Nov. 2, 1965 M. S. GREEN 3,215,593

HEADBOX FOR TWIN WIRE PAPER MAKING APPARATUS

Filed Jan. 25, 1963 3 Sheets-Sheet 1

FIG-1

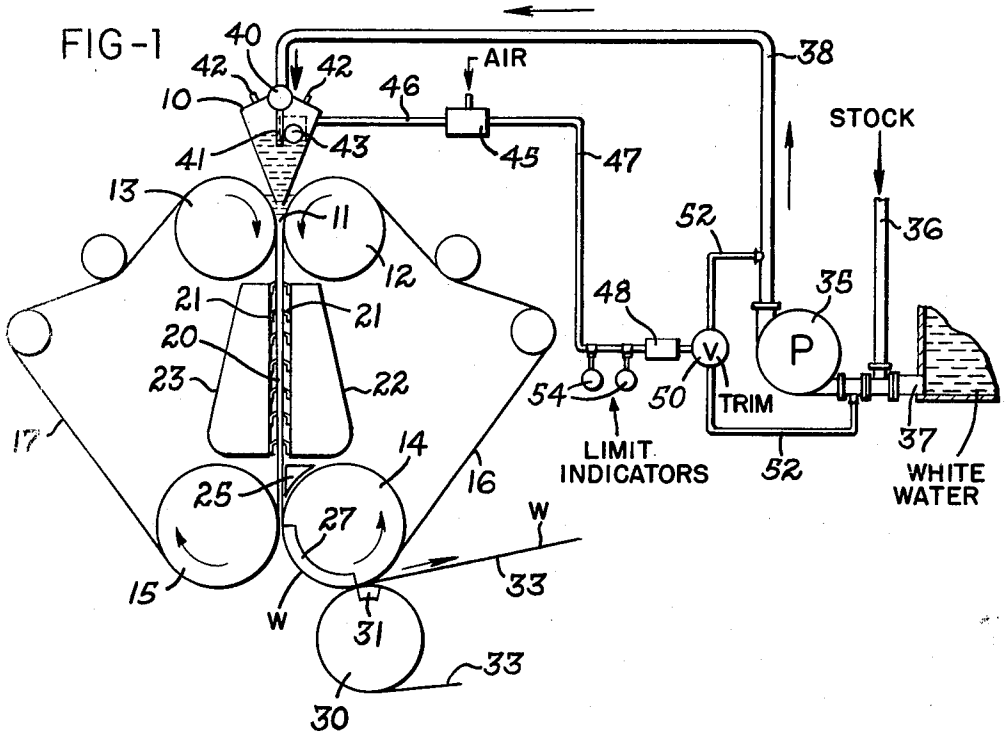


FIG-3

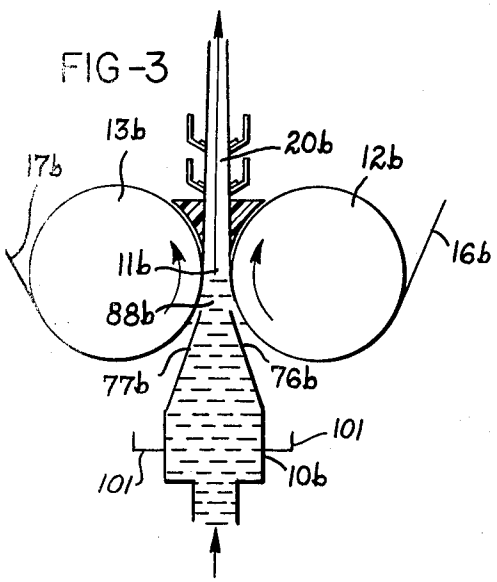
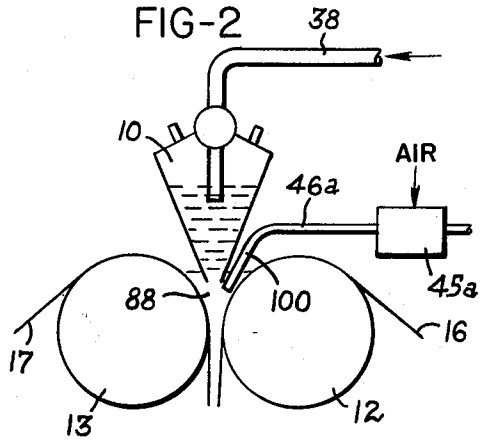


FIG-2



INVENTOR.
MARSHALL S. GREEN
BY
Marschal, Biebel, French & Bugg
ATTORNEYS

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HEADBOX FOR TWIN WIRE PAPER MAKING APPARATUS

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FIG-4

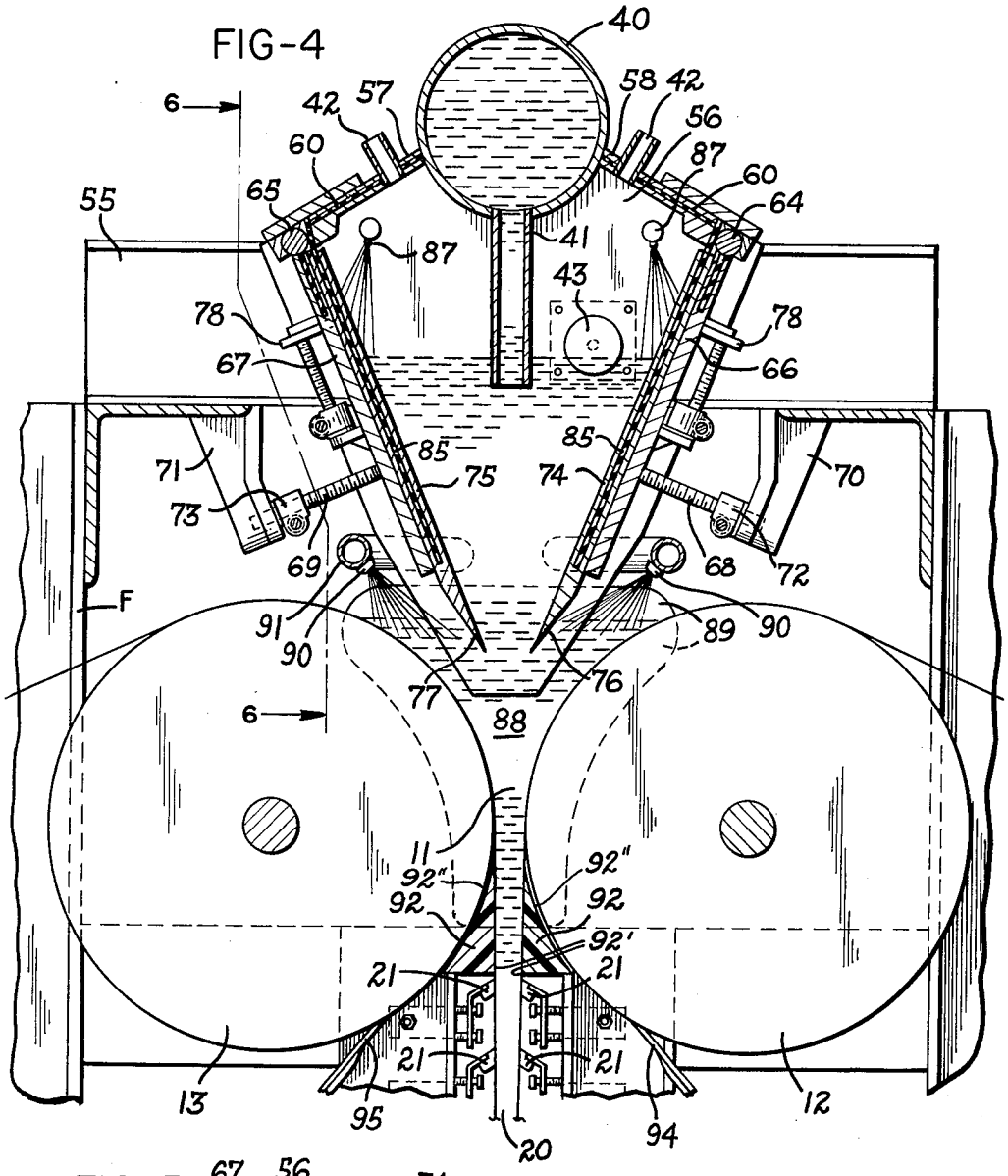
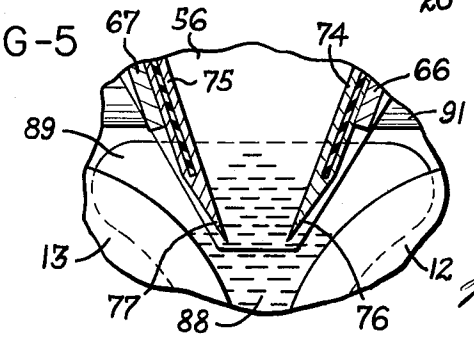


FIG-5



INVENTOR.
MARSHALL S. GREEN
BY
Marshall, Bibel, French & Briggs
ATTORNEYS

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HEADBOX FOR TWIN WIRE PAPER MAKING APPARATUS

Filed Jan. 25, 1963 3 Sheets-Sheet 3

FIG-6

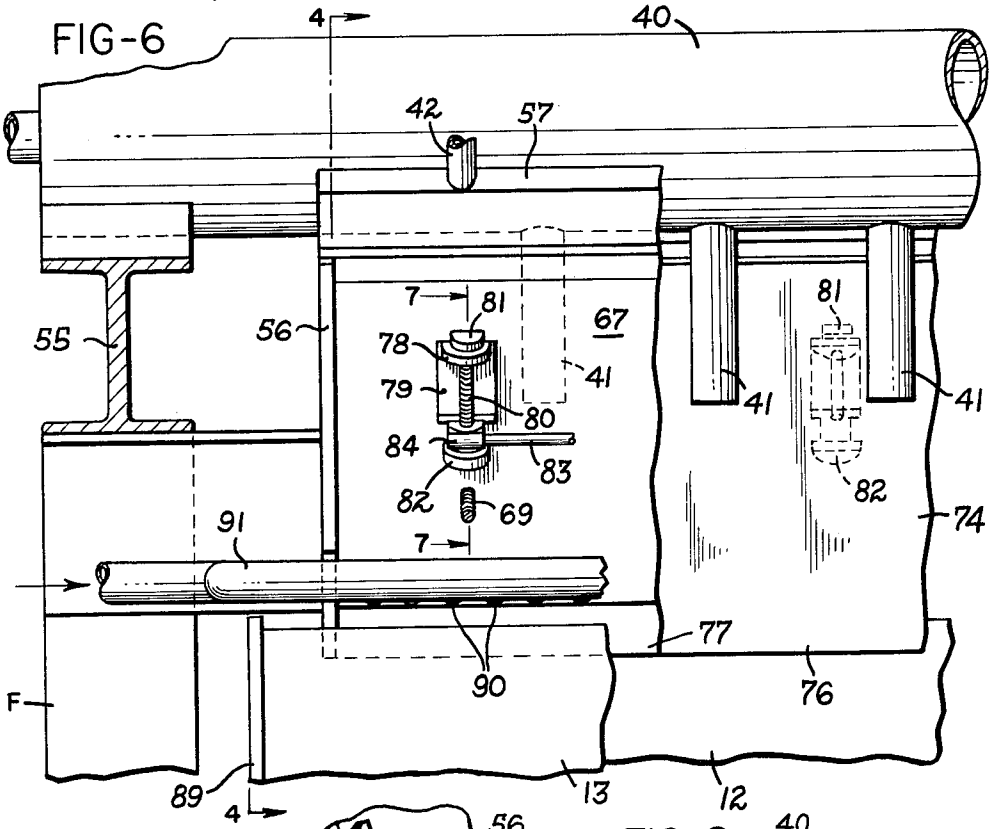


FIG-7

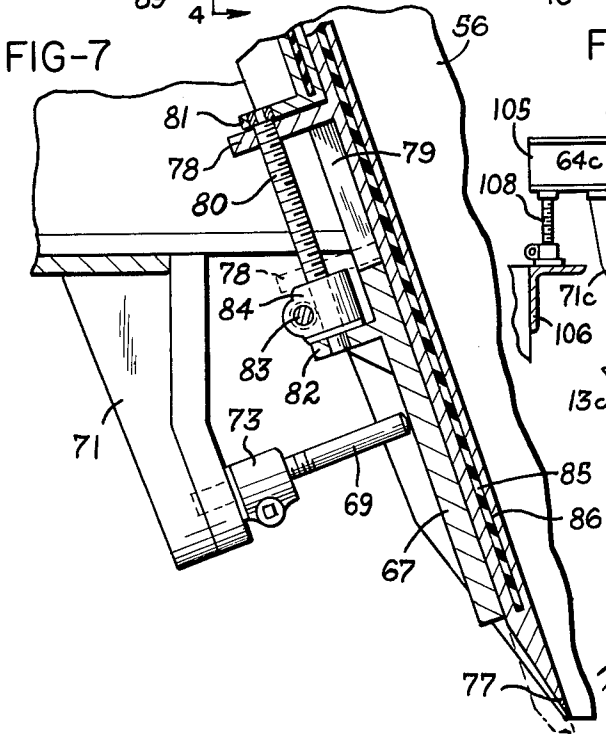
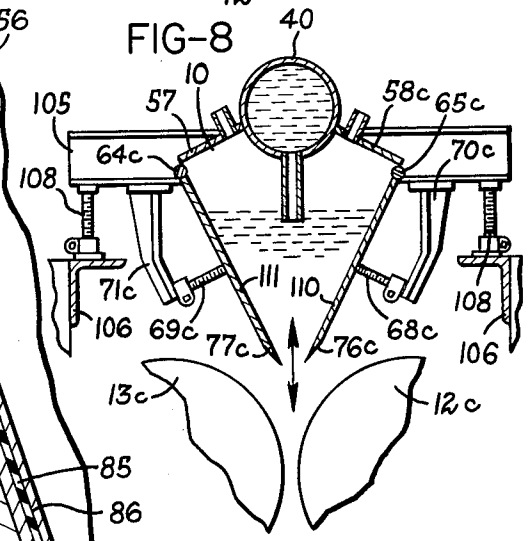


FIG-8



INVENTOR.
MARSHALL S. GREEN
BY
Marshall, Bibel, French & Bugg
ATTORNEYS

United States Patent Office

3,215,593

Patented Nov. 2, 1965

3,215,593

HEADBOX FOR TWIN WIRE PAPER MAKING APPARATUS

Marshall S. Green, Watertown, N.Y., assignor to The Black-Clawson Company, Hamilton, Ohio, a corporation of Ohio

Filed Jan. 25, 1963, Ser. No. 253,858
10 Claims. (Cl. 162—301)

This invention relates to paper making machinery, and in particular, the invention relates to an improved system for supplying paper stock to the forming members of various types of paper machines.

Many of the headboxes used at present suffer from the disadvantage that the slice or outlet opening which regulates the flow of stock from the headbox into the forming zone often requires adjustment in order to obtain a paper web having uniform thickness and consistency. To obtain a proper outflow therefrom, a skilled technician requires a considerable amount of time to position correctly the upper lip of the slice so that a jet flows therethrough at a speed substantially equal to the speed of the forming wire. This jet speed is produced by the head of fluid in the headbox or, in the case of pressure type headboxes, by the use of air pressure acting on the fluid, and a jet speed of 2000 feet per minute requires more than 200 inches of water head. Even then, slight changes in the stock consistency, in the ambient temperatures, or in the pressure in the headbox or speed of the wire will cause variations in the flow through the slice, thus requiring additional adjustment.

While generally applicable to all paper making machines, the invention has special relation to paper machinery of the general type shown in United States Letters Patent to Baxter, No. 2,969,114 for Paper Machinery, assigned to the assignee of this invention, and characterized by the incorporation of a pair of forming wires arranged to travel vertically in closely spaced relation through a forming zone wherein formation of the paper sheet takes place. The invention provides particularly satisfactory results with high speed machinery generally similar to that described in the Baxter patent as it supplies the volume of stock required by the forming zone to form a high quality sheet.

Thus a primary object of this invention is to provide apparatus capable of supplying paper stock to the forming zone of a high speed paper making machine in such a manner that a paper web having an improved uniformity and quality throughout is obtained.

An important object of this invention is to provide a headbox system wherein the flow of stock into the forming zone is independent of the aforesaid factors which cause irregular stock flow, and particularly to provide apparatus of the aforesaid type wherein the stock is gradually accelerated to the speed of the forming wires so that as the stock enters the forming zone, there is substantially no relative movement between the stock and the forming wires.

A further object of this invention is to provide a headbox system wherein stock flows at high speed from a manifold to the forming zone of a paper machine in a smooth path so that pockets of air are not trapped in the stock to lessen the quality of the resulting paper, and particularly to provide a system of such type which does not require minute control of the stock flow to insure proper flow into the forming zone and/or to compensate for variations in the forming wire speed.

Another object of this invention is to provide apparatus of the aforesaid type wherein the headbox has a relatively small volume so that large quantities of stock are not concentrated therein thus minimizing the opportunity for

settling, flocculation and the development of other conditions tending to cause non-uniformity in the fiber distribution which may result in paper of an inferior quality.

Another object of this invention is to provide a headbox system for a paper making machine having a vertical forming zone defined between two wires moving downwardly at high speeds in a gradually converging path wherein the flow of stock into the forming zone is determined by the spacing of the wires at the entrance end of the forming zone, the rate of movement of these wires and the consistency of the stock.

Still another object of this invention is to provide a headbox of improved, simplified and novel construction which is equally adapted for use on any type of paper making machine, and particularly to provide a headbox system as outlined above having some or all of the aforesaid characteristics which is constructed for maximum ease of maintenance and particularly for maximum dependability and simplicity throughout.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings—

FIG. 1 is a schematic view illustrating paper making machinery in accordance with the invention;

FIG. 2 is a fragmentary schematic view illustrating a modification of the headbox arrangement in the machine of FIG. 1;

FIG. 3 is a schematic showing of another embodiment of the headbox system of the invention;

FIG. 4 is a view partly in elevation and partly in section along the line 4—4 of FIG. 6 showing in detail the structure of the headbox assembly shown in FIG. 1;

FIG. 5 is a fragmentary view showing an adjusted position of the lips of the headbox assembly of FIG. 4;

FIG. 6 is a sectional view taken essentially along the line 6—6 of FIG. 4 and partially broken away to illustrate the interior of the headbox;

FIG. 7 is a sectional view taken essentially along the line 7—7 of FIG. 6; and

FIG. 8 is a view similar to FIG. 4 and illustrating another embodiment of the invention.

Referring to the drawings, wherein preferred embodiments of the invention are illustrated, the paper making machine of FIG. 1 includes a headbox **10** for flooding with stock the space above the nip **11** of a pair of two breast rolls **12** and **13**. The couch rolls **14** and **15** are respectively positioned in parallel relationship below the breast rolls **12** and **13**, and each pair of breast and couch rolls has a forming wire **16** or **17** entrained therearound so that a vertical forming zone **20** is defined between the breast and couch rolls.

The wires **16** and **17** move downwardly from the nip **11** through the forming zone **20** in a gradually converging path guided by the supporting deflectors **21** to exert a squeezing action on the stock between the wires which expels the white water therefrom through the wires, thus forming a paper web W. The deflectors **21** also serve the important purpose of removing this water from the rear side of the wires **16** and **17** by deflecting it outwardly and downwardly therefrom into the collection pans **22** and **23** from where it is returned to the white water supply system. Specifically, the deflectors **21** are shown and described in the copending United States application for Paper Machinery, Serial No. 232,337, filed October 8, 1962, and assigned to the assignee of this invention.

As the wires **16** and **17** leave the last pair of deflectors **21**, the suction box **25** holds the newly formed web W on the right-hand wire **16** and separates it from the wire **17**, and the suction box **27** in the couch roll **14** holds the web thereon until engagement with the transfer roll **30**,

which has a suction box 31 therein for transferring the web from the forming wire 16 to the press felt 33.

The stock supply system which maintains a predetermined level in the headbox 10 includes the pump 35 which receives and mixes the stock and white water from the pipes 36 and 37, respectively, and forces this mixture through the supply pipe 38 to the header 40, from where it flows through the down spouts 41 spaced along the header to the interior of the headbox 10. The header 40 may be tapered in an axial direction with an outlet at the smaller end, thus insuring even and continuous flow through the header and through each of the downspouts 41. The space above the stock in the headbox is preferably vented to the atmosphere through the vent tubes 42. However, the headbox 10 could be closed and connected to an air pressure supply or the like so that it operates as a pressure box, if desired. The speed of the pump 35 is correlated with the speed of the forming wires 16 and 17, as well as with the weight of the paper being produced, so that the stock is supplied to the headbox 10 at the volumetric rate required for proper operation of the machinery.

To maintain a desired level in the headbox 10 to insure flow therefrom at the preset rate equal to the flow of stock into the forming zone 20, the float 43 controls the operation of a control unit 45 by controlling the air flowing through the line 46. That is, air flowing from the control unit 45 through the pipe 46 is varied by the float depending on its vertical position so that the unit 45 senses the level in the headbox 10. The level control unit is of conventional design, and includes a pilot valve, not shown, which is positioned in response to the air flow from the line 46 and which correspondingly positions a larger valve for controlling the flow of air from the source through the line 47 to the actuator 48 of the trim valve 50.

Thus when the stock in the headbox 10 drops below the prescribed level, the float 43 effects a reduction in the air flow from the line 46 so that control unit 45 correspondingly positions the actuator 48 to decrease the opening of the trim valve 50. Since the trim valve 50 controls flow of stock through the bypass line 52 from the outlet to the inlet side of the pump 35, closing the valve 50 reduces the return of stock to the inlet side of the pump thereby increasing the flow to the headbox 10. When the level in the headbox 10 is above that desired, the trim valve 50 automatically is opened so that additional stock is bypassed through the line 52 to the inlet side of the pump 35 thereof to reduce the supply through the pipe 38 to the headbox 10. The limit indicators 54 are preferably lights which are energized when the trim valve 50 reaches its extreme positions thus giving the operator an indication that further adjustment in the flow to the headbox 10 cannot be made by the control unit 45 and the associated trim valve 50.

A preferred embodiment of headbox structure is shown in FIGS. 4–7 as including the header 40 which is supported in a cantilevered manner on the machine frame F by the horizontal beam 55. The vertical end walls or plates 56 of the headbox 10 are welded, or otherwise suitably connected, to the header 40, and the downwardly sloped cover plates 57 and 58 are similarly connected to the header 40. The seals 60 may be interposed between the cover and end plates 56–58 for fluid tight connection therebetween. The cover plates 57 and 58 have vent tubes 42 thereon for connecting the interior of the headbox 10 to the atmosphere, and the spouts 41 on the header 40 extend downwardly therefrom to a point below the surface of stock in the headbox 10 to prevent splashing and turbulence of the stock as it flows from the header. The float 43 and associated control valve, not shown, for controlling the air flow from the line 46 may be mounted on one of the end plates 56, as best seen in FIG. 4.

The side wall assemblies are secured on the outermost edges of the cover plates 57 and 58 by the hinges 64 and 65, respectively, which support the outer side plates 66 and 67 for movement about the axis of the hinge as controlled by the adjusting screws 68 and 69. These screws are supported on brackets 70 and 71 which are in turn mounted on the beam 55, and the screws 68 and 69 are rotated by the drive sleeves 72 and 73 rotatably coupled to the brackets 70 and 71 so that rotation thereof moves the screws 68 and 69 in a direction perpendicular to side plates 66 and 67. While only one of the support screws is shown for each of the side plates, two or more may be used for each side plate depending on the length of the headbox 10.

The outer side plates 66 and 67 have the inner side plates 74 and 75, respectively, movably mounted thereon so that the lips 76 and 77 on the lower ends thereof can be raised or lowered with respect to the nip 11. Each of the inner plates 74 and 75 is mounted on the associated outer plate 67 or 68 by the ears 78 rigidly secured to the inner plates and projecting outwardly of the headbox 10 through an elongated slot 79 (FIGS. 6 and 7) in the associated outer side plate. The adjustment screws 80 are mounted parallel to the length of the slots 79 by the projections 81 and 82 which extend perpendicularly from the outer side plates, and threadedly engage the ears 78 so that rotation thereof effects movement of the associated inner plate with respect to the adjacent outer side plate.

The screws 80 are rotated by turning a drive shaft 83 (FIG. 6) which interconnects the drive sleeves 84 rotatably secured to the projections 82, thus causing the ears 78 to ride up or down on the screw to lower or raise the inner plates 74 or 75 to adjust the associated lips 76 and 77 with respect to the nip 11. While two of the screws 80 and associated equipment have been provided for each of the side plates 74 and 75, a larger number may be used, again depending on the width of the headbox 10. The seals 85 are provided in the grooves 86 formed in the edges of the inner and outer side plates 66, 67, 74, and 75 for contact with the end plates 56 to prevent leakage between the side and end plates. The sprays 87 are provided internally of the headbox 10 for cleaning the inner side walls 74 and 75 so that the stock does not build up thereon.

As shown in FIG. 5, the space between the breast rolls 12 and 13 immediately above the nip 11 defines a trough 88 for receiving the flow of stock from the headbox 10, and spillage from the ends thereof is prevented by the end plates 89 provided at each end of the trough adjacent the rolls 12 and 13. Suitable seals may be provided between the end plates 89 and the rolls 12 and 13 to reduce leakage therebetween. The spray nozzles 90 on the manifold pipes 91 are provided in the areas between the lips 76 and 77 and the rolls 12 and 13, respectively, to minimize foaming and stagnation in these areas.

Baffle means comprising block members 92 are provided in the spaces below the nip 11 between each breast roll 12 or 13 and its associated wire 16 or 17 to minimize the creation of suction in these areas as the forming wires leave the breast rolls at high speed, thus greatly reducing the uncontrolled flow of liquid drawn through the wires at this point. As shown in FIG. 4, each of the blocks 92 has one flat surface 92′ arranged for engagement with the adjacent surface of the associated forming wire, and its opposite surface 92″ is cylindrically curved on substantially the same radius as the associated breast roll. The flat and curved surfaces of each block 92 intersect to define sharp upper edge on the block, and each block is supported as shown in FIG. 4 with the upper edge extending substantially to the line of separation of the adjacent wire 16 or 17 from its associated breast roll so that these blocks substantially fill the space between each wire and breast roll immediately below the nip 11 and thus effectively block the suction effect which would otherwise be created in this space by the rapidly downwardly moving surface of the breast roll. Since these

blocks **92** are in contact with the wires **16** and **17**, they should have wear resistant and non-corrosive qualities, and a suitable material for this purpose is a phenolic laminated plastic material sold under the trade name "Micarta."

The doctor blades **94** and **95** are mounted for contact with the breast rolls **12** and **13**, respectively, to maintain the surfaces of these rolls free of deposits and fluids which might collect thereon as the rolls move the wires through the flooded trough **88** and the nip **11**. Immediately below the blocks **92** are the deflectors **21** which support the wires and remove liquid from the rear side thereof as described in the aforesaid copending application.

In operation, the headbox **10** is supplied with stock at a predetermined rate determined from the speed of the forming wires **16** and **17**, the width of the nip **11**, and the consistency of the stock so that the flow into the flooded trough **88** will generally be sufficient to maintain a predetermined level therein so that there is uniform flow into the forming zone **20**. Slight variations in this level are sensed by the float **43** which effects adjustment in the trim valve **50** to increase or decrease the flow to the headbox **10** as already described.

The stock flows through the opening between lips **76** and **77** and into the flooded trough **88**, and as the forming wires **16** and **17** pass around the breast rolls **12** and **13**, the stock in contact therewith is gradually accelerated so that in the area of the nip **11**, the stock is moving at a rate substantially equal to the speed of the wires, thus insuring a consistent frictionless rate of flow into the forming zone **20**, even at very high wire speeds. As the wires move through the forming zone **20**, the gradually converging wires **16** and **17** squeeze the white water through each side of the forming zone so that "two-sidedness" is eliminated. The paper web which emerges from the forming zone is transferred to the felt **33**, in the manner outlined above for subsequent processing.

The adjustments in the position of the lips **76** and **77** are provided so that the level of stock in the trough **88** above the nip **11**, as well as the rate of flow thereinto, can be varied as required when changes in the wire speed, stock consistency, or width of the nip are made in order to maintain a satisfactory level and rate of flow into the trough **88**. Thus when it is desired to increase the space between the lips **76** and **77**, the adjustment screws **68** and **69** can be appropriately turned causing the weight of the side plates **66**, **67**, **74**, and **75** to pivot themselves about the hinges **64** and **65**.

To adjust the lips **76** and **77** in a vertical direction, the cross shafts **83** are suitably rotated to move the inner plates **74** and **75** with respect to the outer plates **66** and **67**, thus shifting the lips **76** and **77** with respect to the breast rolls. Thus by a combination of these adjustments, the horizontal opening between the lips, and the depth of stock in the flooded trough **88**, can be made as required. While specific structure has been shown and described for making these adjustments, it is possible to use other expedients in lieu thereof including automatic apparatus for changing the relative position of the lips.

Another embodiment of the apparatus for sensing the level of stock in the headbox is shown in FIG. 2, and it includes a probe **100** which extends below the surface of stock in the flooded trough **88**, as opposed to a float directly in the headbox for sensing level of fluid therein. The probe **100** is connected to the air line **46***a* which supplies low pressure air thereto, and the resistance offered to the flow of air from the probe is a true indication of the depth of fluid above the probe outlet and, therefore, in the flooded trough **88**. Thus the pressure in the air line **46***a* controls the pilot valve in the control unit **45***a* which in turn effects positioning of the trim valve **50** in substantially the manner described above. In all other respects this embodiment operates substantially identically to that discussed above.

Another embodiment in the headbox and flooded trough arrangement is shown in FIG. 3, wherein the wires **16***b* and **17***b* which define the forming zone **20***b* are moving vertically upward. The headbox **10***b* is pressurized for forcing stock into the trough **88***b* between and immediately below the nip **11***b* so that an excess of stock is available therein, and the forming wires draw this stock therebetween in substantially the same manner as the apparatus shown in FIG. 1. A limited amount of stock will escape between the lips **76***b* and **77***b* and the breast rolls **12***b* and **13***b* so that suitable collection apparatus **101** is provided for accumulating this overflow and recommitting it to the stock supply system. However, it should be appreciated that the high speed of the forming wires **16***b* and **17***b* and the rolls **12***b* and **13***b* impedes flow between the lips and the rolls. This embodiment can also be adapted for use in a Fourdrinier type paper machine by eliminating the wires and allowing the stock to pass through the nip and around one of the breast rolls onto a horizontally moving wire.

FIG. 8 illustrates another embodiment of apparatus for adjusting the lips **76***c* and **77***c* with respect to the breast rolls **12***c* and **13***c*. The headbox **10***c* is supported by one or more cross beams **105** which in turn are supported at their opposite ends on the bracket **106** of the frame F by the jack screws **108**. Thus rotation of the screws **108** by use of a suitable tool causes the entire headbox **10***c* to be moved in a vertical direction. The lips **76***c* and **77***c* are adjusted in a horizontal direction in substantially the same manner as described above in connection with the FIG. 4 embodiment. Thus the side walls **110** and **111** of the headbox are pivoted to the cover **57***c* and **58***c* by the hinges **64***c* and **65***c*, and the screws **68***c* and **69***c* on the brackets **70***c* and **71***c* cooperate with the weight of the side walls **110** and **111** to change the relative horizontal position of the lips **76***c* and **77***c*.

A suitable flexible coupling will be provided between the supply pipe **38** and the header **40** in FIG. 8 to facilitate vertical movement of the headbox **10***c*. The relative position of the lips and the breast rolls **12***c* and **13***c* can therefore be varied in a vertical direction by using the screws **108** whereas horizontal adjustment thereof is effected by the jack screws **68** and **69**, so that the rate of flow into the flooded trough **88** as well as the level therein can be adjusted as required for proper operation of the machinery to produce high quality paper.

Thus the present invention has provided paper making machinery wherein the flow of stcok into the forming zone is not dependent on even flow through a slice of a headbox or the pressure in such headbox. On the contrary, the invention provides an excess of stock in the space immediately above the forming nip with the forming wires drawing stock therefrom as required thus producing a paper web of improved quality and uniformity. Also, the lips **76** and **77** are adjustable to vary the width of the nip **11** so that the headbox **10** can easily be adapted for making paper of different weights and at different speeds.

Paper making apparatus constructed as described is capable of making paper at substantially higher speeds than have heretofore been possible, and it does not require suction apparatus for removing water during sheet formation, other than the limited use of suction equipment as described for controlling the position of the sheet on the wires and press felt. Thus the apparatus is capable of producing thirty-pound (per 3000 square feet) paper with a forming zone of the order of only seven feet in length and with the forming wires moving at speeds of the order of 3000 to 3500 feet per minute, and in addition to the advantages of high-speed operation and elimination of conventional suction equipment, the resulting paper will have the further major advantages of freedom

from two-sidedness, improved uniformity, and a unique fibre structure.

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. In paper making apparatus comprising a frame, a pair of imperforate breast rolls supported on said frame in closely spaced relation defining a vertical nip therebetween, end plate means cooperating with said breast rolls to define a trough above said nip and between said breast rolls, a pair of couch rolls associated with said breast rolls respectively and supported in vertically spaced relation below the associated said breast rolls, a pair of endless forming webs looped around associated said breast and couch rolls for travel through a forming zone between said breast and couch rolls, a headbox mounted on said frame above said trough including side and end walls defining therebetween a container for holding stock, and means for supplying stock to said container, the combination of cooperating lips on the lower ends of said side walls of said headbox depending into said trough to a lower level below the top thereof and spaced above said nip to define therebetween an outlet from said container for supplying stock to said trough, and control means for regulating the supply of stock to said container to maintain a suply rate substantially identical to the rate of flow through said nip into said forming zone while maintaining the depth of stock in said trough above said lower level of said lips.

2. In paper making apparatus comprising a frame, a pair of imperforate breast rolls supported on said frame in closely spaced relation defining a vertical nip therebetween, end plate means cooperating with said breast rolls to define a trough above said nip and between said breast rolls, a pair of couch rolls associated with said breast rolls respectively and supported in spaced relation below the associated said breast rolls, a pair of endless forming webs looped around associated said breast and couch rolls for travel through a forming zone between said breast and couch rolls, a headbox assembly mounted on said frame above said trough including outer side walls, end walls on each end of said outer side wall defining therebetween a container for holding stock, and means for supplying stock to said container, the combination of an inner side wall mounted on each of said outer walls of said headbox assembly for reciprocation thereon, cooperating lips on the lower ends of said inner such walls extending into said trough and defining therebetween an outlet from said container for supplying stock to said trough, and adjustment means for raising and lowering said inner side walls with respect to said trough and said nip.

3. In paper making apparatus comprising a frame, a pair of imperforate breast rolls supported on said frame in closely spaced relation defining a vertical nip therebetween, end plate means cooperating with said breast rolls to define a trough above said nip and between said breast rolls, a pair of couch rolls associated with said breast rolls respectively and supported in spaced relation below the associated said breast rolls, a pair of endless forming wires looped around associated said breast and couch rolls for travel through a forming zone between said breast and couch rolls, a headbox assembly mounted on said frame above said trough, and means for supplying stock to said headbox assembly, the combination of cover means extending across the top of said headbox assembly, hinge means on the outermost edges of said cover means, side wall assemblies connected to said hinge means for pivotal movement, end walls on each end of said side wall assemblies defining therebetween a container for holding stock, control means for controlling the flow of stock to said container to maintain a predetermined level therein, cooperating lips on the lower end of said side wall assemblies defining therebetween an outlet from said container for supplying stock to said trough, and adjustment means for moving said side wall assemblies about said hinge means to increase or decrease the horizontal distance between said lips for varying the flow of stock into said trough.

4. In paper making apparatus comprising a frame, a pair of imperforate breast rolls supported on said frame in closely spaced relation defining a vertical nip therebetween, means cooperating with said breast rolls to define a trough above said nip and between said breast rolls, a pair of couch rolls associated with said breast rolls respectively and supported in spaced relation below the associated said breast rolls, a pair of endless forming webs looped around associated said breast and couch rolls for travel through a forming zone between said breast and couch rolls, a headbox mounted on said frame above said trough, and means for supplying stock to said headbox assembly, the combination of cover means on the top of said headbox, side wall assemblies connected to said cover means, end walls on each end of said side wall assemblies defining therewith a container for holding stock, control means for controlling the flow of stock to said container to maintain a predetermined level therein, lips on the lower end of said side wall assemblies defining therebetween an outlet from said container for cooperation with said predetermined level in said container to supply stock to said trough at a rate sufficient to maintain a substantial excess of stock in said trough, and adjustment means for varying the relative spacing of said lips in a horizontal direction to vary the width of said outlet.

5. In paper making apparatus comprising a frame, a pair of imperforate breast rolls supported on said frame in closely spaced relation defining a vertical nip therebetween, end plate means adjacent the opposite ends of said breast rolls to define the ends of a trough between said breast rolls above said nip, a pair of couch rolls associated with said breast rolls respectively and supported in spaced relation below the associated said breast rolls, a pair of endless forming webs looped around associated said breast and couch rolls for travel through a forming zone between said breast and couch rolls, a headbox assembly mounted on said frame above said trough, and means for supplying stock to said headbox assembly, the combination of cover means on said headbox assembly, hinge means on the outermost ends of said cover means, outer side walls connected to said hinge means for pivotal movement, end walls on each end of said outer side wall defining therebetween a box-like container for holding stock, control means for controlling the flow of stock to said container to maintain a predetermined level therein, an inner side wall mounted on each of said outer walls for reciprocation therein, cooperating lips on the lower end of said inner walls defining therebetween an outlet from said container for supplying stock to said trough, first adjustment means for moving said outer side walls about said hinge means to vary the horizontal distance between said lips, and second adjustment means for raising and lowering said inner side walls with respect to said outer side walls.

6. In paper making apparatus comprising a frame, a pair of imperforate breast rolls supported on said frame in closely spaced relation defining a vertical nip therebetween, means cooperating with said breast rolls to define a trough above said nip and between said breast rolls, a pair of couch rolls associated with said breast rolls respectively and supported in spaced relation below the associated said breast rolls, a pair of endless forming webs looped around associated said breast and couch rolls for travel through a forming zone between said breast and couch rolls, and a headbox supported by said frame above said trough, and means for supplying stock

to said headbox assembly, the combination of cover means on the top of said headbox, side wall assemblies connected on opposite sides of said cover means, end walls secured at each end of said side wall assemblies defining therewith a container for holding stock, control means for controlling the flow of stock to said container to maintain a predetermined level therein, lips on the lower end of said side wall assemblies defining therebetween an outlet having a width correlated with said predetermined level in said container to supply stock to said trough at a rate sufficient to maintain a substantial excess of stock in said trough, adjustment means for varying the relative relation of said lips in a horizontal plane to vary the size of said outlet, and means interposed between said headbox and said frame for moving said headbox in a vertcial direction to adjust the vertical spacing between said lips and said nip to vary the level of stock in said trough.

7. In paper making apparatus comprising a frame, a pair of imperforate breast rolls supported on said frame in closely spaced relation defining a vertical nip therebetween, means cooperating with said breast rolls to define a trough on one side of said nip and between said breast rolls, a pair of couch rolls associated with said breast rolls respectively and supported in spaced relation with the associated said breast rolls, a pair of endless forming webs looped around associated said breast and couch rolls for high speed travel through a forming zone between said breast and couch rolls, headbox means mounted on said frame for supplying stock to said trough, and means for supplying stock to said headbox, the combination of lips extending from said headbox into said trough and defining a converging passage terminating within said trough, and control means for regulating said stock supplying means to a supply rate maintaining said lips fully submerged in stock within said trough while also maintaining a continuous flow of stock through said nip into said forming zone.

8. The combination defined in claim **7** comprising means establishing a minimum relative spacing of said lips sufficiently wider than said nip between said breast rolls to maintain a lower rate of flow of stock between said lips than through said nip and thereby to cause the stock to accelerate in flow rate as it enters said nip.

9. In paper making apparatus comprising a frame, a pair of imperforate breast rolls supported on said frame

in closely spaced relation defining a vertical nip therebetween, means cooperating with said breast rolls to define a trough above said nip and between said breast rolls, a pair of couch rolls associated with said breast rolls respectively and supported in spaced relation below the associated said breast rolls, a pair of endless forming webs looped around associated said breast and couch rolls for travel through a forming zone between said breast and couch rolls, headbox means mounted on said frame, and means for supplying stock ot said headbox means, the combination of means defining at least one passage leading from said headbox means to a level within said trough below the top of said trough, control means for regulating said stock supplying means to maintain the depth of stock in said trough above said level, baffle means located below said nip between each said breast roll and the associated such forming web for minimizing suction through such webs in the areas closely below said nip, and means between said baffle means and said couch rolls for effecting drainage of liquid through such webs.

10. The combination defined in claim **9** wherein said baffle means comprises a pair of blocks each associated with one of said breast rolls, each of said blocks having a flat surface arranged for engagement with the associated such forming web and a cylindrically curved surface substantially matching the adjacent surface portion of the associated said breast roll, said curved and flat surfaces of each said block intersecting to define a top edge for said block, and said blocks being positioned with said edges extending substantially to the line of separation of each such web from its associated said breast roll below said nip.

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DONALL H. SYLVESTER, *Primary Examiner.*

MORRIS O. WOLK, *Examiner.*