of the head box comprising a plurality of superposed series of ducts in fan-shaped relation transversely of the head box, the adjacent series of said ducts having the passageways thereof disposed in non-parallel relation so that the flow of the paper stock from the outlet ends thereof will deposit the paper stock in layers upon the table wire with the fibres in intersecting angular relation.

2. In a head box construction for paper making machines the combination of a head box body having a slice opening therein, and a slice construction at said opening comprising a plurality of separate layers of ducts, the ducts of adjacent layers being provided with passageways disposed in non-parallel relation so that the flow of paper stock from the outlet ends thereof will deposit the paper stock in layers upon the table wire with the fibres in intersecting angular relation, said ducts in depth tapering restrictingly from the inlet ends thereof to the outlet ends thereof at the slice opening of said box whereby to effect gradual increase in velocity of the paper stock from the said inlets of the ducts to the outlet ends thereof.

3. In a head box construction for paper making machines the combination of a head box, a slice in the head box comprising a plurality of superposed series of slices, said slices being formed to provide passageways therethru of substantially truncated oblique wedge-shaped formation and the slices of one series being disposed in crossed angular relation with respect to the run of the passageways of the other series so that the paper stock will flow with gradually increasing velocity thru said passageways and be disposed in superposed layers at feeding points upon a table wire with the fibres of the paper stock of one layer disposed in non-parallel relation with respect to the fibres of the adjacent layers.

4. In a head box construction for paper mak-

ing machines the combination of a head box, a slice in the head box comprising a plurality of superposed series of ducts, the ducts of each of the series comprising parallel side walls, convergently disposed top and bottom walls arranged with the convergence from the inlet end to the outlet end of said ducts, the outlet and inlet ends of the ducts being arranged in parallel planes in oblique angled relation with respect to the longitudinal center line of the duct passageway, said side, top and bottom walls defining a flow passageway therethru from the inlet end towards the outlet end of substantially truncated wedge-shaped formation, the ducts of one series being disposed in non-parallel relation with respect to the ducts of the other series whereby to deposit superposed layers of paper stock the fibres of which are in non-parallel relation.

LEO J. BOETTINGER.