

Feb. 16, 1971

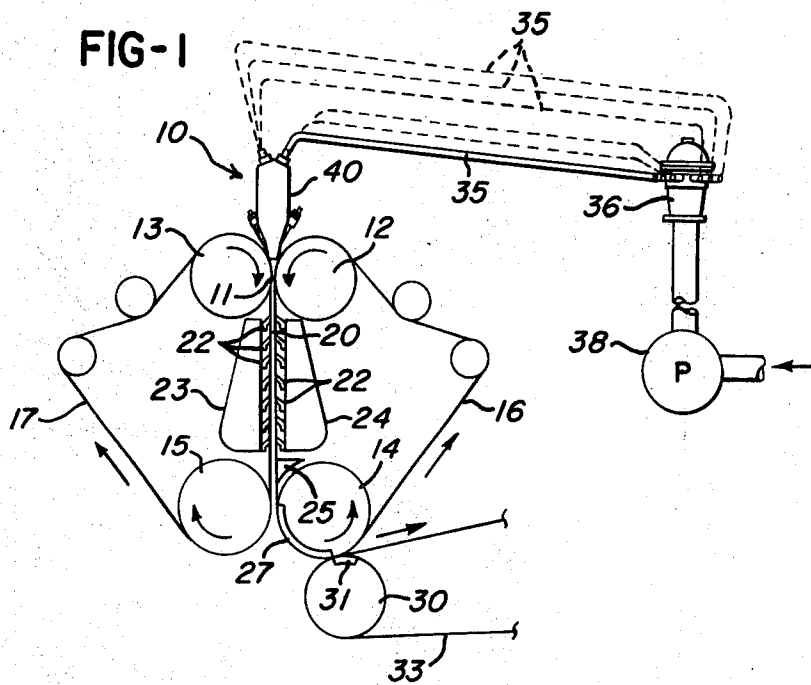
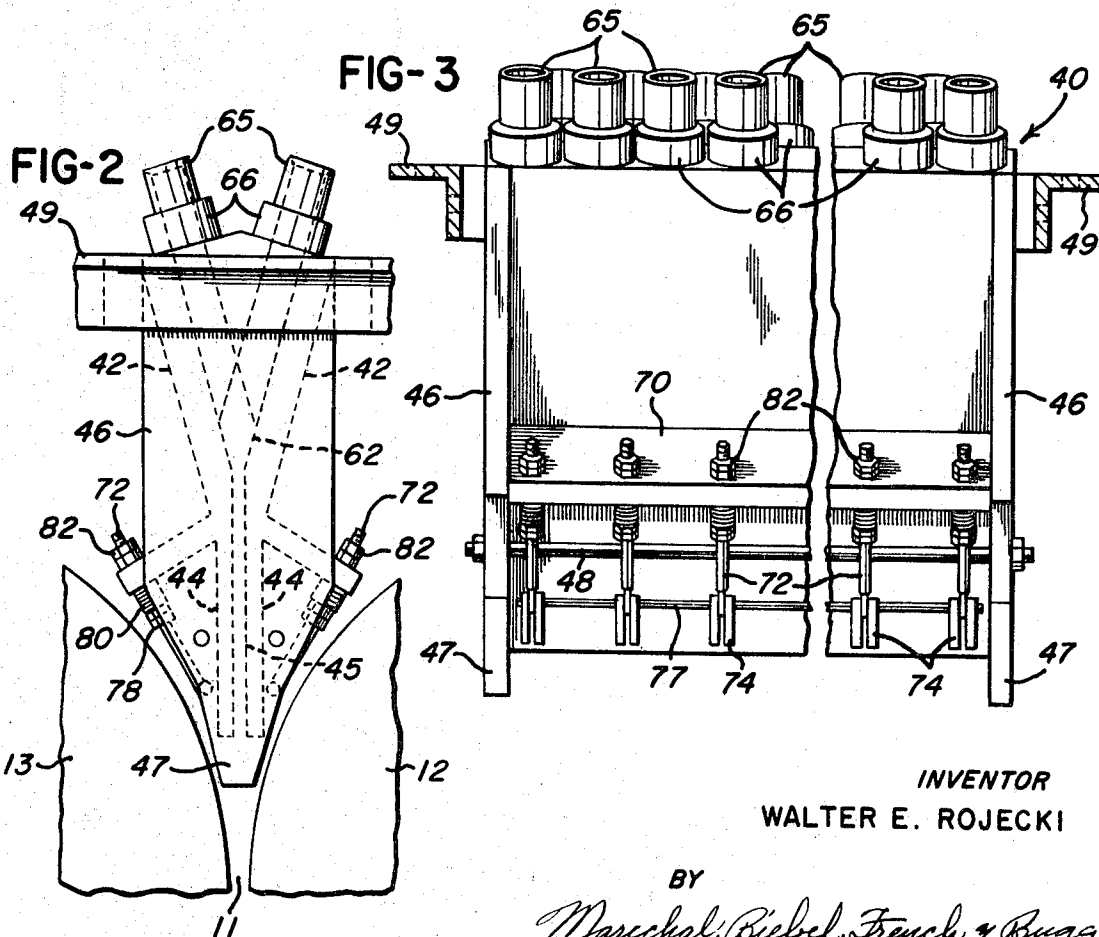
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3,563,852

HEADBOX FOR TWIN WIRE PAPER MAKING APPARATUS

Filed Aug. 11, 1967

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG-4

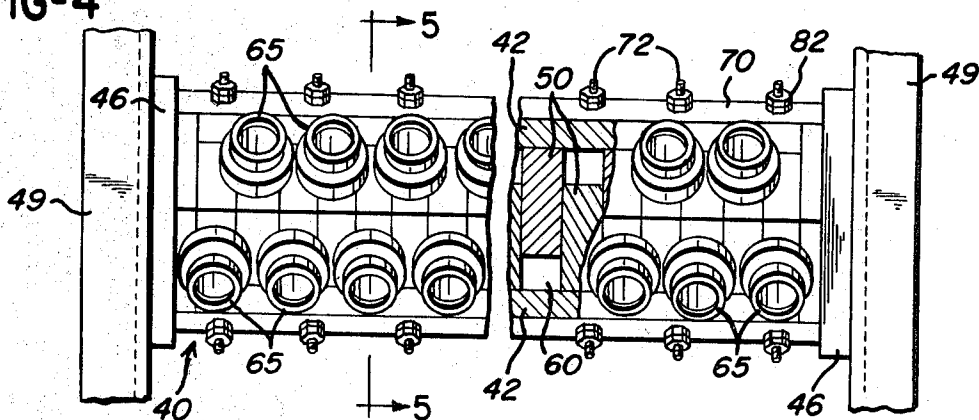


FIG-5

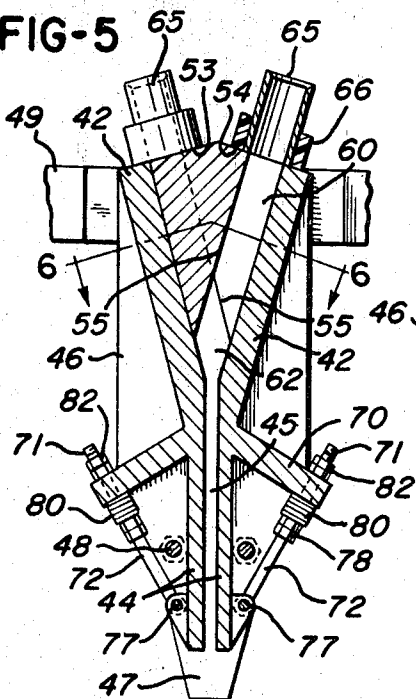


FIG-6

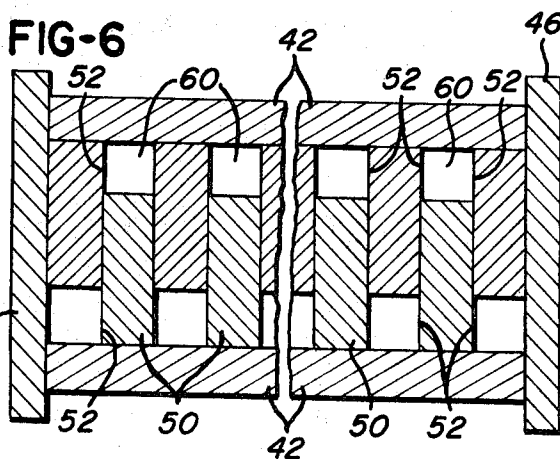
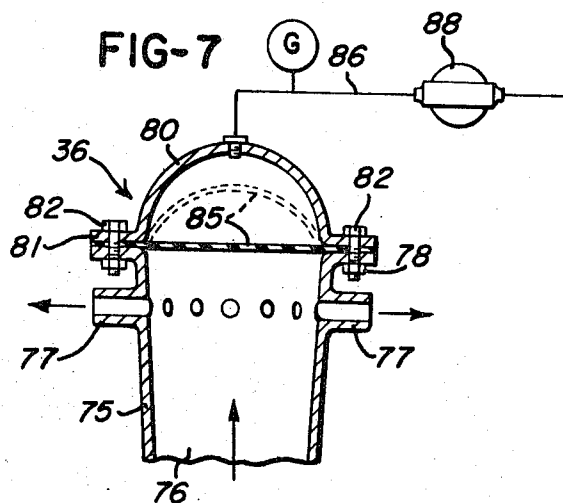


FIG-7



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HEADBOX FOR TWIN WIRE PAPER MAKING APPARATUS

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9 Claims

ABSTRACT OF THE DISCLOSURE

A headbox for use with a twin wire vertical paper making machine comprises a main body having therein two rows of downwardly extending stock inlet passageways which converge in an alternating manner into a high pressure blending chamber extending parallel to the nip, and spaced lip members defining a discharge slot leading from the blending chamber for directing a controlled stream of paper making stock downwardly into the forming zone at a velocity substantially equal to the speed of the wires.

BACKGROUND OF THE INVENTION

The headbox of the invention is adapted for use on a paper making machine generally of the type shown in Baxter U.S. Reissue Pat. No. 25,333 and characterized by the incorporation of a pair of endless forming wires or webs arranged to travel substantially vertically in closely spaced relation for defining a forming zone wherein the formation of the paper sheet or web takes place. As shown in Green Pat. No. 3,215,593, issued to the assignee of this application, the paper making stock may be supplied to the forming zone by flooding the space above the breast roll nip with stock discharged from the bottom slot of a headbox positioned directly above the nip extending parallel to the breast rolls.

Another form of headbox which has proved successful for supplying stock to the nip between the breast rolls is disclosed in copending application Ser. No. 434,051 filed Feb. 19, 1965, now Pat. No. 3,450,596, and assigned to the assignee of the present invention. It has been found, however, that with some paper making stock, it is desirable to avoid flooding the space above the nip and to feed the stock directly into the forming zone at substantially the speed of the wires to prevent entrapment of air within the stock in the forming zone. Moreover, it is important with some paper making stocks to minimize the internal volume of the headbox so that large quantities of the stock do not dwell therein sufficiently long to result in settling or separation which tends to cause non-uniformity in the paper sheet.

SUMMARY OF THE INVENTION

The present invention is directed to an improved compact headbox wherein the paper making stock is directed downwardly into the forming zone under pressure and at a velocity substantially equal to the speed of the forming wires or webs so that the space above the nip is not flooded. The headbox of the invention also provides a high pressure, low volume blending chamber which extends parallel to the nip for receiving multiple flows of stock along its length in such a manner to eliminate the chance for stock to settle or separate within the headbox.

In a typical headbox constructed in accordance with the invention, the paper making stock is directed into the headbox in multiple flows through two inclined rows of downwardly extending passageways arranged in alternately converging relation, and the lower ends of the passageways connect with a common blending chamber. The

stock is directed from the blending chamber between spaced lip members which are effective to produce a high velocity, low pressure stream of stock into the forming zone.

The particular construction and arrangement of the inlet passageways and the blending chamber assure that the stock is uniformly supplied to the blending chamber without cavitation or turbulence and is discharged uniformly between the lip members along the nip and into the forming zone at a velocity substantially equal to the speed of the wires so that relative movement between the stock and the wires is minimized and the entrapment of air in the stock is eliminated.

In addition, this construction provides for continuous acceleration of the stock progressively through the system thereby avoiding hydrodynamically unstable deceleration zones. Other advantages and features of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic view in side elevation illustrating a vertical paper making machine incorporating a headbox constructed in accordance with the invention;

FIG. 2 is an enlarged end view of the headbox shown in FIG. 1;

FIG. 3 is a side elevation of the headbox shown in FIG. 2;

FIG. 4 is a plan view of the headbox shown in FIG. 3, with a part shown in section;

FIG. 5 is a section taken generally on the line 5—5 of FIG. 4;

FIG. 6 is a section taken generally on the line 6—6 of FIG. 5; and

FIG. 7 is a section of a pulse dampening system.

DESCRIPTION OF A PREFERRED EMBODIMENT

The paper making machine of FIG. 1 is shown as generally of the type disclosed in Baxter patent Re. 25,333. The headbox 10 delivers stock to the nip 11 of a pair of metering or breast rolls 12 and 13. Couch rolls 14 and 15 are respectively positioned in parallel relationship below the breast rolls 12 and 13, and the corresponding breast and couch rolls have forming wires 16 and 17 entrained therearound so that a vertical forming zone 20 is defined between the breast and couch rolls.

The forming wires 16 and 17 move downwardly from the nip 11 through the forming zone 20 in gradually converging paths guided by the supporting deflectors 22 which exert a squeezing action on the stock between the wires to expel the white water therefrom through the wires into the collection pans 23 and 24 from where it is returned to the white water supply system. As the wires 16 and 17 leave the last pair of deflectors 22, the suction box 25 holds the newly formed web on the wire 16 and separates it from the wire 17. 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 is shown schematically in FIG. 1 as including multiple stock supply lines 35 which connect the headbox 10 to a flow divider 36 similar to that disclosed in Green et al. Pat. No. 3,296,066. Stock is supplied to the flow divider 36 by a suitable pump 38 connected to the usual supply lines or chests, not shown, or fresh stock and white water.

Referring to FIGS. 2-6, the headbox 10 includes an elongated body 40 which extends substantially the full length of the breast rolls 12 and 13. The body 40 includes a pair of converging flat side walls 42 forming a V-shaped angle therebetween. The walls 42 are integrally connected

to corresponding flat lip members 44 which extend longitudinally to define a discharge slot 45 spaced in vertical alignment with the nip 11. The lip members 44 may be either parallel or slightly converging towards the bottom of the slot.

The side walls 42 are rigidly connected on opposite ends by end walls 46 having lower generally V-shaped portions 47 which project slightly below the lower edges of the lip members 44 and somewhat closer to the nip 11. The lip members 44 abut the end walls 46 but are not rigidly connected so that the lip members 44 can move relative to the end walls 46. Tie bolts 48 connect the lower portions 47 of the end walls to prevent spreading, and angle mounting brackets 49 are secured on the upper portions of the end walls 46 for supporting the headbox in the position shown in FIG. 1.

The side walls 42 are provided with a series of interfitting generally triangular shaped block portions 50 which are integrally or otherwise rigidly connected to each other as well as to the side walls 42. Each block portion 50 has parallel flat side surfaces 52, flat upper end surfaces 53 and 54 which are angularly disposed, and a flat edge surface 55. As illustrated in FIG. 5, the surface 55 of each block portion 50 is spaced parallel to the inner surface of the opposing side wall 42 by a distance equal to the thickness of the block 50 so that the interfitting block portions 50 and side walls 42 cooperate to define two rows of downwardly extending and alternately converging passageways 60 each having a square cross-sectional configuration.

The lower portions of the surfaces 55 of the block portions 50 cooperate with the lower inner surface of the converging side walls 42 to define a longitudinally extending blending chamber 62 interconnecting the lower ends of the passageways 60 and having a generally diamond-shaped profile. The blending chamber 62 opens downwardly into the discharge slot 45 defined between the lip members 44.

A cylindrical inlet tube 65 is positioned above the upper end of each passageway 60 and is supported by a sleeve 66 rigidly secured to the upper coplanar surfaces of the adjacent side wall 42 and blocks 50 surrounding the passageway 60. As illustrated in FIG. 1, the inlet tubes 65 are connected to the corresponding stock supply lines 35 which lead from the flow divider 36. It is to be understood, however, that stock may be supplied to the passageways 60 by other means, as for example, the inlet tubes 65 may be connected by a single manifold pipe or header connected to receive stock from the pump 38. The header or pipe would preferably have a longitudinally tapered configuration to provide for a uniform flow rate of stock into each of the tubes 65 and corresponding passageways 60.

Referring to FIGS. 3 and 5, a longitudinally extending flat plate 70 extends integrally from the lower portion of each side wall 42 at the junction of the corresponding lip member 44, and includes a series of longitudinally spaced holes 71. A threaded rod 72 extends through each hole 71 and has a head portion pivotally connected to a corresponding bracket 74 rigidly connected to the corresponding lip member 44 adjacent its lower edge. A longitudinally extending rod 77 extends through aligned holes formed within the brackets 74 and head portions of the rods 72 for each lip member 44 to form the pivot connection.

A pair of lock nuts 78 are mounted on each rod 72 and cooperate with the underneath surface of the corresponding plate 70 to confine a compression spring 80 mounted on the rod. A second pair of lock nuts 82 are mounted on the upper end portion of each rod 72 above the corresponding plate 70, and as a result of the slight flexibility of each lip member 44, the lip members can be warped to adjust the width of the discharge slot 45 for controlling the velocity of the stock into the nip 11. As mentioned above, the lip members 44 may be spaced

parallel or converge slightly towards their lower edges, but normally would never be adjusted to diverge downwardly.

It is desirable to employ some means for dampening pulsation in the paper making stock flowing from the pump 38. While different forms of dampening means may be used, preferably the pulse dampening means is incorporated as a part of the flow divider 36. Thus referring to FIG. 7, the flow divider 36 includes a generally cylindrical housing 75 which has an axially extending inlet 76 connected to the pump 38 and a series of circumferentially spaced radially extending outlet tubes 77 which are connected to the corresponding inlet tubes 65, by the lines 35. The housing 75 includes an upper peripheral flange 78 on which is mounted a semi-spherical or dome-shaped cover 80 having a base flange 81 secured to the flange 78 by a series of bolts 82.

A resilient thin rubber membrane or diaphragm 85 is clamped between the flanges 78 and 81 so that it is positioned adjacent the outlet tubes 77 and normal to the stock flow into the inlet 76, and is adapted to deflect or extend into the cover 80 as indicated by the dotted line in response to pulses in the stock flow through the inlet 76 from the pump 38. Air is supplied to the cover 80 above the diaphragm 85 by a line 86 extending from the top center of the cover to a suitable air source through a controller 88.

The volume of the cover 80 is so calculated to have a critical frequency equal to or slightly less than the lowest imposed stock line frequency to provide maximum sensitivity to vibration pulses and thereby to provide effective pulse absorption. The air pressure within the cover 80 above the diaphragm 85 is controlled by the controller 88 so that the pressure is substantially equal to the stock pressure in the line from the pump 38 so that the diaphragm 85 is normally maintained in the generally flat position as indicated and deflects from this position when a pulse is received.

The paper making stock is supplied to the passageways 60 at uniform pressure from the combined flow divider and pulse dampener 36 and then flows from the passageways 60 into the blending chamber 62 where the pressure remains relatively high, as for example, on the order of 20 p.s.i. The stock then increases in velocity within the slot 45 between the lip members 44 and is discharged from the lower end of the slot 45 at a velocity substantially equal to the speed of the wires 16 and 17. As a result of the increase in velocity of the stock between the lip members 44, the pressure drops to a substantially lower value, as for example, on the order of 1.5 p.s.i.

From the drawings and the above description, it becomes apparent that a headbox constructed in accordance with the invention provides several desirable features and advantages. For example, one important advantage provided by the headbox 10 is that the stock flows uniformly from the discharge slot 45 into the nip 11 and forming zone 20 at a high velocity so that there is no chance for entrapping air entrapped within the stock. The small volume of the blending chamber 62 also assures that the stock cannot collect and dwell for sufficient time to produce settling or separation of the heavier fibers within the stock. The structural requirements of the headbox are minimized as a result of the direct load transfer between the plates or side walls 42 and the generally triangular segments or blocks 50, thereby eliminating a beam action in the body 40.

Another important feature of the headbox 10 is provided by the interfitting relationship of the blocks 50 and the cooperation of the blocks with the converging side walls 42 to define the square passageways 60. That is, by having the abutting side surfaces 52 of each adjacent pair of blocks in coplanar relationship, the passageways 60 converge alternately in a staggered or offset relation to effect a flow of stock into the chamber 62 contiguously along its length and thereby assure a uniform flow of stock from

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the chamber into the slot 45 without cavitation or turbulence. As a result, a uniform flow of stock flows from the bottom of the slot 45 into the forming zone 20 for producing a paper web of especially high quality.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form 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. A headbox for delivering paper making stock to a paper making machine having a pair of breast rolls arranged in horizontally spaced relation defining a vertically extending nip therebetween and a pair of endless forming webs arranged for travel around said breast rolls and downwardly through said nip in spaced converging relation defining a forming zone therebetween, said headbox comprising an elongated body extending parallel to said breast rolls above said nip, means defining a plurality of longitudinally spaced passageways along the length of said body and extending downwardly within said body, each said passageway having an upper inlet end and a lower discharge end, means defining a longitudinally extending blending chamber connecting said discharge ends of said passageways, a pair of substantially parallel spaced lip members extending downwardly from said blending chamber and including opposed substantially vertical inner surfaces defining a longitudinally extending narrow discharge outlet, said inner surfaces extending downwardly between said breast rolls in vertical alignment with said nip, means for effecting relative movement of said lip members to change the spaced relation of said inner surfaces thereof and the width of said outlet, and means for supplying stock to said upper inlet ends of said passageways to effect a high velocity downward stream of uniformly blended stock through said outlet and into said nip.

2. A headbox as defined in claim 1 wherein said passageways in one of said rows are offset longitudinally in relation to said passageways in the other said row to form an alternately converging relationship among said passageways for producing a uniform flow of stock into said blending chamber.

3. A headbox as defined in claim 1 wherein each said passageway has a substantially square and uniform cross-sectional configuration formed by opposing flat wall surfaces, and each said passageway within each said row has at least one of said side wall surfaces in coplanar relation with one of said side wall surfaces of the next successive said passageway in the other said row to provide

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a flow of stock into said blending chamber contiguously along the length of said chamber.

4. A headbox as defined in claim 3 wherein said side wall surfaces defining said passageways cooperate to define said blending chamber and provide said chamber with a generally diamond-shaped profile.

5. A headbox as defined in claim 1 wherein said means defining said passageway comprise a series of generally triangularly shaped block portions, a pair of converging side wall members support said block portions in inter-fitting spaced relation so that said side wall members, and block portions cooperate to define said rows of alternately converging said passageways.

6. A headbox as defined in claim 1 wherein said stock supplying means include resilient diaphragm means for dampening pulses within the flow of stock into said passageways.

7. A headbox as defined in claim 1 wherein said stock supplying means include a generally cylindrical flow divider housing having means defining an axially extending inlet and a plurality of radially extending outlets, a resilient diaphragm mounted on said housing and positioned adjacent said outlets generally normal to the flow of stock through said inlet, a cover mounted on said housing over said diaphragm member, and means for controlling the air pressure within said cover in back of said diaphragm for dampening the pulses within the flow of paper making stock into said inlet.

8. A headbox as defined in claim 7 wherein said housing includes a peripheral flange adjacent said outlets, a cover having a semi-spherical dome and a circumferential external flange, means for connecting said flanges of said housing and said cover with said diaphragm member therebetween, an air supply line connected to said cover, and said controlling means comprising a controller within said air supply line.

9. A headbox as defined in claim 1 wherein said passageways are arranged in two longitudinally extending rows and converge toward said blending chamber.

References Cited

UNITED STATES PATENTS

3,296,066	1/1967	Green et al.	162—338
3,450,596	6/1969	Green	162—344

REUBEN FRIEDMAN, Primary Examiner

T. A. GRANGER, Assistant Examiner

U.S. Cl. X.R.

162—303, 340, 343