Oct. 27, 1970 K. WOLF 3,536,581

OVERFLOW CONTROL FOR BREAST BOX OF A PAPER MAKING MACHINE

Filed March 8, 1967 2 Sheets-Sheet 1

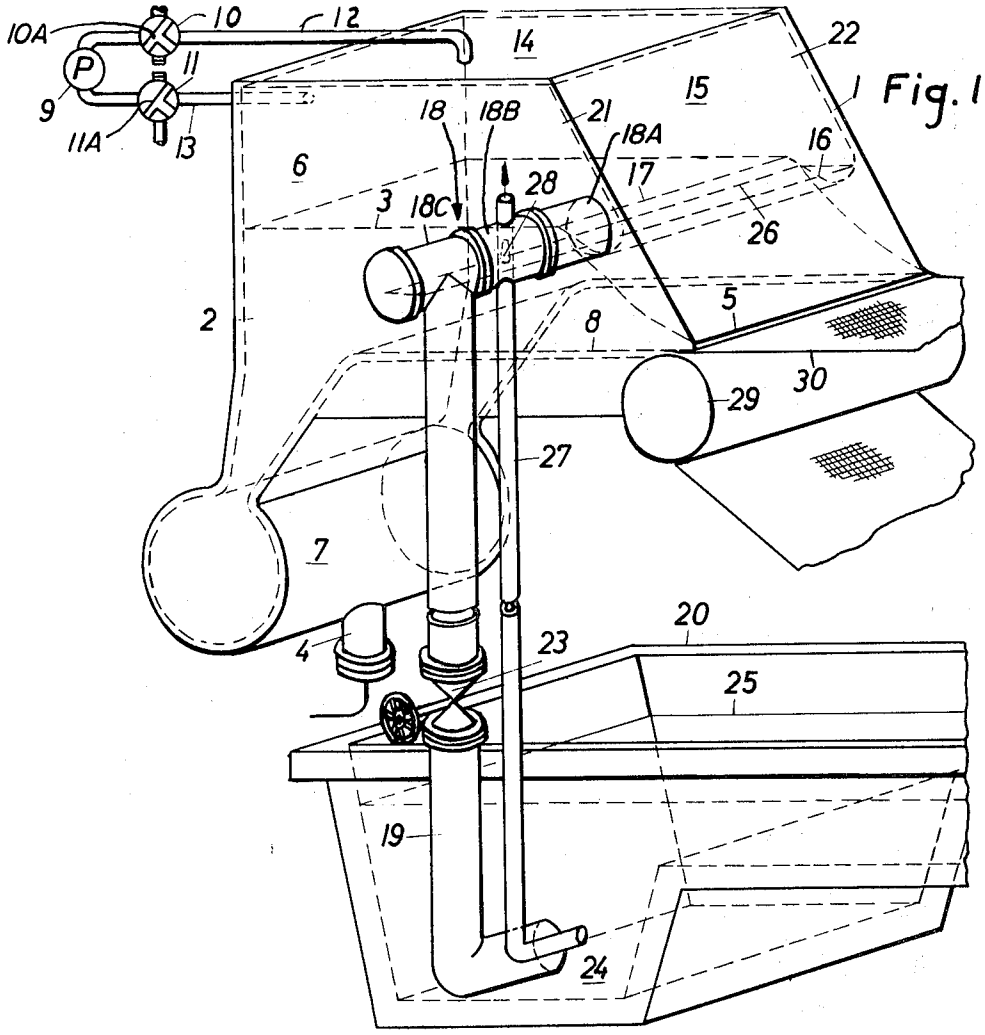


Fig. 1

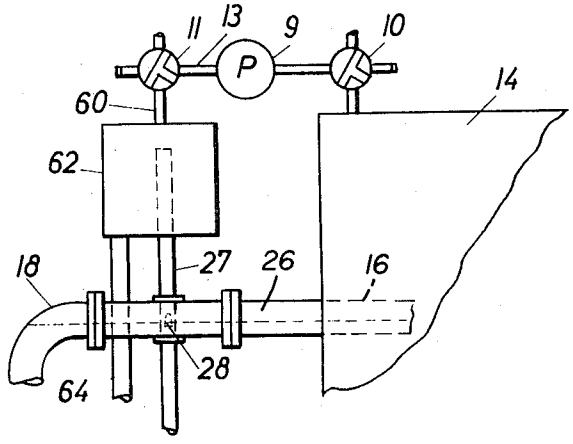


Fig. 4

INVENTOR.
KARL WOLF

BY

Melvin A. Crosby

Oct. 27, 1970 K. WOLF 3,536,581

OVERFLOW CONTROL FOR BREAST BOX OF A PAPER MAKING MACHINE

Filed March 8, 1967 2 Sheets-Sheet 2

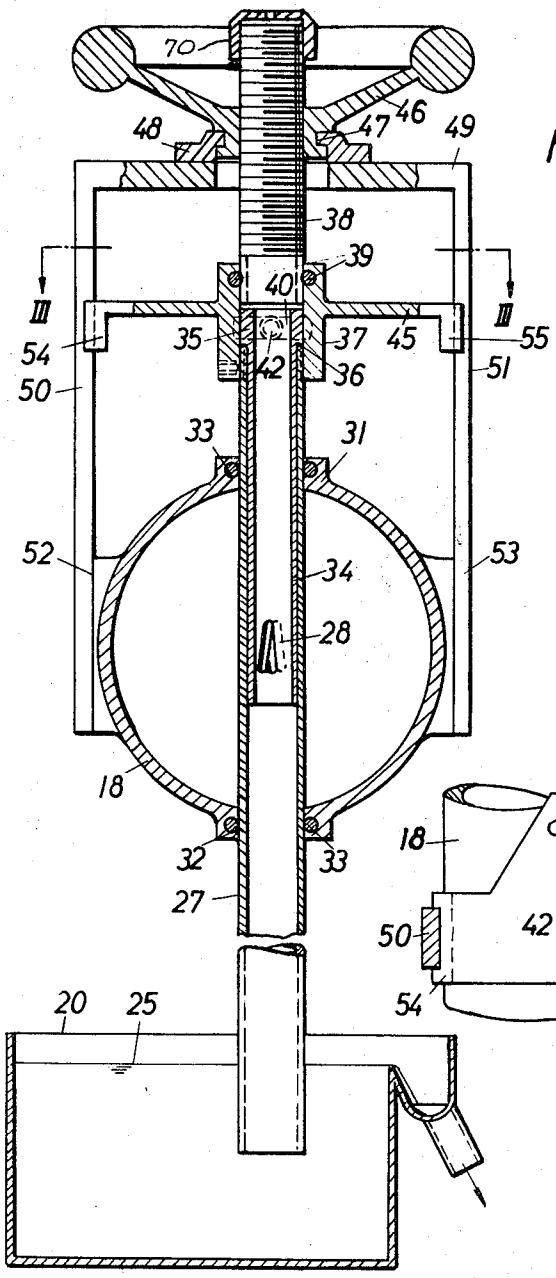
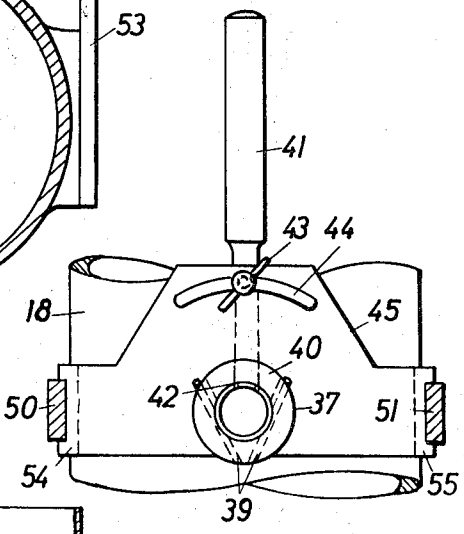


Fig. 2

Fig. 3



INVENTOR.
KARL WOLF
BY
Melvin A. Cranley

United States Patent Office 3,536,581 Patented Oct. 27, 1970

3,536,581

OVERFLOW CONTROL FOR BREAST BOX OF A PAPER MAKING MACHINE

Karl Wolf, Heidenheim-Schnaitheim, Germany, assignor to J. M. Voith GmbH, Heidenheim, Brenz, Germany

Filed Mar. 8, 1967, Ser. No. 621,660
Claims priority, application Germany, Mar. 16, 1966, 1,511,239
Int. Cl. D21f 1/02
U.S. Cl. 162—259 14 Claims

ABSTRACT OF THE DISCLOSURE

A closed breast box for a paper making machine having an overflow gutter or trough inside the breast box above the discharge nozzle to skim off foam from the suspension in the breast box and connected to a drain conduit. An air pump is connected to an air space or cushion in the breast box above the suspension. Devices in the form of an auxiliary drain conduit and a line to the atmosphere control the levels of the suspension in the gutter and in the breast box and, thus, also the air pressure in the air space or cushion.

CROSS REFERENCE TO A RELATED APPLICATION

This application is based on German application, Ser. No. V 30,645, filed Mar. 16, 1966.

BACKGROUND OF THE INVENTION

The present invention relates to a breast box for paper machines, cardboard machines and similar machines for making webs from fibrous suspensions in which the breast box is essentially closed off from the atmosphere and is equipped at the one side of its lower portion with a feed line, and at the opposite side at the lower portion with a discharge nozzle. The breast box, furthermore, is equipped above the level of the fiber suspension therein with an air cushion in the chamber formed at the top of the breast box which is created and maintained by an air pump.

The fiber suspension passes through the discharge nozzle to a wire or other water permeable draining surface. Such machines operate at high operational speeds whereby the liquid level of the fiber suspension inside the breast box is rather close to the bottom thereof to avoid the creation of regions of low suspension velocity in the breast box in which fibers could flocculate. A certain pressure is needed for bringing about an outlet velocity of the fiber suspension issuing from the discharge nozzle, which velocity will correspond to the speed of movement of the member forming the draining surface, and this velocity is brought about, in the main part, by the air cushion maintained above the suspension in the breast box by the air pump.

The rate at which suspension passes through such a breast box in a unit time is rather large, often weighing from 500 to 1000 times as much as the web produced from the suspension. The closed air space or chamber above the suspension inside the breast box is rather small in relation to the amount of suspension to be handled.

Furthermore, most of the fiber suspensions processed in such breast boxes contain materials which tend to create a foam from air bubbles which rise in the fiber suspension and become collected at the surface thereof inside the breast box. Such a foam is driven towards the front or nozzle wall of the breast box by the movement of the suspension underneath the foam as the suspension flows toward the discharge nozzle. This foam, in known constructions of such breast boxes with an air cushion, often occupies a significant portion of the air space in the breast box.

In order to overcome the disadvantageous effects of such foam accumulations, and to prevent foam particles from becoming entrained in the suspension as it passes through the nozzle, and which would detract from the quality of the web, it has been suggested to place above the discharge nozzle on the inside of the breast box, an overflow gutter or trough which extends across the full width of the breast box and is provided with one or more drain conducts leading to the outside of the breast box. The overflow gutter is attached to the inside of the front wall of the breast box and has a lip or edge just underneath the normal level of the suspension in the breast box. This longitudinal edge or lip forms the overflow edge which is located roughly at the desired height of the suspension inside the breast box and over which edge, suspension and foam flow into the overflow gutter.

The drain conduit leading from the gutter extends through a wall of the breast box to the outside, and has its lower end immersed in the liquid in the backwater basin or extending into another container which contains liquid and is, furthermore, immersed deeply so as to avoid undesirable loss of air from the breast box. By permitting a small amount of suspension to flow over the overflow edge into the gutter, foam resting on the suspension also flows into the overflow gutter and is entrained by the suspension therein and carried to the backwater basin or other container at the outlet end of the drain conduit and becomes dissolved in the liquid.

Because the amount of air inside the breast box will unavoidably vary, the suspension level during operation will not always remain at the same height, but will undergo some change which will, in turn, produce fluctuations in the amount of suspension which flows across the overflow edge into the gutter. Therefore, the amount of the foam which is entrained with the overflowing suspension may be subject to fluctuation and, therefore, there will frequently be an undesirable accumulation of foam at the overflow edge. This could take place, for example, when the amount of suspension passing across the overflow edge becomes reduced to a small amount, or even, reduces to zero.

SUMMARY OF THE INVENTION

The present invention has, as a primary object, the solution of the problem of preventing fluctuation in the rate of overflow of suspension from the breast box into the overflow gutter thereby to establish stable and uniform foam removal conditions. Further objects of the invention are to stabilize the operation of the machine; to improve the product therefrom.

According to the present invention, this problem is solved by providing the first drain conduit, or conduits, leading from the overflow gutter with an overflow control device so constructed and arranged as to maintain a predetermined or normal liquid level in the overflow gutter and, further, by providing a second drain conduit or tube extending through the first mentioned drain or discharge conduit, the cross sectional area of which is small relative to the cross sectional area of the first drain conduit and which has a secondary outlet opening or port at about the plane of the normal liquid level in the gutter and extending angularly through said plane. This second drain conduit or tube leads to a point below the liquid level in a liquid containing container, such as a fluid-filled backwater basin. The upper end of the second conduit or tube may be vented to the atmosphere so that a very small amount of air can escape continuously from the air space of the breast box. The amount of escaping air will be reduced when the suspension level in the gutter rises and will be increased when the suspension level in the gutter falls because of the change in the exposed area of the secondary outlet opening or port in the second conduit.

A small change in the rate at which suspension flows over the long overflow edge brings about a substantial change in the level of the liquid in the overflow gutter, and induces a corresponding change in the opposite sense of the amount of escape air which passes through the secondary outlet opening or port of the second drain conduit or tube about the level of the suspension in the gutter, and induces, in this way, a change of the suspension level in the breast box in the opposite direction. In this way, accidental changes of the air pressure inside the breast box become compensated with a speed and efficiency which has never heretofore been accomplished. This effect really prevents any accidental change of the suspension level inside the breast box, because any changes in the rate at which suspension overflows into the gutter are immediately counteracted by this effect right inside the breast box. The extraordinarily high efficiency referred to comes about because any accidental change of the suspension level inside the breast box will produce a great change in the rate of suspension overflowing into the gutter evenly over the long length of the overflow edge.

The changed total amount of suspension over flowing into the gutter will flow with an unchanged velocity through the first drain conduit. Thus, a small change of the suspension level in the breast box will result in a great change in the level inside the overflow gutter, up to from 10 to 50 times as great as the change of the level inside the breast box. This multiplying, or amplifying effect brings about extraordinarily great stability of the rate at which the suspension flows into the overflow gutter across the overflow edge, and this way brings about not only a uniform and stable removal of the foam from the breast box, but also a very stable suspension level inside the breast box, a constant air pressure in the air space or cushion of the breast box, constant outflow velocity of the suspension issuing from the discharge nozzle, and improved quality of the web.

With breast boxes for papermaking machines of a great width, it is advantageous to place at each side of the breast box a first drain conduit with a section of second drain conduit which is equipped with a secondary outlet opening or port. The two drain conduits may also be connected together undereneath the breast box by the aid of a horizontal tube to which a common discharge tube is connected. In both arrangements the lower ends of these conduits lead to the backwater basin or to another liquid container. When two first drain conduits are provided, a single second drain conduit or tube may be provided having a port or opening at the normal suspension level. Such a construction of the second drain conduit or tube avoids a construction wherein two second conduits with separate scondary discharge openings or ports exist which act independent from each other. Thus, the height of these two openings might, in practical operation, show slight differences. Such differences can be of importance in creating difficulties with respect to a correct control of the amount of overflow from the overflow trough or gutter.

It is proposed, furthermore, by the present invention to construct the secondary outlet opening or port in the second drain conduit or tube as a vertical slit, or a slit which is inclined with respect to a vertical axis so as to have a vertical main extension. By such a construction there will be available, even with great fluctuations of the liquid level in the overflow gutter, enough cross section of the secondary outlet opening or port inside the first drain conduit to bring about a discharge of fibrous suspension and of air, to avoid the portion of the secondary discharge opening or port which lies above the level becoming too great even if the liquid level in the first drain conduit drops to a very low level. In this connection, according to a further idea of the invention, the clear width of the secondary outlet opening or port increases from top to bottom.

Instead of one such secondary outlet opening or port,

two or more such openings can be placed in the wall of the second drain conduit or tube.

In order to adjust the rate at which suspension flows across the overflow edge to control the removal of foam arising in the breast box with the smallest amount of overflow of suspension into the gutter, each secondary outlet opening or port is arranged so that it can be adjusted as to height with respect to the overflow gutter. This could be brought about, for example by an orifice restricting member which covers a portion of the secondary outlet opening and which is adjustable to various heights.

In operation of the machine, it is of importance to keep the amount of air which flows to the atmosphere through the secondary outlet opening or port as small as possible. In order to bring this about, according to another feature of the invention, the effective cross sectional area of at least one secondary outlet opening or port can be adjusted. This adjustment can also be made by availing of the orifice restricting member referred to. In this way the amount of air which escapes can be adapted to the amount of foam which is to be removed, while, further the added advantage is realized that, inside the breast box, fluctuations of the air pressure are kept at a minimum.

The amount of air escaping at a given overflow of suspension into the overflow gutter can be adjusted so that it will be only a small fraction of the rated output of the air pump. In this way the air pump will have enough reserve capacity to compensate immediately for small changes in the amount of air which escapes when the suspension level in the overflow gutter changes. The described construction of the secondary outlet opening or port reduces air pressure fluctuations inside the breast box and makes it possible to employ a rather small air pump for adjusting the air pressure in the breast box.

An especially advantageous construction is obtained by placing the one, or the several, secondary outlet opening or openings inside a preferably vertical second drain tube or conduit which extends into or through the first drain conduit. With a construction where the second drain tube or conduit penetrates the first drain conduit, the upper end of the second drain tube is closed close to the secondary outlet opening, or openings, so that suspension, foam, and air may flow together through the secondary outlet opening, or openings, into the second drain tube. When this occurs, the air will squeeze foam through the secondary outlet opening, or openings, so that only a small portion of the foam is passed through the first drain conduit together with the remainder of the suspension which is flowing from the overflow gutter. In this way the foam removal from the breast box is achieved in an ideal manner.

In order to keep the air which has left the box via the secondary outlet opening and the air which is expelled from the entrained foam which breaks down, away from the backwater basin, it is preferred to let the second drain tube pass through the first drain conduit and, preferably, in the vertical direction. The part which protrudes upwardly from the first drain conduit serves as an air expulsion tube and preferably runs out into the free atmosphere.

The second drain or discharge tube can readily be connected to the first drain conduit so as to be adjustable therein. For example, the second drain tube can pass through a packing in the first drain conduit which is equipped with a set screw, and adjustment of the height of the secondary outlet opening occurs by a simple shifting in the longitudinal direction of the second drain tube, and the desired position is retained by a tightening of the set screw.

The adjustment of the effective area of the secondary outlet opening or port in the second drain tube can be accomplished by having two telescopically arranged coaxial tubes, both with ports and one non-rotatable in the first drain conduit and the other rotatable so that the degree of registration of the ports can be varied at will by

adjusting the rotatable tube. A lever attached to the rotatable tube can rotate it and a clamp screw can clamp the lever in adjusted position.

Both of the tubes are carried by a frame member slidably guided on guideways stationary on the first drain conduit. The guideways carry a handwheel threaded to an extension of the tubes fixed in the frame so that by rotation of the handwheel the tubes are raised or lowered substantially vertically in the first drain conduit.

The first drain conduit is formed in parts with one section connected to the overflow gutter and extending through a side wall of the breast box and other sections outside the breast box. The sections are preferably provided with flanges so the outer sections can easily be put in place on the inner sections and removed therefrom and, together with the tubes and the adjusting mechanism therefor, can form a unit ready for installation. The said sections form a horizontal header portion peripherally closed and closed at the outer end. The first drain conduit also includes a portion leading downwardly from the outermost one of said sections.

The device according to the invention also renders it possible to operate the breast box with the air cushion at a pressure which is lower than atmospheric, if the second drain conduit or tube which is provided with the one or the several secondary outlet openings does not open to the atmosphere and immerses with its free outlet end into the backwater basin or into another deep container which is filled with liquid.

The upper end of the second drain conduit or tube in this case is connected by a conduit to the air pump which acts as a vacuum pump. Into this conduit there may be placed a trap for entrained liquid, the liquid discharge tube of which also immerses deeply into a liquid container, such as a backwater basin. Another conduit acting as a pressure conduit leads from the pump to the atmosphere. If both the conduits of the air pump are connected to the air space at the top of the breast box, and if each conduit is provided with a threeway stop cock with a side outlet, then it will become possible, by a simple adjustment of the two threeway stop cocks, to operate the breast box with pressure below atmospheric or with a pressure above atmospheric. During operation with a subatmospheric pressure. the suction conduit is connected to the air space or cushion in the breast box, and the pressure conduit is connected to the atmosphere. During operation with a pressure higher than the atmospheric, the suction conduit is connected to the atmosphere, and the pressure conduit is connected to the air cushion in the breast box.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the present invention will be readily apparent from the following description considered in relation to the showing in the accompanying drawings, wherein:

FIG. 1 is a perspective view, somewhat schematic, of a breast box with an air cushion and an overflow gutter according to the present invention;

FIG. 2 is a vertical section through the first drain or discharge conduit and second drain or discharge tube showing how the tube could be adjusted;

FIG. 3 is a section on line III—III of FIG.2; and

FIG. 4 shows a modification wherein the breast box is under less than atmospheric pressure.

DESCRIPTION OF THE OPERATION OF THE PREFERRED EMBODIMENTS

In FIG. 1, the closed breast box **1** of a papermaking machine, has an air cushion above the suspension level **3** in a chest **2**. A feed line **4** feeds the fiber suspension to the breast box **1** from a source which is not shown. The suspension is supplied in homogeneous condition into chest **2** at the bottom at the rear wall **6**, remote from the discharge nozzle **5** at the forward end, and which supplying occurs with the interposition of a stock distributor **7**, and the distribution occurs across the full width of the paper making machine. The suspension then flows in a rather thin layer above the bottom **8** of the chest **2** toward the discharge nozzle **5**. The suspension leaves the discharge nozzle **5** in a layer which has a uniform thickness across the full machine width, and is delivered to a draining member, such as a wire **30**, which approaches the discharge nozzle **5** over the breast roll **29**.

The layer of suspension is dewatered through draining member or wire **30** and the fibers and other solids of the suspension become deposited upon the surface of draining member or wire **30**. The liquid, with a small residual amount of fibers and solids, passes through the meshes of the draining member or wire **30** as the so-called backwater, into a backwater basin **20** which is located underneath the machine.

The air cushion, which is present inside the chest **2** above the suspension level **3**, is maintained by the aid of a motor-driven air pump **9**, a suction conduit **12** leading to pump **9**, and a discharge conduit **13** leading from pump **9**, each of which carries one threeway stopcock **10**, **11**, each fitted with a valve means **10***a*, **11***a*. Conduits **12** and **13** are connected with the air space or cushion in the chest **2** above the suspension level **3** as by leading through the back wall **6** or the top wall **14** of the chest **2**.

The threeway stopcocks **10**, **11** serve for adjusting the effect of the air pump **9** on the air cushion above the suspension, depending upon wether the air cushion operates at higher than atmospheric pressure or at less than atmospheric pressure. The breast box can, of course, be operated at atmospheric pressure.

During operation with higher than atmospheric pressure, the air pump **9** draws air through the lateral port of the threeway stopcock **10**, adjusted at this time to close the end of conduit **12** leading to the breast box, and the air drawn in by the pump then passes through the conduit **13** into the air space. An excess of air supplied by the pump may be returned into the atmosphere by an adjustment of the threeway stopcock **11** to partially open the lateral port thereof.

During operation with a subatmospheric pressure in the air cushion, the air is drawn through conduit **12** from the air cushion and the threeway stopcock **10**, and, by a partial opening of the lateral port of this threeway stopcock, air may be admitted from the atmosphere. The pumped air is expelled through the lateral port of the threeway stopcock **11**, into the atmosphere, the end of conduit **13** leading into the breast box at this time being blocked.

When the suspension is transported, it will entrain more or less air which passes into the chest **2**. The air will rise inside the suspension as it flows through the upwardly directed portion of the stock distributor **7**, and accumulates at the suspension level **3** inside chest **2**. Many kinds of paper require fiber suspensions which contain admixtures which foam heavily, and the entrained air will create a stiff foam which becomes accumulated above the suspension level. Rather large amounts of foam can be created this way.

The volume of the chest above the suspension level is small in relation to the amount of suspension processed, so that, with foaming fiber suspensions, the foam, within a rather short time, will occupy more or less all of the air space in the breast box. This foam is driven by the suspension, which flows across chest **2** from the stock distributor **7** towards the discharge nozzle **5**, namely towards the front or nozzle wall **15** of chest **2**.

In order to remove this foam from the chest **2**, it is known to place on the inside of the front wall **15**, in overflow trough or gutter **16** which extends across the full width of chest **2**, and which is equipped with a drain conduit generally indicated at **18** for the discharge of suspension and foam which flows into the gutter **16**. The discharge conduit **18** comprises a horizontal header portion which includes a section **18A** extending through the

wall of the breast box and connected at its inner end to gutter **16**, a section **18B** outside the breast box and connected to the outer end of section **18A** by flanges, and a section **18C** connected to the outer end of section **18B** by flanges. The header is peripherally closed and is closed at the outer end and a portion **19** of the drain conduit leads downwardly from section **18C**. The overflow edge **17** which is arranged somewhat underneath the desired suspension level **3**, is separated from the front wall **15** of the chest **2** by said overflow gutter **16** to which is connected the drain conduit **18**.

Across this overflow edge **17**, therefore, there will always flow a little suspension into the overflow gutter **16**, thereby entraining the foam which floats upon the suspension and exists inside the uppermost layer of suspension. The suspension which passes over into the overflow gutter **16**, together with the foam, is then passed on by the drain conduit into the backwater basin **20** which is placed underneath the machine and to which the lower end of portion **19** is connected at a submerged location.

Section **18B** of the header portion of the drain conduit carries a second drain tube **27** which has a secondary outlet opening or port **28** therein. Tube **27** extends through section **18B** in vertical direction and port **28** is inside section **18B**. The portion **19** of the discharge conduit carries a flow regulating or control valve **23**.

Sections **18B** and **18C** of the header portion of the drain conduit, and valve **23** all have flanged ends to permit replacement thereof without interrupting operation of the machine on the following text, the drain conduit **18** is referred to as the first drain conduit while tube **27** is referred to as the second drain conduit, or tube.

An average liquid level **26** inside the overflow gutter **16** is adjusted by the adjusting of flow regulating valve **23**, or by a corresponding flow controlling device, as, for example, by a second overflow edge which is placed underneath the overflow edge **17** of gutter **16** inside the header portion of the first drain conduit. The change of the position of this liquid level **26** brought about by irregularities of the amount overflowing into the gutter **16** will be compensated immediately by the action of the secondary outlet opening or port **28** as will be described hereinafter.

The portion **19** of the first drain conduit **18** runs out into a pit **24** of the backwater basin **20**, at a depth where the pressure is greater than the greatest pressure head which might occur in chest **2**. This can be done because the level **25** of the backwater is kept constant in a manner known per se. This provision insures that no air can escape from chest **2** via portion **19** of the first drain conduit.

The small second drain conduit or tube **27**, which is small in comparison to the internal diameter of the header portion of the first drain conduit **18**, passes in the vertical direction through section **18B** and has its open, upper end protruding from the said section. The lower end of the second drain tube **27** spills out either freely into the backwater basin **20**, or is immersed therein.

The vertical second drain or tube **27** is provided with a slot-like opening or port **28** arranged inside section **18B** approximately at the height of the suspension level **26**, and extending in a vertical direction. The clear width of the slot-like opening or port **28** increases from top to bottom, so that the upper portion thereof, above level **26**, which is located in the air space in the header portion, is narrower than the portion which is located below level **26**. Thus, a small amount of air from the air cushion of chest **2** continuously flows through the upper portion of port **28** into the atmosphere, which escaped air becomes immediately replaced in chest **2** by the output of the air pump **9**. If, now, for any reason whatsoever, the amount of suspension passing across the overflow edge **17** changes, and which occurs with only a very small change of the height of the suspension level **3** inside chest **2**, then the liquid level **26** in the header portion will become changed an amount which is a multiple of the amount of change of the level inside the chest **2**.

Inside the header portion, the flowing suspension, occupies a cross section which, in the case of a circular tube, is a circular segment. The width of this segment in comparison to its width is much smaller, than lateral width of chest **2** is in respect to the overflow height of chest **2**. Therefore, a small change of the amount of suspension which passes across the overflow edge **17** will lead to a much greater change liquid level height **26** in the header portion than the change of the suspension level **3** inside chest **2**, which led to the level change in the header portion. Thus, even if the rate of suspension passing over the overflow edge **17** change a very little only, the portion of the secondary outlet port **28**, which is available for the passage of the air, is changed greatly, and therefore the amount of air discharged from chest **2** also changed greatly. In case the suspension level **3** inside chest **2** rises, the rate of overflow through outlet port **28** increases and air flow decreases, and in case the suspension level **3** inside chest **2** drops, the rate of overflow becomes smaller while the air flow increases.

Instead of placing the slot opening **28** in a vertical tube such as second drain tube **27** which passes through the section **18B** of the header portion of discharge conduit **18**, it may be placed directly in the wall of section **18B**. For the arbitrary adjusting of the rate of suspension which passes across the overflow edge **17**, the height of the slot opening or port **28** in relation to the height of the overflow edge **17** may be changed. This may be brought about by placing a movable member **34** which is also equipped with such a slot opening, or port at the level of the secondary outlet opening **28** in the second outflow tube **27**. By such a construction of the secondary outlet opening or port **28**, it becomes possible to shut off partially the port **28** by a shifting of the movable member **35** and in this way to reduce the effective cross section of the port **28**. This renders it possible to adjust the rate of overflow to the amount of foam which arises, so that the foam removal from the chest **2** is brought about with the smallest possible consumption of suspension and air.

In the example according to FIGS. 2 and 3, the vertical second drain pipe or tube **27**, which carries the secondary outlet opening or port **28**, passes centrally through the section **18B** of the header, and is sealed in place by sealing rings **33** at regions **31** and **32** where it enters and leaves section **18B**. In contrast to the example according to FIG. 1, means are provided for the accurate adjusting of the secondary outlet opening or port **28**, i.e. for raising or lowering it with great precision, and means are also provided for changing the effective cross section of the port **28** by way of an adjustable tube **34**.

Tube **34** telescopically is arranged inside the second drain tube **27** so that it can rotate and reciprocate therein, and has a collar **35** at its upper end, above the upper end of second drain tube **27**, whereby said collar **35** will rest on the upper end of tube **27**, with its shoulder **36** which faces downwardly. Upon the upper end of the drain tube **27** which is equipped with an external thread, is screwed a frame member **37**. There is inserted in frame member **37** from above an air expulsion tube **38**, which does not interfere with turning of the tube **34** inside the second drain tube **27**. Tube **38** is secured by pegs **39** against any turning or shifting.

Machined in frame member **37** is a horizontal incision **40** at the height of the collar **35** of the tube **34**. An adjusting handle **41** extends through incision **40** and has a cylindrical end secured by a thread **42** into a correspondingly threaded bore in the collar **35** of the tube **34**. By turning the tube **34** on the longitudinal axis of the second drain tube **27** by the adjusting handle slot-like openings in tubes **27** and **34**, which are the same shape and at the same level, can be varied as to the degree of registration thereof from fully open to fully closed. In the one terminal position of the adjusting handle **41** the outlet open-

ing of the tube 34 coincides fully with the one of the second drain tube 27, so that the full outflow cross section of the secondary outlet opening or port 28 is obtained. In the other terminal position of handle 41, the secondary outlet opening or port 28 is completely closed because the slot-like opening of tube 34 is completely blocked by the wall of the second drain tube 27.

In order to secure the handle 41 in adjusted position, at a certain distance from the longitudinal axis of the second drain tube 27, a threaded bore is machined into the stem of the adjusting handle 41, into which is threaded a wing screw 43. Wing screw 43 passes through an arcuate slit 44 which is located in a metal sheet 45 attached to frame member 37 directly above handle 41, as by welding.

Metal sheet 45, by aid of the wing screw 43, is pressed against the upper side of the adjusting handle 41, and this secures the adjusting handle 41, and, therefore, tube 34 in adjusted position.

For the accurate setting of the height of the secondary outlet opening or port 28 with respect to the longitudinal axis of the header section 18B, and therefore, with respect to the overflow edge 17 of chest 2, the air expulsion tube 38 is provided with an external thread on which is threaded a handwheel 46 which has an internal thread for this purpose. The hub of the handwheel 46 has a groove 47 into which extend annular protrusions of a split collar piece 48. This collar piece 48 is attached upon a yoke or fork 49, which in its center has a bore, through which the air expulsion tube 38 freely passes.

This yoke or fork 49 is attached by spaced legs 50, 51 to the lateral surfaces 52, 53 of the section 18B. These legs 50, 51 serve simultaneously as slide-guides so as to prevent the frame member 37 from following the turning motion when the adjusting handle 41, or the handwheel 46, is actuated. For this purpose the metal sheet 45, which is rigidly connected to the frame member 37, is widened towards the legs 50, 51 and is equipped with guide pieces 54, 55 which have notches. These notches surround the correspondingly shaped sliding surfaces of the legs 50, 51 and slide thereon.

From the foregoing it will be seen that, when the air cushion is under a pressure above atmospheric, the rise and fall of the level in the overflow gutter will respectively increase and decrease the degree of restriction to air flow through port 28 and thereby bring about changes in the air cushion pressure which will tend to maintain suspension level 3 inside chest 2 constant.

For sub-atmospheric operation, the arrangement diagrammatically illustrated in FIG. 4 is availed of. In FIG. 4, the upper end of second drain tube 27 is connected to the suction side of pump 9 by an air conduit 60 having therein a liquid-from-air separator 62 which drains the liquid separated from the air via a conduit 64 to beneath the liquid level in a container, such as a backwater basin. Air pump 9 may discharge into the atmosphere or return a part of the pumped air to the air cushion. It will be appreciated that, with the FIG. 4 arrangement, a rise in the liquid level 26 in the overflow gutter 16 will increase the restriction to air flow at port 28 so that the pressure of the air cushion will tend to rise and, instead of aggravating the condition leading to an increased rate of suspension flow into the overflow gutter 16, will tend to compensate therefor. A drop in liquid level in the gutter 16, similarly, leads to a compensating action by air permitting a more rapid withdrawal of air from the air cushion by pump 9.

FIG. 2 shows how a perforated cap 70 could be provided to screw on the upper end of air expulsion tube 38.

Each of threeway stopcocks 10, 11 referred to has two branches connected to a main conduit and a third branch connected to a lateral conduit or opening leading to the atmosphere. In a first position of the stopcock flow in the main conduit passes through the valve; in a second position the branch of the main conduit connected to the air pump 9 leads to the atmosphere via a lateral conduit or port; in a third position that branch of the main conduit connected to the chest 2 is closed off and the other branch of the main conduit which is connected to the chest 2 leads to the atmosphere; and adjusted positions therebetween for restricting the connection so made.

It will be appreciated that the present invention, in addition to improving the removal of foam from the suspension, also improves the quality of the web formed because, by maintaining the suspension level 3 and the air pressure in chest 2 constant, the rate of flow from discharge nozzle 5 to the wire 30 is stabilized and does not vary.

It will further be understood that the supply of suspension from conduit 4 is of such a nature as to be sensitive to changes in pressure of the air cushion whereby the compensation action of varying the area or port 28 available for air flow is effective for holding level 3 in chest 2 constant.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What is claimed is:

1. In a breast box for a paper making machine having an inlet at the bottom in back for the supply of a fibrous suspension to the box and a discharge nozzle at the bottom in front for the discharge of suspension from the box to a fluid pervious draining element or wire, said breast box having a closed top forming a chamber for entrapment of air in the breast box above the level of the suspension in the breast box, said breast box having an overflow trough extending laterally across substantially the full width of the breast box on the inside of the front wall of the breast box above the discharge nozzle and having a horizontal overflow edge beneath but near the normal level of the suspension in the breast box so that suspension and foam thereon will flow over said overflow edge into said trough, and a circumferentially closed first drain conduit leading from said trough through a side wall of said breast box to outside said breast box and including a horizontal header portion at the trough end at about the same level as said trough, a valve in said first drain conduit downstream from said header portion for maintaining the suspension level in said trough and header portion in a predetermined horizontal plane when the suspension level in said breast box is normal; the improvement comprising; a second drain conduit small in cross sectional area as compared to the cross sectional area of said first drain conduit and leading into said header portion and extending angularly through the said plane, said second drain conduit having an upper end and a lower end which discharges suspension into a container at a lower level than said header portion, and a lateral opening in said second drain conduit and positioned so as to be intersected by said predetermined horizontal plane, and means for causing flow of air from said chamber over said suspension and through said lateral opening in said second drain conduit to the upper end of said second drain conduit, said means comprising an air pump connected to either said chamber or to the said upper end of said second drain conduit.

2. A breast box for a paper making machine according to claim 1 which includes a pair of three way valves each having a first port means connected to a respective side of said air pump and second port means leading to the atmosphere, one of said valves having third port means connected to said chamber and the other of said valves having third port means connected to the upper end of said second drain conduit, said pump moving air in a direction toward said chamber and away from the upper end of said second drain conduit, and a valve member in each valve controlling the communication of the port means of each said valve.

3. A breast box for a paper making machine according

to claim 1 which includes a liquid containing container at a level lower than said header portion and in which said second drain conduit leads downwardly from said header portion and has its lower end disposed beneath the liquid level of the liquid in said container.

4. A breast box for a paper making machine according to claim 3 in which the said second drain conduit leads upwardly through the top of said header portion and has its upper end vented to the atmosphere.

5. A breast box for a paper making machine according to claim 3 in which the said second drain conduit leads upwardly through the top of said header portion, conduit means connecting the upper end of said second drain conduit to the suction side of said air pump, and the discharge side of said air pump being connected to the atmosphere.

6. A breast box for a paper making machine according to claim 1 in which at least the portion of said second drain conduit disposed in said header portion and said opening therein are vertical.

7. A breast box for a paper making machine according to claim 6 in which said opening is slit-like and widens from top to bottom.

8. A breast box for a paper making machine according to claim 6 which includes means for adjusting said second drain conduit in the vertical direction in said header portion thereby to adjust the effective height of said opening relative to said plane.

9. A breast box for a paper making machine according to claim 6 which includes means to adjust the effective area of said opening.

10. A breast box for a paper making machine according to claim 6 in which said second drain conduit extends in the vertical direction completely through said header portion.

11. A breast box for a paper making machine according to claim 10 in which said header portion comprises a plurality of sections in end to end relation and flanged at the opposite ends, one of said sections having said second drain conduit mounted therein and being insertable in and removable from said header portion as a unit.

12. A breast box for a paper making machine according to claim 10 which includes a tube telescopically engaging said second drain conduit at least in the region of said opening, said tube having a second opening therein corresponding in size and shape to the opening in said second drain conduit and adapted for variable registration with the opening in said second drain conduit, and means connected to said tube for moving said tube relative to said second drain conduit to vary the degree of said registration of said openings.

13. A breast box for a paper making machine according to claim 12 which includes screw threaded means connected to said tube and said second drain conduit outside said header portion and operable for adjusting said tube and said second drain conduit as a unit in the vertical direction in said header portion.

14. A breast box for a paper making machine according to claim 12 in which means are provided externally of said header portion and connected to said tube for adjusting said tube angularly relative to said second drain conduit to vary the degree of registration of said openings and for locking said tube in adjusted positions thereof.

References Cited

UNITED STATES PATENTS

3,092,539 6/1963 Schmidt et al. ---- 162—337 XR

FOREIGN PATENTS

547,595 10—1957 Canada.

S. LEON BASHORE, Primary Examiner

R. H. TUSHIN, Assistant Examiner

U.S. Cl. X.R.

162—337, 340