Jan. 18, 1944. J. W. VEDDER ET AL 2,339,730

PAPER STOCK FLOW VALVE REGULATING MECHANISM

Filed Jan. 20, 1942 2 Sheets-Sheet 1

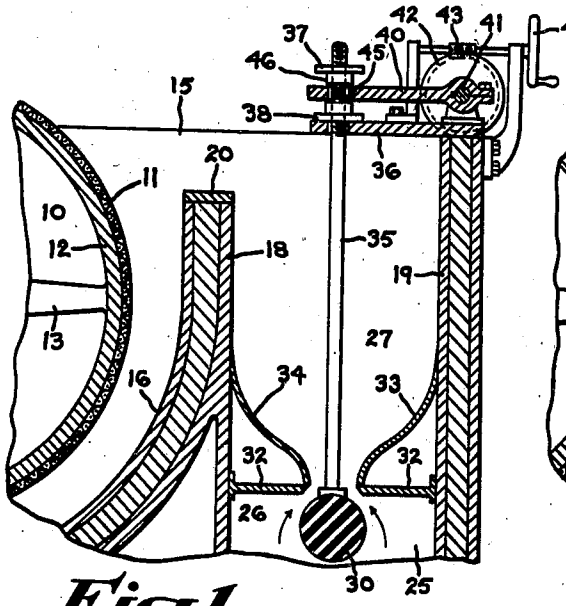


Fig.1

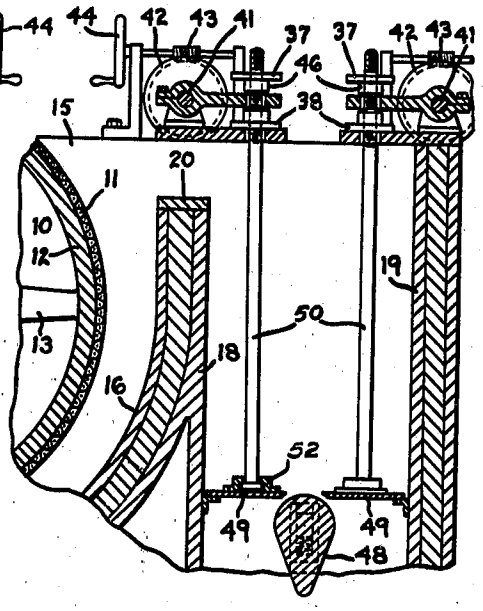


Fig.3

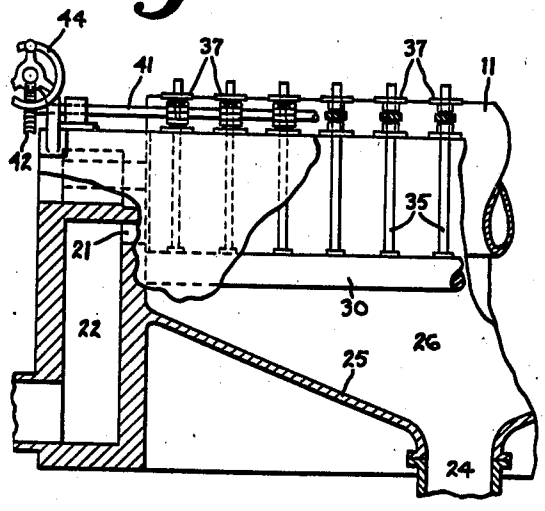


Fig.2

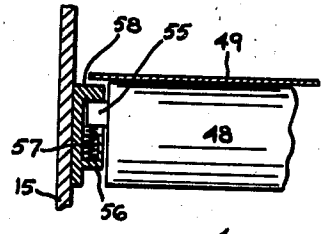


Fig.4

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PAPER STOCK FLOW VALVE REGULATING MECHANISM

Filed Jan. 20, 1942 2 Sheets-Sheet 2

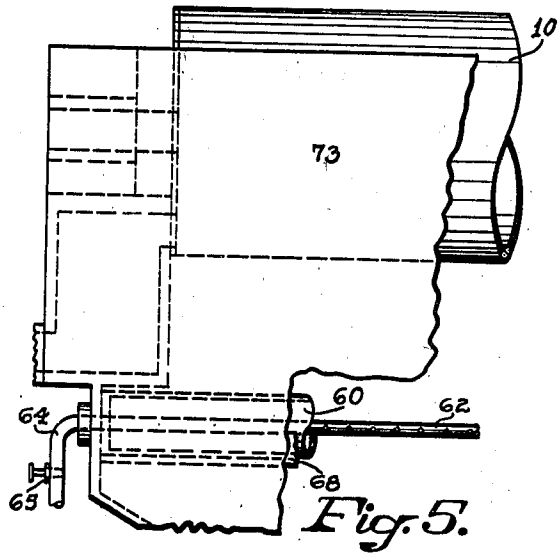


Fig. 5.

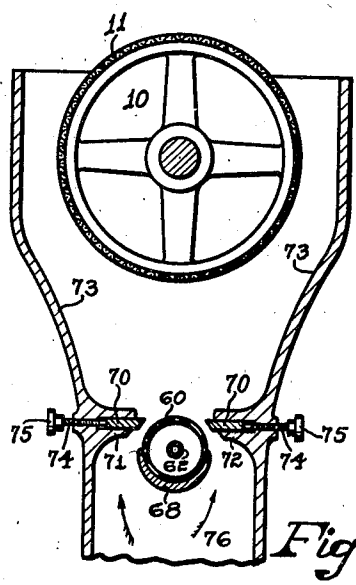


Fig. 6.

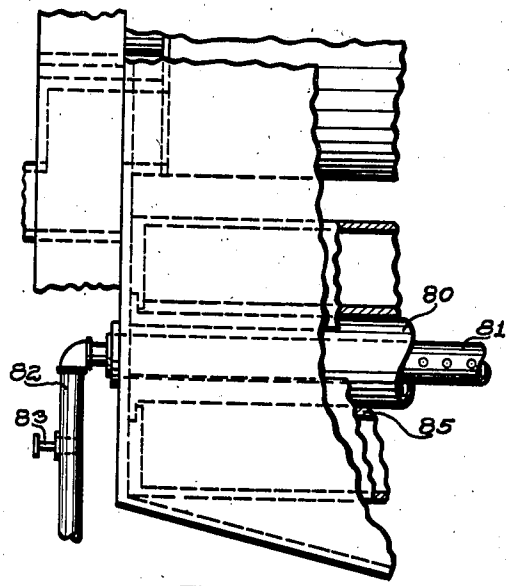


Fig. 7.

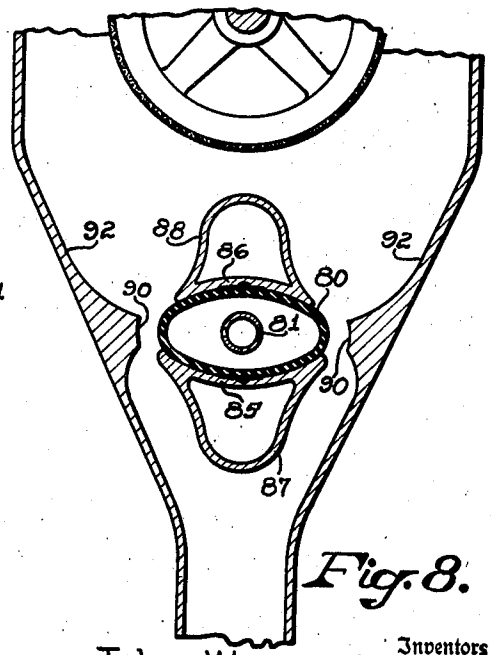


Fig. 8.

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PAPER STOCK FLOW VALVE REGULATING MECHANISM

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10 Claims. (Cl. 92—43)

This invention relates to a stock flow regulating mechanism for a paper making machine and more particularly to regulatable valve mechanism which may be employed both to regulate the quantity, manner and uniformity of stock flow and to provide a local control which can serve to further regulate the thickness of the paper web that is being formed.

The two types of paper making machines to which this invention applies are the Fourdrinier machine, having the pulp stock flowing on to a moving endless wire fabric, and the cylinder mold, having a rotatable cylinder provided with a peripheral wire fabric surface on which the paper web is formed. The flow of stock to each machine may be over a weir or lateral vertical wall, and in the case of the cylinder mold it may pass upwardly from a throat located beneath the cylinder. The paper pulp should be fed toward the moving wire mesh under carefully controlled conditions to promote the formation of a paper web of uniform thickness and required characteristics. It is particularly important that the stock flow smoothly and uniformly throughout the length of the cylinder or the width of the Fourdrinier wire. The velocity of flow of the stock and the shape and location of the inlet pipe may be such as to cause localized conditions resulting in the web being laid on the wire in a non-uniform thickness or with localized thicker or thinner portions. It is, therefore, desirable to provide a valve mechanism or a flow regulating device which may be employed both to control the total amount of stock and the uniformity of delivery of stock passing to the wire and to control the flow of the stock locally, so that if the stock tends to build up too thickly at any given location, the valve mechanism may be regulated to vary or control such conditions.

The primary object of this invention is, therefore, to overcome such difficulties and provide a stock flow regulating mechanism for paper making machines which will permit a localized control of the stock flow as well as a regulation of the method and manner of stock flow and the quantity thereof that flows to the machine in accordance with the requirements of a given paper making operation. Further objects will be apparent in the following disclosure.

In accordance with this invention, we have provided a cylinder mold or Fourdrinier paper making machine in which the entrance chamber or throat, through which the stock flows to the screen or wire surface on which it is to be laid as a web, is provided with an elongated narrow entrance orifice having a control valve arranged to shut off or to regulate the supply of stock flowing therethrough. In order to insure a local control, either the valve or the valve seat or both, is made flexible and mechanism is provided for flexing one or both of these parts locally at any desired location. The flexible valve may be made of a resilient body, such as a solid and flexible rubber bar or a hollow rubber tube adapted to be expanded by suitable means to control the size of the opening regulated thereby.

Referring to the drawing which illustrates several embodiments of this invention:

Fig. 1 is a fragmentary, vertical sectional detail of a part of a cylinder mold machine having a flexible valve controlling the stock inlet;

Fig. 2 is a fragmentary, vertical elevation, partly broken away and in section, of the construction of Fig. 1;

Fig. 3 is a fragmentary, vertical sectional detail showing a flexible valve seat employed with a stationary valve for controlling the inlet;

Fig. 4 is a fragmentary sectional detail of one end of the floating valve of Fig. 3 and its spring support;

Fig. 5 is a fragmentary, vertical elevation, partly broken away, of a modified form having the valve comprising both an adjustable slice plate and an inflatable flexible tube arranged to control the inlet;

Fig. 6 is a vertical sectional detail of the construction of Fig. 5; and

Figs. 7 and 8 are similar views of another modification having only an expansible tube to control the stock flow.

Referring to Figs. 1 and 2 of the drawing, the apparatus there illustrated comprises a cylinder mold 10 having a peripheral wire screen 11 suitably mounted on supporting rings 12 carried on radially arranged arms 13 projecting outwardly from a central supporting hub which is rotatably mounted and driven in any suitable way. The vat within which the cylinder rotates comprises end walls 15 and a semi-cylindrical lateral wall 16 spaced from the cylinder at the sides and below the same. The stock flows to the vat through an inlet chamber formed in part by the vertical wall 18 which constitutes the upper portion of the arcuate wall 16. The end walls 15 and a wall 19 parallel with the wall 18 form therewith a rectangular chamber which extends preferably the length of the cylinder 10 so that the stock flowing from the entrance over the weir 20 of the wall 18 pass directly in a sub-

stantially direct line flow to the cylinder throughout its length. The waste water that passes through the wire mesh of the cylinder into the interior thereof escapes through a suitable opening 21 into the end compartment 22 and then passes from the machine. In order that the stock may be controlled at its entrance to the machine, an inlet pipe 24 may be arranged to introduce the stock into the entrance chamber, and sloping walls 25 (Fig. 2) serve to form a hopper shaped lower chamber 26 which is separated from the upper chamber 27 by the valve 30.

In accordance with this phase of the invention, the valve may be a long bar 30 made of suitable flexible material, such as a medium hard vulcanized rubber or a flexible synthetic resin substitute, which may be bent locally as required. This bar or valve is adapted to be vertically moved relative to a laterally extending valve seat formed by the flanges or plates 32 which project inwardly and laterally from the vertical walls 18 and 19. These valve seat plates 32 may be made of suitable material, such as compressed metal fibre, resin or wood, and they are rigidly positioned. They may be provided with upwardly flaring walls 33 to provide a smooth flow of stock above the valve, and the walls below the valve may also be suitably shaped for the same purpose. Each is preferably provided with a sloping lower edge surface 34 which has been preshaped so that the valve 30 will seat fully thereagainst and shut off all flow of liquid when the valve is seated. The flexible elongated valve bar 30 is preferably shaped as a cylinder or otherwise provided with upwardly converging surface portions which may make a tight fit with the seat plates, so that the valve parts may shut off the stock flow.

In order that the valve bar may be flexed locally, it is mounted on a series of vertically adjustable rods 35 secured to the valve bar at spaced intervals. These adjustment rods 35 pass freely through supporting bars 36 mounted on the vat. They are provided with screw threads at their upper ends which carry the hand wheel 37 and a check wheel 38 threaded thereon. By rotating any of the wheels 37 and 38, which are supported by the bars 36, the associated push and pull rod 35 is suitably adjusted vertically and thereby moves and flexes the elongated valve bar 30 at that point and provides a localized differential flow of stock at the adjusted points, and so makes it possible to vary the thickness and lay of the web wherever desired.

All of the push and pull rods 35 may be adjusted simultaneously and to the same extent, so that the valve bar may be brought into a seating engagement with the faces 33 of the flange plates 32 and thereby shut off all of the flow of stock. Likewise, if the valve 30 is lowered to the same extent throughout its entire length, then an opening of uniform width is provided between the valve and the seat. This is accomplished by means of the mechanism shown in Figs. 1 and 2 and comprises a set of levers 40 keyed to a common shaft 41 which is suitably mounted in bearings on the vat walls. The shaft is rotated through a slight arc by means of the worm wheel 42 actuated by the worm 43 on a suitably mounted cross shaft which is in turn rotated by the hand wheel 44. Each of the arms 40 has an opening 45 therethrough within which is loosely mounted the push and pull rod 35. The hand wheel 37 has its central depending hub 46 rounded off at its lower end, and the upwardly extending hub of the check wheel is similarly constructed, so that each of these hubs rockingly engages the edges of the opening 45 in the arm 40 and thus permits the arm to be adjusted vertically as desired. Whatever may be the adjustments locally of the push and pull rods 35, yet the bar may be moved to the same extent throughout its length by the worm drive mechanism which causes simultaneous operation of all of the rocking arms 40. This permits a quick adjustment of the rate of flow of stock through the valve opening.

Standard or suitable cylinder vat or Fourdrinier flow box construction may be provided with this valve, and the various constructional features thereof may be used herewith. For example, we may use a cylinder mold vat construction having an under feed entrance of the type illustrated in Figs. 5 to 8 inclusive and as fully described and claimed in the copending application of Lowe, Vedder & Adams Serial No. 327,856 filed on April 4, 1940; and suitable constructions may be employed for regulating the position of any part or all of the valve bar from outside of the vat. Likewise, the valve and associated entrance chambers may be arranged to lead to a Fourdrinier flow box, as will be readily understood.

The construction in Fig. 3 shows a rigid valve bar 48 made of metal, wood, fibre, resin, rubber or any other suitable material which may be held substantially stationary, while the valve seats are arranged to move relative thereto. The bar may be streamlined as shown and suitably mounted on the end walls 15 of the vat, or on supporting rods which are stationary or arranged to be moved as shown in Figs. 1 and 2. In order to effect a localized adjustment of the stock flow, one or both of the valve seats in this construction is a plate 49 made of a flexible material, such as a hard rubber or resin, or it may be made of a thin flexible metal, such as monel metal or stainless steel. Each of these valve plates 49 is suitably mounted on the vertical walls 18 and 19 of the entrance chamber, and each may be separately adjusted by means of the push and pull rods 50 which may be mounted as are the rods 35 of Figs. 1 and 2.

Each of the plates 49 may be adjusted through equal distances by means of the construction above described with reference to Figs. 1 and 2. A double adjustment may be effected by employing duplicate sets of rock arms 40 and worm drive operating mechanisms. The lower end of each rod 50 has an enlarged floating head suitably mounted within a cup shaped housing 52 on the flexible valve seat 49. The hand wheels 37 and 38 threaded on each rod 50 may be adjusted to lift the rod vertically independently of all other rods. This provides for local regulation of the valve seats at each side of the valve and wherever desired. In order to adjust all of the rods 50 simultaneously and to the same extent for either or both valve seats, two sets of rock arms 40 are provided, and each set of arms is lifted or lowered by the two hand operated worm drive mechanisms 53 above described. Each of the operating mechanisms may be turned simultaneously to the same extent and the valve plates 49 are thus moved equally throughout their lengths. In this construction just the same as in Figs. 1 and 2, the valve 40 is a long bar and the valve seat is an elongated slot which preferably extends substantially the length of the vat, although the valve and the valve slot may be made shorter if desired. If the valve bar adjustment of Fig. 1

is also used, then either the seats or the bar or both may be adjusted locally to vary the passage of stock at a given point, or either part may be adjusted to regulate the quantity of stock as a whole which flows to the wire. Each of the valve bars may, if desired, be mounted as indicated in Fig. 4 so that it will float relative to the flexible valve seats 49 and thus permit a fuller seating of the parts. That is, the end of the valve bar 48 has a reduced portion 55 riding within a vertical slideway 56 suitably mounted on the side wall of the flow chamber. The end of the bar is urged upwardly by a spring 57 against a stop 58 which is positioned to permit full closure of the valve opening. This permits the valve bar to float and make a better contact with the locally adjusted flexible valve seats.

In the construction of Figs. 5 and 6, the valve is a hollow inflatable tube 60, such as flexible rubber of the type used for automobile inner tubes, but thick walled and strong to control the stock flow. Any suitable material may be employed. The tube is adapted to be expanded by any suitable mechanical device and preferably by blowing it up by means of gas or water or other fluid pressure so as to force it against a valve seat and thus close off the valve passage. In this construction, the tube 60 of soft rubber has its ends closed and thus forms a container for fluid which may be introduced thereto by means of the pipe 62 having a series of holes for the purpose. An outside pipe 64 connects the inner pipe 62 with any suitable source of fluid pressure which may be regulated by a valve mechanism as required, such as an ordinary stopcock 65. The rubber tube is preferably supported in a trough shaped wooden or metal member 68 and to which the tube is preferably vulcanized or otherwise fastened at its lower middle portion so as to hold the tube properly in position. This trough 68 is suitably secured and supported on the end walls of the vat.

The valve-seat may be formed of two plates 70 which are made of flexible material, such as resin or rubber or any other substance that can be flexed to provide for local control of the opening of the valve. These slide plates or slice bars 70 are suitably mounted for adjustment toward and from the flexible rubber valve tube 60 as shown particularly in Fig. 6. A suitable mounting therefor comprises two spaced supporting flanges 71 and 72 suitably mounted on the casing wall and between which the plate 70 slides. A set of push and pull rods 74 adjustable through the casing wall are secured to the edge of the plate 70 at spaced intervals. These have hand wheels or adjustment nuts 75 on their outer ends so arranged that by turning these heads the bar 70 may be flexed lengthwise or moved more or less parallel with itself and towards the valve tube 60. The valve seat plates 70 are preferably beveled or otherwise shaped on their inner ends to fit snugly against the flexible tube.

In the construction of Figs. 5 and 6, the elongated valve is located directly beneath the cylinder mold and the walls 73 of the bottom of the vat diverge upwardly to positions on both sides of the mold 10 so that the flow of the stock past the valve is distributed quite evenly to the entire length of the rotating cylinder 11. The inlet chamber 76 beneath the valve may be suitably connected to a supply pipe for introducing the stock. This type of valve construction is particularly useful for that type of cylinder vat construction because of the ease of local regulation of the valve seat slides or slice bars 70 as well as the ability to inflate the tube 60 from an outside air or water pressure source and quickly close off the flow of stock as desired. The flow of stock may also be controlled by inflating the tube 60 only partly so that it does not contact with the valve seat plates and the stock may escape past its surface at a regulated rate. The vat and mold construction may be made according to any suitable design or as above described.

The modification of Figs. 7 and 8 omits the slide plates, and the valve is so arranged beneath the cylinder mold that the stock flow may be regulated or entirely closed off merely by inflating or deflating the tube 80. This tube 80 may be shaped and made the same as tube 60. A perforated pipe 81 is mounted within the tube and connects to an outer pipe 82 with a suitable source of fluid supply which is regulated by a suitable valve 83. The rubber tube 80 may be mounted on a supporting shelf 85. The tube is preferably vulcanized to the central medial line portion of this shelf so that it is held properly in position. The upper part of the tube likewise may be vulcanized or otherwise secured to the central medial line portion of a further plate 86. The two plates 85 and 86 are each provided with streamlined walls 87 and 88 which are so shaped that the stock flow may pass the valve without too great a turbulence caused by the valve construction. The inflatable rubber valve 80 is thus arranged to be moved only laterally by the fluid pressure close to or into contact with two suitably shaped valve seats 90 projecting inwardly from the sloping walls 92 of the stock entrance chamber. In this construction, the entire regulation of the stock flow is effected by the fluid pressure coming through the pipe 81, and the stock flow may be either cut down to a desired extent or it may be entirely cut off by a proper manipulation of the valve 83 and the resultant inflation or deflation of the rubber tube 80.

The operation of each of the above described constructions will be readily apparent. The wire screen on which the paper web is laid, whether a Fourdrinier wire or a cylinder mold, receives the pulp stock that flows over the weir 20 or equivalent construction. The conduit for the pulp stream is substantially as wide as the width of the wire, so that the stream flows without either converging or diverging crosswise of the wire and thus is in a non-turbulent and quiet condition so that the stock lays in substantially the same manner throughout the entire width of the web. The stock inlet pipe 24 feeds into a chamber 26 which expands to substantially the full width of the wire and the inlet conduit approaching the same, and the valve is substantially as long as the width of the conduit so that when the stock has passed the valve it may flow to the wire screen in a non-diverging stream or one of substantially uniform width. Of course, some latitude is permitted as to the length of the valve opening depending upon its distance from the wire screen and the shape of the passage beyond the valve. However, in accordance with this invention, this valve passage is long and narrow and substantially as long as the width of the conduit, and the valve is so arranged that it does not create any serious turbulent condition in the stock. Also, the valve bar or the inflatable tube is either cylindrical or streamlined at its sides so that the stock may pass quietly and smoothly

through the valve opening. Similarly the supports 68 and 87 of Figs. 6 and 8 are streamlined to aid this condition.

Due to local conditions in a given paper making machine construction, it is often found that the stock tends to flow unevenly, such as more toward one end of the screen than the other thereof. In order to provide the paper maker with an opportunity for changing this condition, we have arranged the valve construction so that either the valve or the valve seat may be locally flexed to permit opening or closing the passage at any given point. The adjustment mechanism of Figs. 3 and 4 permits flexing the valve seats to any desired condition relative to the valve, and then the flexed member may be moved bodily without changing its initial curved condition so as to cause more or less stock to flow through that peculiarly shaped valve opening. That double adjustment construction of Figs. 3 and 4 may be employed with the adjustable valve of Figs. 1 and 2 so that the bar 30 may be flexed to any given shape and then moved bodily as a whole and without changing that shape. This makes it unnecessary for the paper maker to make the fine adjustments required for flexing the bar each time that he opens or closes the valve.

In the constructions of Figs. 5 to 8, the inflation of the flexible valve tube serves either for entirely stopping the stock flow or for regulating the volume of stock that escapes past the valve. The arrangement of Figs. 5 and 6 is such that the flexible slice plates 70 may be set in any desired position to control locally the flow of stock and then the inflatable tube 60 will make proper contact with those plates or seats 70 when duly inflated and irrespective of the flexed condition of the seat.

It will now be appreciated that numerous modifications may be made in this construction and that it may be applied in various locations and constructional arrangements on the various types of paper making machines used in the industry. Hence, the above description is to be interpreted as illustrating the general principles of this invention and as describing our preferred embodiments thereof and not as limitations on the invention, except as is set forth in the appended claims.

We claim:

1. In a paper making machine having a movable wire screen on which a paper web is laid, a pulp stock flow controlling mechanism comprising walls forming a conduit which is substantially as wide as the width of the screen and is arranged to cause the paper stock to flow directly to the screen in a stream of substantially uniform width, a valve and associated valve seats at the entrance to said conduit which are substantially as long as is the width of said screen, one of said parts being flexible, and means for causing relative movement of the valve and seats to open and close the valve passage and for flexing said flexible valve part so as to provide a localized control of the passage of the stock.

2. In a paper making machine having a movable wire screen on which a paper web is laid, a pulp stock flow controlling mechanism comprising walls forming a conduit which causes the paper stock to flow directly to the surface of the screen in a stream of substantially uniform width, a movable flexible valve and associated valve seats at the entrance to said conduit which are substantially as long as the width of the conduit, and mechanism associated therewith for flexing the valve relative to the valve seats so as to control the flow of stock locally.

3. In a paper making machine having a movable wire screen on which a paper web is laid, a pulp stock flow controlling mechanism comprising walls forming a conduit which is substantially as wide as said screen and is arranged to cause the paper stock to flow in a stream of substantially uniform width directly to the screen, two lateral valve seats in said conduit and a long narrow flexible valve engageable with said seats, said valve being substantially as long as the width of the conduit, and mechanism comprising rods connected to the valve at spaced intervals for flexing the same and controlling the stock flow locally and for moving the valve relative to the seats to regulate the volume flow.

4. In a paper making machine having a movable wire screen on which a paper web is laid, a pulp stock flow controlling mechanism comprising walls forming a conduit which causes the paper stock to flow directly to the screen, two valve seats in said conduit and a movable elongated flexible valve, push and pull rods connected at spaced intervals to the valve, means associated with said rods for moving them simultaneously to move the valve toward and from the seats, and cooperating mechanism for individually adjusting a rod to flex the valve and provide a localized control of the stock flow.

5. In a paper making machine having a movable wire screen on which a paper web is laid, a pulp stock flow controlling mechanism comprising walls forming a conduit which causes the paper stock to flow substantially directly and in a non-diverging stream to the screen, an elongated valve which is substantially as long as the width of said conduit and two valve seats associated therewith for controlling or stopping the stock flow, at least one of said valve seats being flexible, and means associated therewith for flexing said flexible valve seat relative to the valve for controlling the stock flow locally.

6. In a paper making machine having a movable wire screen on which a paper web is laid, a pulp stock flow controlling mechanism comprising walls forming a wide conduit which causes the paper stock to flow substantially directly to the screen, an elongated valve in said conduit which is substantially as long as the width of the conduit, two valve seats associated therewith, at least one of the valve seats being flexible, means for relatively moving the valve and the valve seats from an open to a closed position, and associated mechanism for flexing the flexible valve seat to provide a localized control of stock flow.

7. In a paper making machine having a movable wire screen on which a paper web is laid, a pulp stock flow controlling mechanism comprising walls forming a wide conduit which causes the paper stock to flow substantially directly to the screen, an elongated valve and associated valve seats which are substantially as long as the width of the conduit and serve to shut off and to control the stock flow, mechanism including push and pull rods connected to one of the valve parts for flexing the same, and mechanism associated therewith for moving all of the rods simultaneously.

8. In a paper making machine having a movable wire screen on which a paper web is laid, a pulp stock flow controlling mechanism comprising walls forming a wide conduit which leads

the paper stock directly to the screen, an elongated valve and opposed valve seats in said conduit which are substantially as long as is the width of the conduit, said valve being a flexible, hollow, inflatable tube, means for supporting the valve tube near said seats and means associated therewith for expanding the tube to regulate the size of the passage between said valve and the valve seats and thereby control the stock flow.

9. In a paper making machine having a movable wire screen on which a paper web is laid, a pulp stock flow controlling mechanism comprising walls forming a wide conduit which causes the paper stock to flow substantially directly to the screen, an elongated narrow valve and two opposed substantially parallel valve seats in said conduit, the valve being a flexible, hollow, expandable tube and at least one of the seats being flexible, means for supporting the valve tube near said seats, means associated therewith for expanding the tube to regulate the size of the passage between said tube and the valve seats and thereby control the stock flow, and means for flexing the flexible seat and thereby locally adjusting its distance from the valve tube.

10. In a paper making machine having a movable wire screen on which a paper web is laid, a pulp stock flow controlling mechanism comprising walls forming a conduit which is substantially as wide as said screen and is arranged to cause the paper stock to flow in a substantially non-diverging non-turbulent stream to the screen, an elongated valve in said conduit which extends substantially the entire width thereof, two opposed valve seats associated therewith for controlling the stock flow, the valve being a flexible, inflatable, hollow tube, a support for holding the valve tube in position, and means including a valved pipe connected to introduce a regulatable amount of fluid under pressure to said tube and cause it to move relative to the seat, said support being shaped and arranged so as not to materially affect the streamlined flow of the stock to the wire screen.

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