ABSTRACT OF THE DISCLOSURE

A stock supply and distribution system for the headbox or stock inlet box of a papermaking machine including a stock supply header which extends and which is internally compartmentalized across the width of the headbox, and plural groups of narrow risers which communicate respectively the various compartments of the stock supply header with the stock inlet box. A block valve is provided for selectively shutting off flow through any of the groups of risers thereby reducing the total stock flow rate while maintaining a substantially constant rate of flow through the opening flowing compartments and risers.

BACKGROUND OF THE INVENTION

This invention relates generally to the field of papermaking machines and more particularly to a supply and distribution system for delivering stock to the inlet box or headbox of a papermaking machine.

Those skilled in the art of papermaking machines have long sought improved methods of and means for supplying the stock to the stock inlet box or headbox of a papermaking machine. The main reason for such continued investigations resides in the necessity in providing an even distribution of stock fibers across the entire width of the forming surface of the papermaking machine to provide the uniform gas weight profile essential in the production of quality paper.

Many stock supply apparatus intended to provide an improved distribution of stock fibers are known in the prior art. While many of these known arrangements are satisfactory in many respects, all have the disadvantage of providing a substantially even distribution of the stock fibers across a rather narrow range of stock flow rate.

Accordingly, the improved distribution of stock fibers in known arrangements is sharply reduced as the stock flow rate is reduced (or increased) from a given flow rate. On the other hand, the stock flow rate must be varied as the production speed of the papermaking machine varies and since the range of stock flow rate in which satisfactorily even distribution of stock fibers is limited the range of production rates of papermaking machines is likewise limited.

The limited range of satisfactory stock flow rates is due in part to the necessity of maintaining the velocity of the stock in the various passages of the stock supply and distribution system within limited ranges in order to provide the large and small scale stock turbulences necessary in maintaining an even distribution of the stock fibers. Generally a stock supply and distribution system is constructed so as to provide the requisite stock velocities at a given total rate of stock flow. As the total stock flow rate is varied (in order to provide for different production rates or to accommodate the manufacture of different types or qualities of paper) the velocity of the stock in the supply and distribution system varies accordingly and the turbulences generated in the stock as the stock flow rate is varied may not be suitable for providing an even distribution of the stock fibers across the entire width of the papermaking machine.

In view of the foregoing it is an object of the present invention to provide a stock supply and distribution system for a papermaking machine the stock flow rate of which can be adjusted over a rather wide range while maintaining a suitably even distribution of stock fibers across the entire width of the papermaking machine.

To that end the present invention may be summarized as comprising a stock header extending across the width of the inlet box or headbox of the papermaking machine and a plurality of groups of small pipes or risers extending upwardly from the header to the stock inlet box. The interior of the stock header is partitioned to form a plurality of compartments and each group of risers communicates with only one of the compartments. Each of the compartments can be individually and selectively opened or closed with respect to the source of stock, as a consequence of which the total flow rate of the stock to the stock inlet box can be varied considerably while maintaining a substantially constant velocity of the stock through the compartments of the stock header and the risers connected thereto.

As a result of this substantial uniformity of velocity, the large and small scale turbulences established by the supply and distribution system remain substantially uniform across a much greater range of total stock flow rate than is available in known arrangements.

Another object of the invention is to provide a simple and easily operated arrangement for selectively rendering each of the header compartments and the risers connected thereto operative and inoperative. To this end the invention features a relatively narrow throat through which the stock flows into the main chamber of the inlet box and to which the risers are connected and an adjustable valve block in the throat for covering and uncovering the open ends of the risers.

Hereinbefore the stock flow rate could be reduced to no more than about one half the optimum flow rate while maintaining a suitably even distribution of stock fibers across the width of the papermaking machine. By virtue of the present invention, however, stock flow rates can be reduced to one quarter of the normal flow rate and even less while maintaining a satisfactory distribution of stock fibers. The operation of the papermaking machine is therefore much more flexible and the production rates which can be accommodated by the machine and the various types of paper which may be manufactured by the machine are widened and increased substantially.

Other features of the invention include the alignment of the risers in spaced groups each of which extends the entire width of the papermaking machine. The top and bottom walls of the relatively narrow throat with which the upper ends of the risers communicate extend in parallel relation to one another and in perpendicular relation to the risers. The supply conduit which supplies the pressurized stock to the header includes a straight run immediately upstream of the header whilst the header itself is tapered in a downstream direction.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example only.

FIG. 1 is a vertical cross-sectional view of the stock supply and of a Fourdrinier machine constructed in accordance with the principles of the present invention.
FIG. 2 is an enlarged view of the stock supply and distribution system taken along lines II—II of FIG. 1. FIG. 3 is a view taken along lines III—III of FIG. 2. FIG. 4 is an enlarged sectional view of the stock inlet header and the risers extending upwardly therefrom as shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Indicated generally at reference numeral 10 is the stock supply end of a papermaking machine which comprises a stock supply conduit 11 and a stock inlet box or headbox 12. A relatively narrow throat 15 of the inlet box 12 communicates with the conduit 11 by means of a distribution or stock supply header 13 mounting an array of relatively small diameter, transversely closely spaced and generally upright risers or tubes 14. The risers 14 which, in the embodiment illustrated, are of uniform diameter and length, provide a relatively high velocity stock flow to the throat 15 wherein a velocity reduction is effected by the deceleration of the stock into a main chamber 16 of the inlet box 12 through a deceleration conduit 17.

The inlet box 12 may be more particularly characterized as comprising a generally horizontal floor 18 suitably mounted on a rear supporting frame 19a and a front supporting frame 19b, both of which are mounted on a supporting surface 20. The inlet box 12 further comprises an upright rear wall 20a, a pair of side walls as at 20b and a forward wall 20c carrying a slice-defining element 20d cooperating with an apron 18a carried by the floor 18 to define an outlet slice gate, from which stock flows onto a travelling forming wire W which is trained around a breast roll B.

The inlet box 12 is further provided with a plurality of rectifier rolls, two of which are indicated at 21a as being positioned in close running relationship with the floor 18 and a wall member 20b of the front wall 20c so as to be situated in the path of the stock as it flows to a slice opening S. Another rectifier roll indicated at reference numeral 21b is disposed generally centrally within the inlet box 12 and in close running relationship with the floor 18.

The inlet box 12 is also provided with a bottom opening 22 which communicates the deceleration conduit 17 with the main chamber 16 and in close running relationship with which there is another rectifier roll 21c.

The stock is delivered to the inlet box 12 from a pump indicated schematically in FIG. 2 at reference character P. In the preferred embodiment the pump P delivers the stock under pressure to a surge tank 22 having a closed air dome disposed at the upper end thereof. The stock is then directed from the surge tank 22 to the header 13 through the conduit 11.

The risers 14 are arranged in rows along the entire length of the header 13. The risers in each row are spaced from one another and are arranged in parallel relation with respect to one another in the direction of the center line of the papermaking machine, that is, in a direction normal to the axis of the breast roll B.

In the embodiment illustrated the header 13 is rectangularly shaped in vertical cross-section and comprises a wall 23 which is disposed in spaced parallel relation to wall members 26 and 27 which form in part the relatively narrow throat 15, and a bottom wall 24 which slopes toward top wall 23. The header 13 also comprises a pair of side walls 28 and 29 which extend in spaced parallel relation to one another and in transverse relation with the top wall 23.

In prior art arrangements the rate of flow of stock to the inlet box 12 is generally varied by varying the speed of the pump P or by adjusting stock flow valves disposed in the stock conduit on the discharge side of the pump P.

The effect of this variation in stock flow rate is a corresponding variation in the velocity of the stock in the various flow passageways which deliver the stock to the inlet box 12. Since the stock velocity cannot be varied substantially from an optimum level without producing an unsatisfactory unevenness in the distribution of the stock fibers the degree of variation in stock flow rate in prior art devices is quite limited.

In accordance with the principles of the present invention, the stock flow rate may be varied over a considerable range without producing an unsuitable unevenness in the distribution of the stock fibers. This is accomplished by providing means for maintaining the velocity of the stock at a substantially constant or uniform level regardless of variations in the stock flow rate.

To this end the header 13 is provided with an inner wall 30 which partitions the interior into a pair of separate compartments 31 and 32 which extend the entire length of the header 13. The volumes of the respective compartments 31 and 32 correspond with one another in proportion to the volumes of the risers 14 with which they respectively communicate.

In the illustrated embodiment the risers 14 are all of the same inner diameter and are of the same length, and since each of the compartments 31 and 32 communicates with an equal number of risers 14 the compartments are themselves equal in volume.

Slidably disposed within the throat 15 is a block valve 33 which extends across the entire width of the inlet box 12 and which may be slidably adjusted in a direction parallel to the center line of the papermaking machine and perpendicular to the back wall 20a of the inlet box 12 by means of adjustment rods 34 which extend through a back wall 36 of the throat 15 and on which are mounted adjustment knob 37. The block valve 33 comprises front and back walls 33a and 33b which are disposed in perpendicular relation to the throat walls 26 and 27 as well as to parallel axes of the risers 14.

In adjusting the flow rate of the stock to the inlet box 12 the block valve 33 may be moved from the position thereof as shown in FIG. 1, at which position the upper ends of all of the risers 14 are uncovered, to a position thereof as shown in FIG. 4, at which position the upper ends of the risers of two rows indicated at 38 and 39 are covered or blocked off. The upper ends of the risers 14 in two other rows indicated at 40 and 41 are uncovered and thus the flow rate of the supply stock is substantially reduced.

If the pump P is operated at the same speed as the block valve 33 is moved from the FIG. 1 to the FIG. 2 position, the velocity of the stock in compartment 32 as well as in the two rows of risers 40 and 41 may be slightly increased even though compartment 31 is rendered inoperative. By suitable reduction in pump speed, however, the stock velocity in compartment 32 as well as in the risers 14 communicating therewith can be maintained at a constant volume regardless of whether the block valve 33 is positioned so as to render the compartments 31 operative or inoperative.

The conduit 11 of the preferred embodiment comprises a section 42 immediately upstream of the header 13 which has a uniform cross-sectional area along the entire length thereof. Adjacent the straight section 42 are a pair of transition sections 43a and 43b which are tapered in an upstream direction and which connect respectively with pipes 44a and 44b leading from the surge tank 22. One of the pipes 44a and 44b is provided with an adjustable stock flow valve as indicated at 46 for controlling the flow of stock to its corresponding one of compartments 31 and 32.

The interior of the header 13 may be divided into more than two compartments. For example, in the embodiment of the invention illustrated herein there are included four rows of risers 14. The header 13 may be divided into four compartments, rather than two, corresponding with the
four rows of risers 14. Thus, the stock flow could be reduced by approximately 25% as each of the four compartments was rendered inoperative.

It will also be understood that the risers 14 may be arranged in patterns and groups different from the pattern disclosed in the illustrated embodiment and that the header 13 may be partitioned in other manners to accommodate such different riser patterns. Regardless of the riser pattern, however, the arrangement must be such as to provide the necessary uniform basis weight profile and small and large scale turbulence across the entire width of the papermaking machine regardless of the fraction of the total number of groups of risers which are operative.

Although minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably come within the scope of my contribution to the art.

What I claim is:

1. A headbox assembly for a papermaking machine comprising:
   a stock headbox,
   a first stock header means extending across the machine the full width of the headbox and having conduits feeding into the headbox,
   a second stock header means extending across the machine the full width of the headbox and having conduits feeding into the headbox,
   said conduits being spaced and sized to provide substantially uniform flow of stock into said headbox across the width thereof,
   valve means for shutting off flow through one of said header means and its conduits to increase the flow through the remaining header means,
   and stock supply means connected to said header means so that the flow through said remaining header means will increase as said one header means is shut off.

2. A headbox assembly for a papermaking machine in accordance with claim 1 wherein the header means are constructed and arranged as a single header construction and the first and second header means are formed by a wall means internally dividing the header into first and second longitudinally extending compartments.

3. A headbox assembly for a papermaking machine in accordance with claim 1 wherein said valve means is connected to the conduits for one of said header means so that the stock flow is shut off at the conduits.

4. A headbox assembly in accordance with claim 1 wherein said conduits are constructed and arranged to discharge through a wall into the headbox and said valve means includes an elongate block valve arranged to block the conduits from said one header means at said wall.

5. A headbox assembly for a papermaking machine in accordance with claim 2 wherein the header construction is tapered from one end to the opposite end and the stock supply means is connected to the wider end of the header construction.

6. A headbox assembly for a papermaking machine in accordance with claim 1 wherein the conduits for the second header means are downstream from the conduits for the first header means and said valve means is constructed and arranged for shutting off flow through the first stock header means.

7. A headbox assembly for a papermaking machine in accordance with claim 1 wherein said conduits discharge into a relatively narrow straight throat leading to the headbox and the valve means includes a blocking member within said throat movable across the ends of the conduits for said one header to shut off the discharge end thereof in the throat.

8. A headbox assembly for a papermaking machine in accordance with claim 1 wherein said conduits are constructed as risers leading upwardly into a relatively straight narrow throat leading to the headbox and the valve means is constructed as an elongated block valve arranged to move across the ends of the conduits of said one header to shut off flow thereof into the throat.

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