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3,515,635

PAPERMAKING MACHINE HEADBOX

Filed March 27, 1967

2 Sheets-Sheet 1

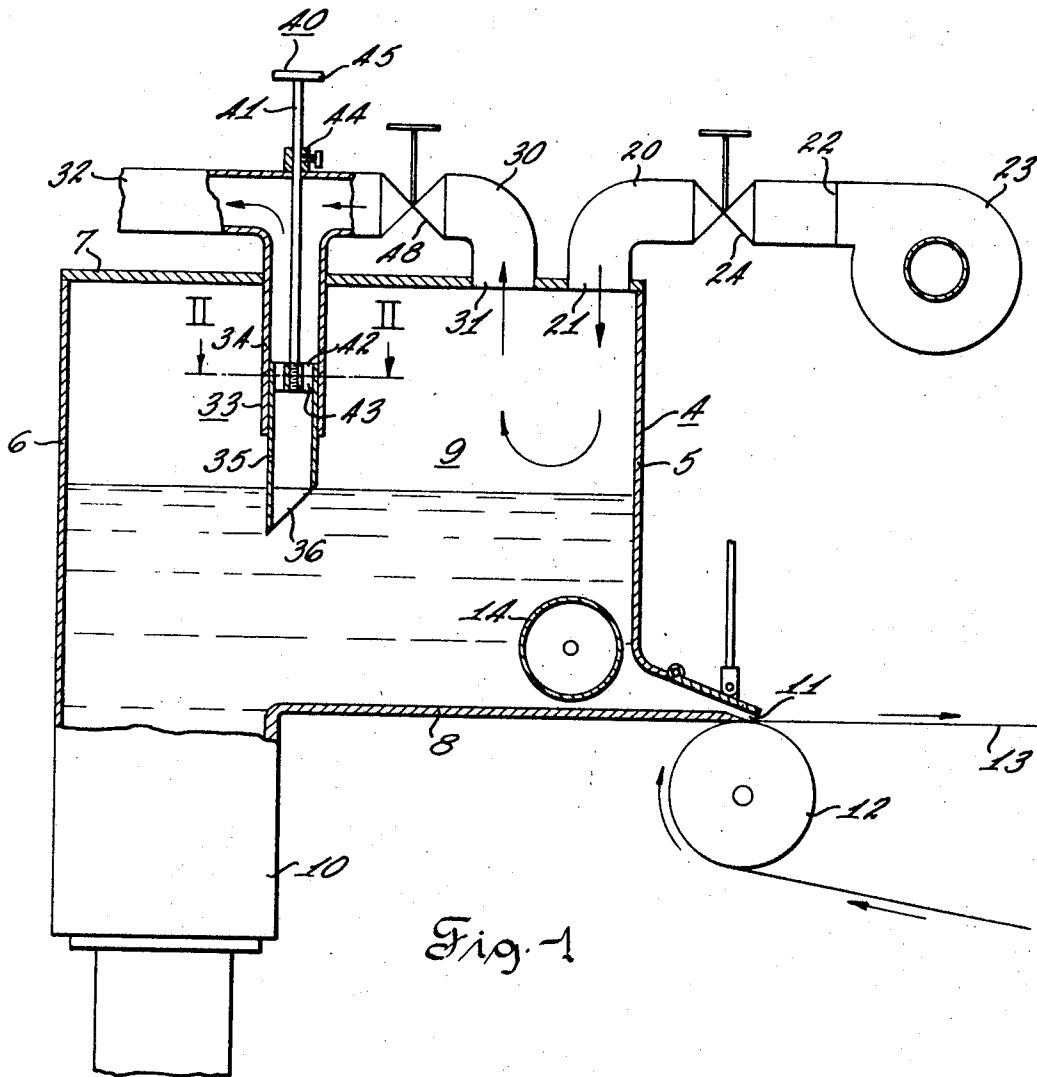


Fig. 1

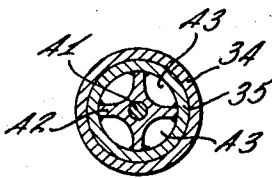


Fig. 2

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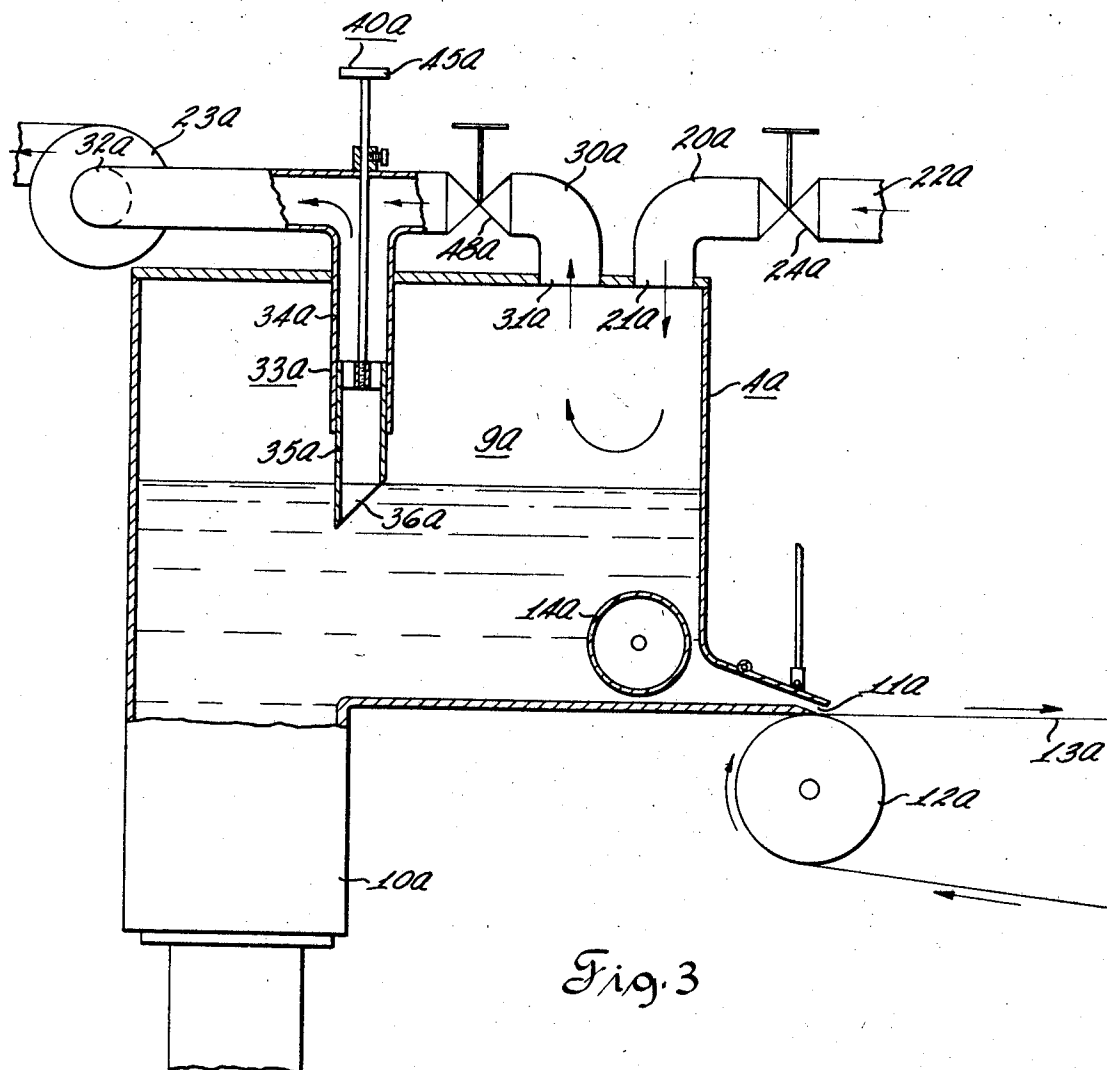
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PAPERMAKING MACHINE HEADBOX
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5 Claims

ABSTRACT OF THE DISCLOSURE

A stock inlet portion of a papermaking machine is disclosed having a headbox for containing a pond of stock and arranged to discharge the stock through a slice outlet. The headbox may be constructed to operate with above atmospheric pressure or with a partial vacuum over the pond within the headbox. A gas inlet conduit and a gas outlet conduit are both connected to the top of the headbox and project therefrom. The projecting end of one of the conduits is connected to a gas pump for causing air to move in and out of the space within the headbox over the stock pond. A vertical standpipe assembly depends from the gas outlet and terminates on its lower end with an orifice that provides for a relatively stabilized head of stock around the standpipe assembly within the headbox at the level of the orifice.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a headbox for a papermaking machine and in particular with a headbox construction that will maintain a predetermined level of paper stock within the headbox.

The function of any headbox is to discharge paper stock evenly across the entire width of a web forming device such as a Fourdrinier wire. Because the web forming wire is moving away from the headbox with a considerable velocity, the stock must spout out of the headbox through a slice opening with optimum velocity. The velocity of the stock spouting from the slice is determined by the total pressure head of stock within the headbox. The total pressure head of the stock is the net total of the gas pressure above the stock within the headbox plus the head of stock within the headbox above the slice opening. For any selected flow rate of stock from a headbox to a web former, there is an optimum total pressure head for the stock within the headbox that should be maintained as closely as possible. Variation in stock feed to the headbox tends to change the stock level and head, and must therefore be compensated for by a change in pressure over the stock tending to restore the desired head and maintain the desired uniform discharge of stock through the slice opening.

DESCRIPTION OF THE PRIOR ART

U.S. Pat. 2,381,286 discloses in FIG. 10 a float operative valve of a construction which, when arranged within a headbox as shown in FIG. 9, will either admit air pressure or vent air pressure above the stock within an enclosed headbox to compensate for variations in stock feed to the headbox. That is, if feed to the headbox is reduced, the level within the headbox will drop and the float operated valve closes the vent and opens the air inlet to increase the air pressure on the stock. The increased air pressure compensates for the drop in stock level and the total pressure head remains relatively constant. A disadvantage of this construction is that it depends on the proper operation of the movable parts within the float operated valve located entirely within the head-

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box and sticking parts can cause the device to fail to operate properly. Access to such parts requires opening the headbox. Another disadvantage of this construction is that there is no provision for adjusting the mechanism to change the desired stock level within the box without opening the box.

A later U.S. Pat. 2,509,822 discloses a headbox that to a degree overcame the disadvantages of the construction according to U.S. Pat. 2,381,286. According to U.S. Pat. 2,509,822, a series of vertically spaced holes are provided in a side wall of the headbox, each providing a possible stock level. A plug is placed in all but one of the holes. The unplugged hole is connected by a conduit to a white water pit beneath the machine. If this arrangement is operated as a pressure headbox, air pressure is discharged into the headbox above the stock level. Either air or stock will always be passing through the unplugged hole to the white water pit (depending upon whether stock is or is not covering the hole) and the total pressure head of the stock level and the pressure over the stock remains relatively constant.

If the arrangement of U.S. Pat. 2,509,822 is operated as a vacuum headbox a vacuum pump is inserted in the line from the unplugged hole to the pit. If the feed to the head box is reduced the stock level will drop, uncovering the hole connected to the pit and permitting the air pressure to escape reducing the pressure over the stock and reducing the resistance to the inflow of stock. With reduced resistance to stock inflow, the stock level will rise. When the stock level rises above the level of the hole connected to the pit the air pressure above the stock will increase thereby creating a greater resistance to stock inflow and slowing down the stock inflow and slowing down the stock feed until the desired stock level is reestablished and both stock and air will bleed through the unplugged hole. A disadvantage of this construction is that stock is discharged to the white water pit and power is required merely to recirculate this stock back to the headbox. Another disadvantage of this construction is that there is no provision to adjust the level of the stock to a level between the vertically spaced holes in the headbox wall.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a headbox with a new and improved stock level control that can be adjusted without opening the headbox.

It is another object of the invention to provide a headbox with a new and improved stock level control that does not require stock from the headbox to bypass the slice.

Still another object of the present invention is to provide a new and improved stock level control that can be adjusted from outside the headbox to provide for a stock to any desired level in the box, without the need to provide numerous plugged holes in a wall of the headbox.

According to a preferred embodiment of the present invention as it may be applied to a pressure headbox, a gas inlet conduit is connected on one end to the top of the headbox and on its second end to a gas pump. A gas outlet conduit is connected on one end to the top of the headbox and its second end is open to the atmosphere. A vertical standpipe depends from a midportion of the gas outlet conduit and projects downwardly through the top of the headbox and terminates with an orifice at a level below the ends of the conduits connected to the top of the headbox, but above the slice outlet. A valve may be provided in gas outlet conduit between the connections to the headbox and the depending standpipe. When the level of a pond of pulp in the head is

below the orifice of the standpipe, gas pumped into the headbox through the inlet conduit will exit through both the connections of the outlet conduit to the top of the headbox and through the orifice of the standpipe. Under such circumstances when incoming gas discharges through two openings into the outlet conduit, no pressure will build up in the headbox. However, when the headbox is filled with a pond of pulp to a level that closes the orifice of the standpipe, then pressure will build up because the gas can exit only by bypassing the standpipe to exit through the valve in the outlet conduit which restricts the outflow of gas to less than the inflow of gas. As the gas pressure builds up over the pond of pulp a resistance to the inwardly flowing pulp is created and pulp inflow is reduced. When the pond level drops to open the standpipe orifice gas pressure in the headbox will be relieved and pulp flow will increase again to raise the pond level. The upward and downward movement of the level of the pond will be between rather narrow limits and the pulp level will substantially stabilize at the level of the standpipe orifice. This level can be made adjustable by providing a standpipe that comprises a pair of telescoping tubes.

The invention can also be applied to a vacuum headbox by merely connecting the discharge of the gas pump to the second end of the gas outlet conduit, rather than connecting the discharge of the gas pump to the second end of the gas inlet conduit, as has been described for the pressure headbox.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation, partly in section, of a pressurized headbox according to the present invention;

FIG. 2 is a fragmentary view in section taken along line II—III in FIG. 1; and

FIG. 3 is a side elevation, partly in section, of a vacuum headbox according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a pressurized headbox 4 is shown comprising vertical walls including a front wall 5 and back wall 6, top structure 7, bottom structure 8, which define an enclosed chamber 9 having a stock inlet 10 and an adjustable slice 11 in its lower portion.

The headbox 4 is arranged with the slice outlet 11 over a breast roll 12 to discharge stock onto a Four-drainer wire 13 looped over breast roll 12 and moving in the direction indicated by arrows. A distributor roll 14 is arranged within the chamber 9 and is parallel to the slice outlet 11 in the usual manner to aid in achieving equal stock discharge across the entire width of slice outlet 11.

The headbox 4 is provided with a gas inlet conduit 20 which on the first end 21 is connected to the top 7 of the headbox 4, to open into the chamber 9 within the headbox. The second end 22 of conduit 20 is connected to the discharge of a gas pump 23. An adjustable gas flow restricting valve 24 may be placed in the conduit 20 intermediate its ends 21, 22.

A gas discharge conduit 30 is provided having the first end 31 connected to the top 7 of the headbox 4, to be open to chamber 9. The second end 32 of conduit 30 is open to atmosphere. A vertical standpipe assembly 33 depends from a midportion of conduit 30. The standpipe assembly comprises a pair of telescoping tubes 34, 35. The outer tube 34 is connected at its upper end to open into conduit 30 and its lower end projects downwardly through the top 7 of the headbox 4. The inner tube 35 projects downwardly from the lower end of the outer tube 34, and the inner tube 35 terminates with an orifice 36 at a level substantially below the first ends 21, 31 of the conduits 20, 30 but above slice outlet 11.

Adjusting means 40 are provided for positioning the inner tube 35 and its orifice 36 at selected elevations. The adjusting means 40 comprise a positioning rod 41

connected to the top of tube 35 by a spider 42 in a manner shown in FIG. 2. As shown in FIG. 2 the spider 42 can be attached to the inner tube 35 such as by welding and the spider and tube 35 define a plurality of gas passages 43. Referring again to FIG. 1, the rod 41 extends upwardly of spider 42 through the outer tube 34, conduit 30, a rod holder 44 and terminates in a portion external to the tube and conduit, and may be provided with a suitable handle 45 on its upper end.

An adjustable gas flow restricting valve 48 is placed in conduit 30 between its first end 31 and the standpipe assembly 33.

In FIG. 3 a vacuum headbox is shown according to the present invention and parts of this headbox similar to parts of the headbox of FIG. 1 are identified with the same reference number but with the suffix *a* added.

In the headbox of FIG. 3 the end 22a of the gas inlet conduit 20a is open to atmosphere and the second end 32a of the gas discharge conduit 30a is connected to the inlet of a gas pump 23a. This arrangement is therefore the reverse of the arrangement shown in FIG. 1. That is, in the headbox of FIG. 3 the gas pump 23a draws gas (atmospheric air) out of the headbox whereas in the headbox of FIG. 1 the gas pump 23 forces gas into the headbox.

In the operation of a pressure headbox as described with reference to FIG. 1, the valve 48 is adjusted to discharge less gas flow from chamber 9 than is pumped into chamber 9 by pump 23 through conduit 20 and valve 24. However, with no stock in chamber 9 or with a pond of stock not up to the level of orifice 36 of the standpipe assembly 33, gas will also discharge through orifice 36, tube 35, spider passages 43, tube 34 and conduit 30 in a bypass around valve 48. The total discharge through valve 48 and orifice 36 and out the end 32 of conduit 30 will therefore be substantially equal to the gas flow into chamber 9 through conduit 21 and no pressure will be built up within chamber 9. As the headbox is fed stock through the inlet 10 the level of the stock will rise and close orifice 36. Thereafter as incoming stock causes the level of the pond to rise with orifice 36 closed, less gas will be discharged from chamber 9 through conduit 30 than is being pumped into chamber 9 through conduit 20. As the gas pressure increases over the pond of pulp in chamber 9, increased resistance to the inward flow of pulp through inlet 10 is created and pulp flow into the chamber 9 is reduced. When the flow of pulp into the chamber 9 is reduced because of variations in stock pressure delivered to the inlet 10, then the level of the pond in chamber 9 will drop. When the dropping stock level opens orifice 36 the gas pressure in chamber 9 over the stock pond will be vented to atmosphere thus reducing the resistance to the inward flow of stock and stock flow into chamber 9 through inlet 10 will increase and the level of the pond will rise. These variations in stock level will be relatively small and the level of the pond in chamber 9 will be substantially stabilized.

In the operation of the vacuum headbox shown in FIG. 3, the valve 48a would also be adjusted to discharge less gas from the chamber than the valve 24a permits to flow into chamber 9a. With a level of stock in chamber 9a not up to orifice 36a, the pump 23a will draw gas out of chamber 9a creating a partial vacuum that will cause an inrush of air into conduit 20a and chamber 9a. As long as orifice 36a is open the valves 48a and 24a can be adjusted so that air is pumped out of chamber 9a at a rate greater than can pass into chamber 9a and a partial vacuum will then be maintained in chamber 9a. As stock flows into chamber 9a and the pond level rises under the influence of both the pressure of incoming stock and the partial vacuum above the pond in chamber 9a, and the orifice 36a will be closed. When orifice 36a is closed air will enter chamber 9a under atmospheric pressure at a greater rate than pump 23a can draw air out through valve 48a and the vacuum will be reduced until the level of the stock in chamber 9a drops sufficiently to reopen

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orifice 36a. In this embodiment of the present invention, as with the embodiment shown in FIG. 1, the variations in stock level will be small and the level of the pond in chamber 9a will be substantially stabilized.

In both embodiments that have been described, it will be a simple matter to make sure that the standpipe assembly 33 or 33a has sufficient vertical height to make certain that stock rising in the standpipe will never be drawn or forced out of the standpipe. Thus a column of stock in the standpipe will be returned to the pond as the stock level drops without the need of any power requirements or costs. Further, the position of orifices 36 and 36a can be adjusted to any vertical position desired and without any need to open the headbox. There is no danger of stock causing the tubes 34, 35 or 34a, 35a to stick together because a light blow can be applied to the top of the handle 45 or 45a to free these members in the unlikely event that stock fibers cause the two tubes to stick together.

From the foregoing detailed description of the present invention, it has been shown how the objects of the present invention have been attained in preferred arrangements for pressure and vacuum headboxes. However, modification and equivalents of the disclosed concepts such as readily occur to those skilled in the art are intended to be included in the scope of this invention. Thus, the scope of the invention is intended to be limited only by the scope of the claims such as are or may hereafter be appended hereto.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A headbox for a papermaking machine comprising: vertical walls, top structure and bottom structure defining a closed chamber having a stock inlet arranged to flow stock into the lower portion of the chamber for forming a pond of stock in the chamber and a stock discharge slice outlet arranged to discharge stock from a lower portion of the chamber;

a gas inlet conduit having a first end and a second end, with the first end connected to said chamber through the top structure and said second end external to the chamber;

a gas discharge conduit having a first end and a second end, with the first end connected to said chamber through the top structure and said second end external to the chamber;

a gas pump connected to the second end of one of said conduits to provide a gas flow from the second end of the gas inlet conduit through said discharge conduit to the second end of the gas discharge conduit;

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a vertical standpipe assembly comprising a pair of concentric telescopic tubes consisting of an inner and outer tube, the upper end of said outer tube connected to open into the gas discharge conduit and said inner tube projecting downwardly from said outer tube to define an orifice at the lower end of said inner tube, said standpipe assembly projecting downwardly through the top structure of said chamber such that said orifice terminates at a level above said slice outlet; orifice level adjusting means connected to the inner of said concentric tubes and projecting upwardly through the outer of said tubes and terminating in a portion external to said standpipe and gas discharge conduit; and said gas discharge conduit having a gas flow restricting valve intermediate the first end thereof and the standpipe assembly connection thereto, said valve defining an internal gas flow restricting passage smaller than the internal passage through said gas inlet conduit so that a rising level of stock in the chamber that closes the orifice of the standpipe results in less gas flow out of said chamber than gas flow into said chamber through said gas inlet conduit and a build-up of gas pressure in said chamber that acts to cause the stock level to drop until the standpipe orifice is opened.

2. A headbox according to claim 1 in which said orifice level adjusting means comprises a positioning rod connected to said inner tube by a spider, and said rod projecting upwardly through the outer tube and the gas discharge conduit, and a rod holder for securing the rod and connected inner tube in selected vertical positions.

3. A headbox according to claim 1 in which the valve is an adjustable gas flow restricting valve.

4. In a headbox according to claim 1 in which said gas pump is connected to the second end of said gas inlet conduit to pressurize the space in said chamber over the pond.

5. In a headbox according to claim 1 in which said gas pump is connected to the second end of said gas discharge conduit to draw a vacuum on the space in said chamber over the pond.

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UNITED STATES PATENTS

2,664,033 12/1953 Hornbostel et al. 162—340

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U.S. Cl. X.R.

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