

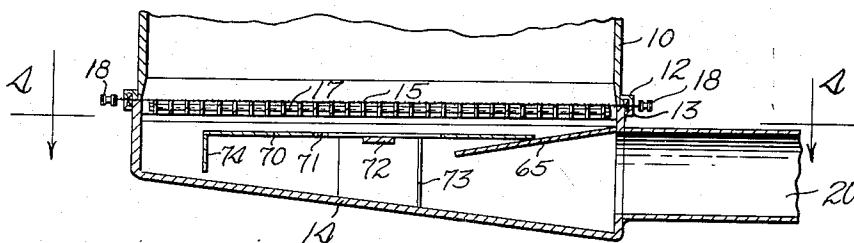
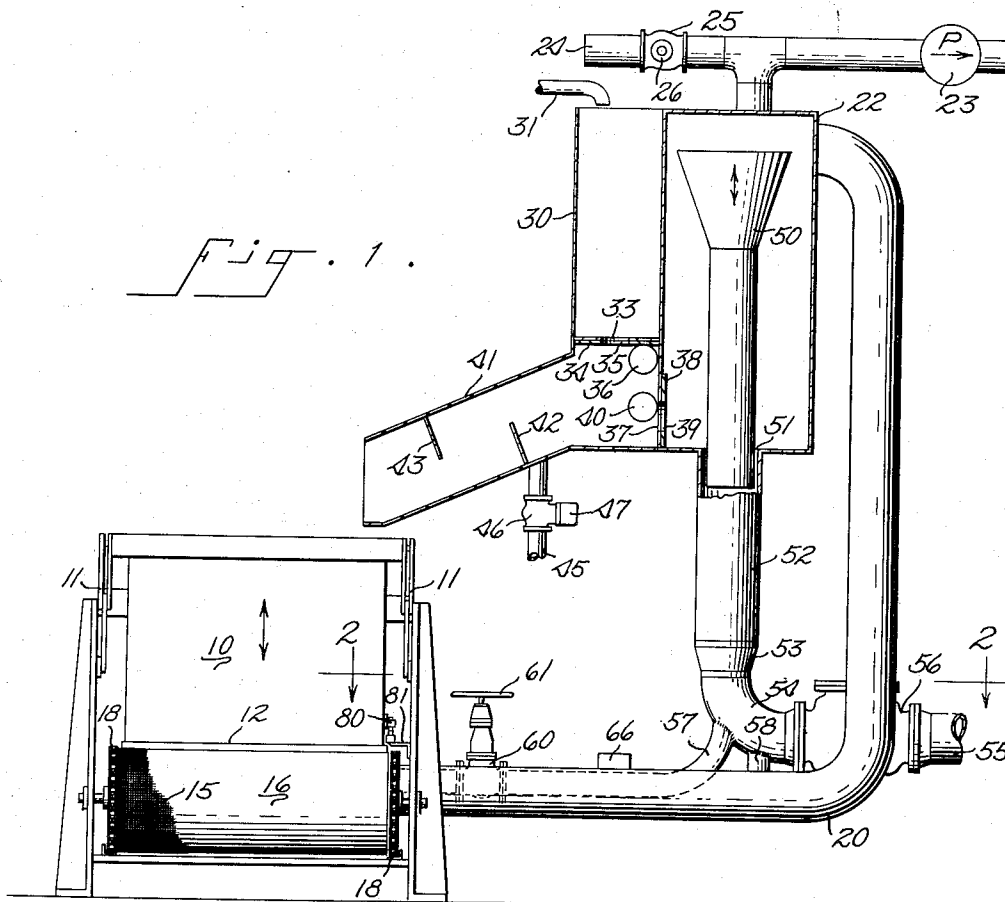
Dec. 1, 1953

R. CHAPMAN
APPARATUS FOR FORMING FIBER MATS, INCLUDING
DECKLE BOXES WITH WHITE WATER RETURN

2,660,935

Filed Dec. 20, 1948

3 Sheets-Sheet 1



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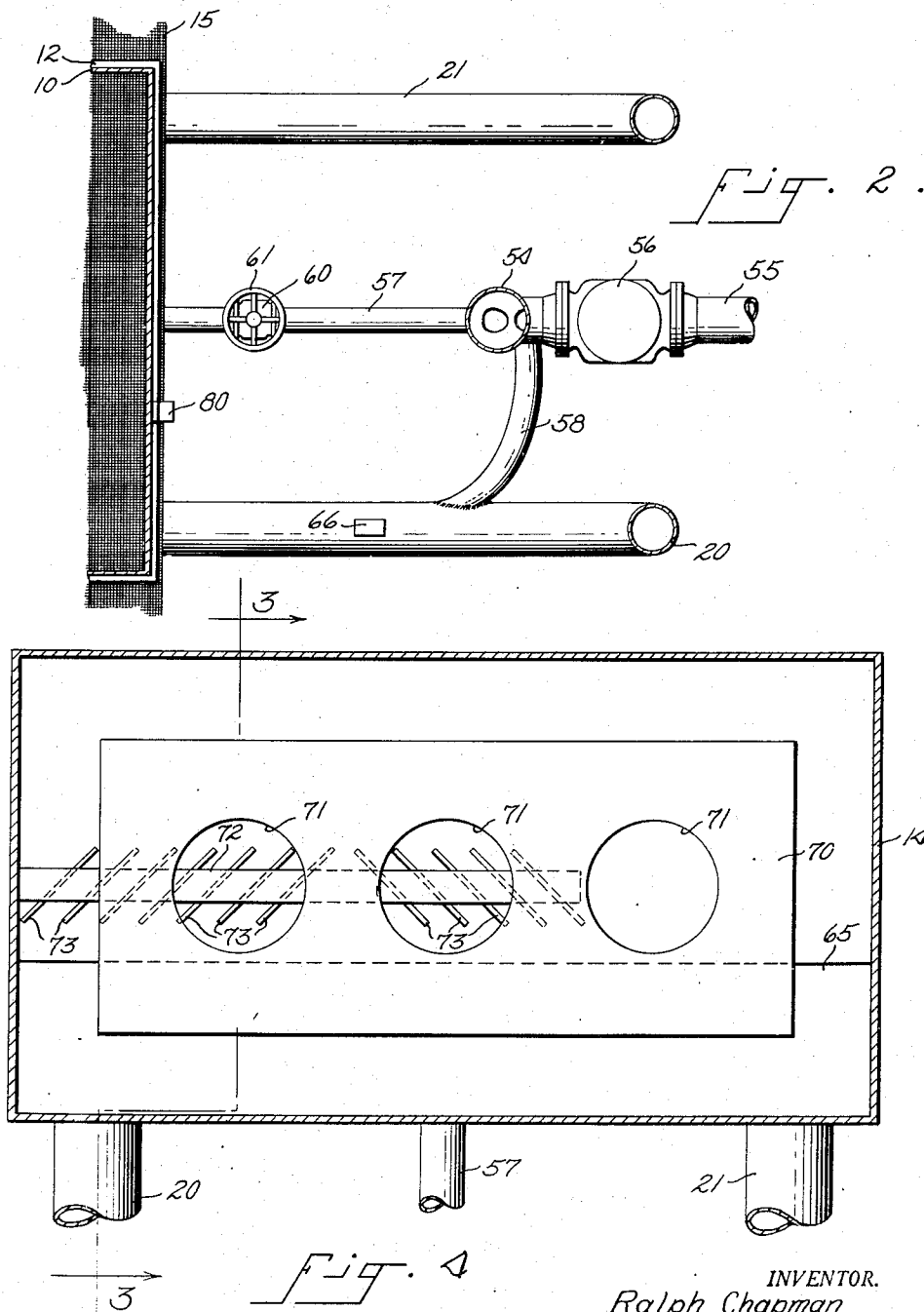
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3 Sheets-Sheet 2



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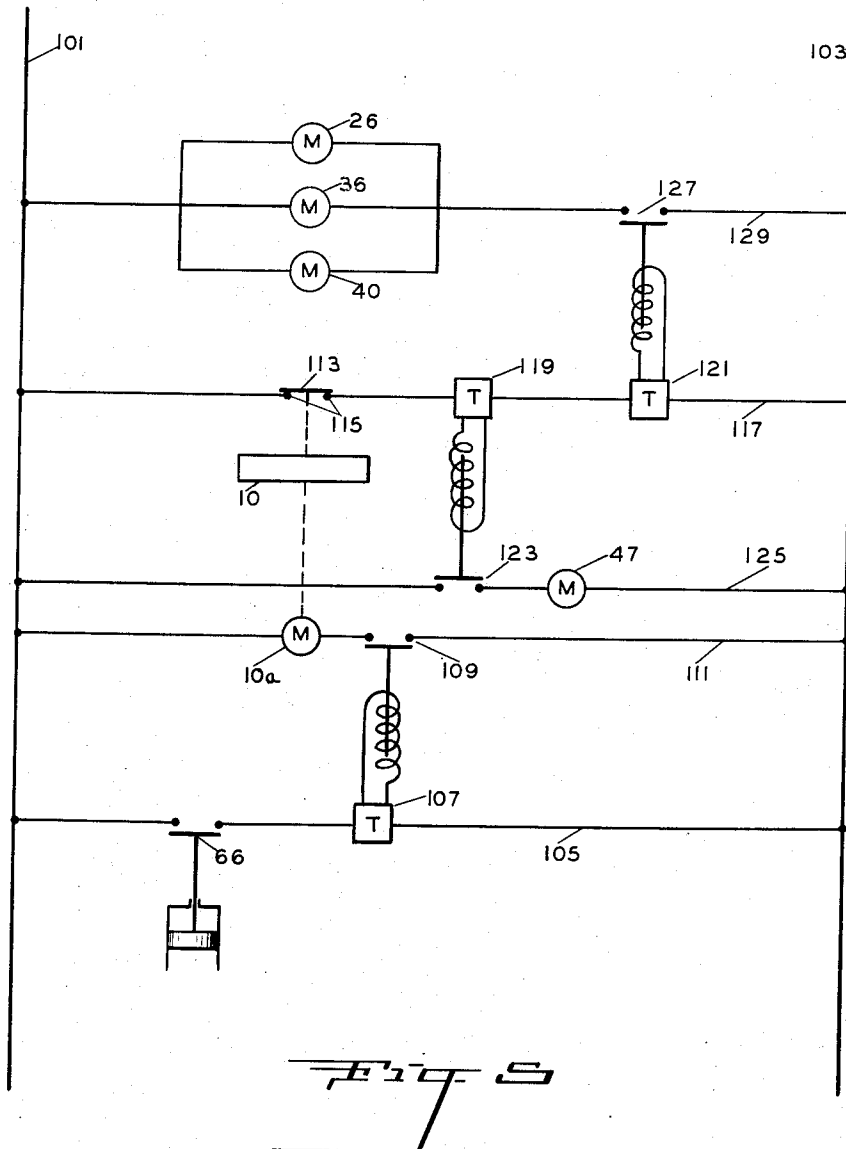
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UNITED STATES PATENT OFFICE

2,660,935

APPARATUS FOR FORMING FIBER MATS,
INCLUDING DECKLE BOXES WITH WHITE
WATER RETURNRalph Chapman, Corvallis, Oreg., assignor to
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Application December 20, 1948, Serial No. 66,176

4 Claims. (Cl. 92-54)

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The present invention comprises an improvement in equipment for forming a fibre mat by withdrawing white water from a slurry of fibres. The particular improvement herein disclosed comprises means whereby the level of liquid in the portion of a forming device beneath a forming screen may be brought back up to the lower surface of the forming screen prior to the deposit of a charge of slurry above the forming screen, so as to avoid the irregular deposit of fibres heretofore produced by the initial rush of liquid through the screen as sometimes occurred in previously employed apparatus such as that disclosed in my copending applications, Serial No. 20,333 and Serial No. 20,334, both filed April 10, 1948, the latter now abandoned, wherein means are disclosed whereby suction is created in an elevated, closed tank to withdraw white water through a screen from forming apparatus comprising a movable deckle box frame positioned above the screen. The principal object of the present invention is to assure uniformity of fibre mats produced by equipment such as disclosed in the aforesaid applications by returning some of the white water to a stationary part of the forming apparatus below the screen prior to the deposit of a succeeding charge of slurry in the movable deckle box frame.

The present application is a companion application to my copending application, Serial No. 66,175, filed December 20, 1948, now U. S. Pat. 2,570,099, executed concurrently herewith and entitled "Forming Tower With Sliding Valves."

A further object of the present invention is to provide means whereby the return of white water from an elevated white water tower to which it has been withdrawn by suction may be permitted under control of means for regulating the flow so that the apparatus may be adjusted to perform over a variable range of time, thus permitting the formation of various thicknesses of fibre mats.

A further object of the present invention is to provide a deckle box or forming vat comprising baffles so arranged beneath the screen that white water may be returned to the space beneath the screen in a very short space of time without having the white water surge through the screen in some places.

The objects and advantages of the present invention may be more clearly understood by reference to the following specification taken in connection with the accompanying drawings wherein like numerals refer to like parts throughout, while the features of novelty will be more readily ascertained by inspection of the appended

In the drawings Fig. 1 is a somewhat schematic representation of a deckle box such as constructed in accordance with the disclosure of the aforesaid application, Serial No. 20,334, filed April 10, 1948, with improvements, combined with a white water tower such as disclosed in the concurrently executed application, Serial No. 66,175, filed December 20, 1948.

Fig. 2 is a horizontal section through a portion of the apparatus taken substantially along line 2-2 of Fig. 1;

Fig. 3 is a vertical section through the lower portion of the forming apparatus taken substantially along line 3-3 of Fig. 4;

Fig. 4 is a horizontal section taken substantially along line 4-4 of Fig. 3; and

Fig. 5 is a schematic wiring diagram of a control circuit for controlling operation of the various electrical components of the apparatus.

Although many different types of forming apparatus may have the present invention incorporated therein, the preferred type of forming vat comprises an upper, rectangular deckle box frame 10 which is vertically reciprocated by suitable motive means shown only diagrammatically as 10a in Fig. 5 and toggles 11 as disclosed in said application, Serial No. 20,334. The frame 10 is provided with a flange 12 around its lower edge in which a gasket may be seated, the gasket therein being adapted to press against a gasket seated in a peripheral flange 13 on a lower, fixed portion 14 of the vat. The upper frame 10 is lifted in timed relation to the movement of a forming screen 15 extending about a roll 16, upon which the formed mat may be fed from the forming apparatus into succeeding equipment such as a cold press, or other apparatus. As disclosed in the aforesaid application, Serial No. 20,334, the screen 15 is horizontally supported within the forming apparatus by a grid 17 of bar members supported within the lower portion 14. The screen 15 may be fed longitudinally by means such as sprocket chains 18 attached to the edges thereof and extending about sprocket teeth on the drum 16 and other drums (not disclosed).

When a charge of slurry has been deposited in the upper frame 10 most of the water therein may be withdrawn through the screen and through the lower section 14 upon the application of suction to pipes 20 and 21 leading from the lower portion 14 into an elevated, sealed white water storage tank 22. Suction is created in the white water tank 22 by means of a continuously operating vacuum pump 23 connected to a pipe leading from the top of the tank. A vent pipe 24 is connected to the same pipe and is open to the

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atmosphere when a vent valve 25 is opened upon energization of a valve motor device 26. When the valve 25 is open vacuum cannot be created within the tank 22, but as soon as the valve is closed the vacuum commences to build up and in short order will be sufficient to lift the withdrawn white water into the tank 22.

A slurry tank 30 is mounted upon the front face of the tank 22 and is adapted to receive a charge of thick slurry through a filling tube 31. As explained in the aforesaid application, Serial No. 20,333, the size of equipment necessary to produce and handle a large quantity of fibre slurry is reduced by having the slurry mixed with needed chemicals while its consistency is maintained relatively high, but best results of interlacing the fibres on a forming screen are achieved when the consistency is fairly low. For this reason each charge into the deckle box frame 10 is intimately mixed with the white water salvaged from the preceding charge to the extent found desirable by experiment, the excess white water being wasted or conducted to other apparatus for forming the thick slurry. In order that intimate mixing of the thick slurry with the white water may be achieved in rapid order the bottom of tank 30 is provided with a plurality of openings 33 adapted to be simultaneously opened and closed by a sliding gate valve 34 having a plurality of openings 35 therein, the gate being moved under control of a suitable valve operating motor device 36, and the white water from tank 22 is simultaneously discharged through a plurality of openings 37 in the lower portion of the front wall of the tank which are simultaneously opened and closed by a sliding gate valve 38 having a plurality of openings 39 therein, the valve being moved by a suitable valve operating motor 40. The openings 33 are preferably arranged directly above the openings 37 so that the jets of white water strike the falling streams of thick slurry. The two bodies of liquid are thus thoroughly mixed and the mixture is then discharged through a closed flume 41 having a plurality of baffles 42 and 43 therein. The flume 41 is preferably the same width as the length of the deckle box and terminates over one edge of the deckle box so that a wide stream of thoroughly mixed liquid is discharged into the deckle box whenever the valve motors 36 and 40 are operated. A drain pipe 45 is preferably provided at the angle between the lower wall of the flume and the first upwardly extending baffle 42, which drain pipe is under control of a valve 46 and suitable valve motor device 47. The valve 46 is closed when the slurry is being discharged but it is desired that the valve 46 be opened simultaneously with the closing of valves 34 and 38 so as to reduce the after-flow of fluid which might drip onto the wet mat before it is discharged from the deckle box.

The extent to which white water is retained within the tank 22 is controlled by a vertically adjustable overflow funnel 50, the lower end of which extends through an over-size opening 51 in the bottom of the tank into a large, vertical, overflow pipe 52. The pipe 52 terminates in a reducer 53 which is connected to the upper end of an elbow 54, the horizontal arm of which is connected to a drain pipe 55 through a check valve 56 of any suitable type adapted to be closed as soon as a vacuum is drawn in the tank 22 when the valves 25, 34 and 38 are closed and a charge is present in the deckle box 10. A white water return tube 57 is connected to the bottom of

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the elbow 54 and extends horizontally into the lower portion 14 of the deckle box. Accordingly, whenever there is fluid present in the deckle box some of the fluid will be withdrawn through the return tube 57 and the vertical pipe 52 into the tank 22 through the annular space 51 surrounding the stem of the funnel 50. The converse is true in that whenever the vacuum is broken in tank 22 some fluid may escape back into the lower portion 14 from the column of fluid standing in the overflow pipe 52 or the funnel 50 and also through the annular space surrounding the stem of the funnel. The reducer 53 directs the flow into the mouth of the tube 57 which is substantially coaxial with the overflow tube. At a point further along the curve of the lower surface of the elbow 54 a second white water return tube 58 extends into one of the white water elevating pipes (in this case pipe 20) so that the water which can escape through the annular space 51 is substantially all returned to the bottom part of the deckle box when the vacuum breaks. The number and sizes of the white water return tubes may vary, the present disclosure being of two tubes such as 57 and 58 which have sufficient capacity, together with the white water standing in the tubes 20 and 21 and the lower portion of the deckle box when the vacuum breaks, to refill the lower portion of the deckle box back to the level of the screen 15, for any thickness of wet mat commercially produced at the present time. If more fluid should be needed a third tube might extend to the elevating pipe 21, or the size of either or both tubes 57 and 58 might be increased. In order to adjust the return flow a valve 59 is provided in at least one of the return tubes, the same being of the regulating type and adjustable through the medium of a hand wheel 61. Adjustment of valve 60 is provided so that for any timing resulting in the production of any desired thickness of wet mat the return flow can be regulated to bring the liquid level back to the screen.

Within the deckle box portion 14 there is provided a baffle 65 extending from the side thereof above the inlets to the pipes 20, 21 and 57 and from end to end of the deckle box, the baffle lying at an inclination downwardly and inwardly into the interior of the lower portion. The result of providing the baffle 65 is that the vacuum will remain unbroken until the water level in the portion 14 reaches the lower lip of the baffle. At this point air begins to pass through the wet mat disposed on the screen 15 and will be drawn through the tubes 20, 21 and 57. The air which can be drawn through the mat cannot exceed the capacity of the pump so that the vacuum will remain sufficient to hold check valve 56 closed as long as vent valve 25 remains closed. A pressure differential switch 66 is preferably placed on the upper surface of one of the white water elevating pipes, in this case pipe 20. Many such switches are available, hence the details are not hereindisclosed. The switch 66 is arranged in a control circuit to be presently described whereby upon the rise in pressure when air passes through the mat action of other control means is initiated.

The first function of the pressure differential switch 66 is to control the actuation of the deckle box frame elevating mechanism including motor 10a. As disclosed in the aforesaid application, Serial No. 20,333, a control circuit is provided whereby the elevation of the deckle box frame 10 to a sufficient height to permit withdrawal of

the formed wet mat causes actuation of screen feeding mechanism whereby the portion of the screen holding the formed mat is fed forwardly out of the deckle box and into succeeding mechanism. As soon as the screen is arrested after having traveled the required distance to place a fresh section of screen within the deckle box, the upper frame 10 is lowered to form a complete enclosure with the lower portion 14. The control circuit of the present invention will now be explained. Referring to Fig. 5, it is apparent that current is supplied to the control circuit through a pair of supply lines 101 and 103. Connected between the supply lines is a line 105 including pressure differential switch 66 and a timer controlled relay 107. The timer controlled relay controls a switch 109 in a line 111 connected between the supply lines, line 111 containing motor 10a previously mentioned.

A bracket 80 on frame 10 supports a movable contact 113, and a bracket 81 on a fixed support holds a fixed contact 115. Contacts 113 and 115 constitute a switch in a line 117 connected between the supply lines, line 117 containing a first timer controlled relay 119 and a second timer controlled relay 121. Timer controlled relay 119 controls a switch 123 in a line 125 connected to the supply lines, line 125 containing motor 47 for controlling valve 46. Timer controlled relay 121 controls a switch 127 arranged in a line 129 connected to the supply lines. Connected in line 129 in parallel relation are motors 26, 36 and 40.

The timer controlled relays are of conventional construction, and hence the detailed construction need not be given. It is sufficient to say that each is of the type adapted to be intermittently energized, and operable during each period of energization to energize a relay associated therewith for a shorter time than the period of energization of the timer, and upon termination of the period of energization of the timer to automatically reset itself to be in condition for a subsequent cycle of operation.

The operation of the control circuit is as follows. It may be assumed that switch 66 is open and that a charge of slurry has been deposited in the deckle box frame 10 and water is being drawn out through conduits 20 and 57. Timer controlled relay 107 is de-energized and thus switch 109 is open. Motor 10a is thus de-energized, and therefore the deckle box frame 10 remains resting on fixed deckle box portion 14 and thus contacts 113 and 115 are in engagement. Timer controlled relays 119 and 121 are thus energized, but at this time in positions for de-energizing the associated relays, so that switches 123 and 127 are open.

When the vacuum first breaks, and is sensed by pressure differential switch 66, the switch closes to energize timer controlled relay 107. Timer controlled relay 107 is set to immediately close switch 109 to thus energize motor 10a and cause deckle box frame 10 to be elevated to separate contacts 113 and 115 and thus de-energize timer controlled relays 119 and 121. Switches 123 and 127 remain open while the timer controlled relays automatically reset themselves.

As soon as the deckle box frame is sufficiently elevated, the screen is moved to remove the wet mat. When a fresh section of screen is in position, the screen is arrested and the deckle box frame returned. As the deckle box frame descends, contacts 113 and 115 are brought into engagement, and a number of events occur. First, timer controlled relay 107 is energized and is set

to immediately energize its relay and thus cause opening of switch 109 to thus de-energize motor 10a. Also, closing of switches 113 and 115 energizes the reset timer controlled relays 119 and 121, timer controlled relay 121 being set to immediately energize its relay and thus close switch 127, while timer controlled relay 119 is set to delay energization of its relay and thus switch 123 remains open. Closing of switch 127 causes energization of motors 26, 36 and 40 so that a slurry charge is formed in and passes down flume 41, while return water flows into box 14. The valve 60 is so regulated with respect to the timing of the cycle that the return flow into the fixed portion 14, while white water and slurry are being discharged into the deckle box frame, is sufficient to bring the level back to the bottom of the screen 15 just before the first of the mixture hits the top of the screen. For any thickness of wet mat, the system may be accurately balanced so that the water strikes both sides of the screen at the same instant.

A short time thereafter, timer controlled relay 121 de-energizes its relay to open switch 127 and thus de-energize motors 26, 36 and 40, so that gate 34, gate 38, and vent valve 25 are closed. Simultaneously with this action, timer controlled relay 119 functions to energize its relay to close switch 123 so that motor 47 is energized to prevent dripping of fluid from flume 41.

In order to prevent surging of the white water through the screen a series of baffles are arranged in the interior of the lower portion 14. The baffles preferably comprise a horizontal baffle 70 extending partially across the deckle box and partially lengthwise thereof at a level slightly below the grid 17. The horizontal baffle is preferably provided with a plurality of openings 71 through which some liquid may flow. A longitudinally extending strap 72 is mounted on the lower surface of the baffle 70, and a plurality of diagonally disposed, vertical vanes 73 extend therefrom to the bottom wall of the portion 14 for slowing down the water returning through the pipe 20 and tube 57. A vertical end baffle 74 extends from the rear edge of baffle 70 to a point slightly above the lower wall of the portion 14. It is preferred that the vanes 73 opposite pipe 20 slant toward the vanes opposite tube 57 and the meeting point between the two sets of vanes be disposed between two of the openings 71 so as to prevent upward surging of the returned white water. Various other arrangements of baffles may be provided without departing from the present invention, the sole requisite being that the water be prevented from surging upwardly through portions of the screen and be caused to return quietly to the level of the bottom of the screen.

Having illustrated and described a preferred embodiment of the invention, it should be apparent to those skilled in the art that the invention permits of modification in detail and arrangement. I claim as my invention all such modifications as come within the true spirit and scope of the appended claims.

I claim:

1. Apparatus for forming a fibre mat by withdrawing white water from a slurry of fibres, comprising a forming vat including an upwardly open, upper part into which a charge of slurry may be directed and a lower part through which white water may be drawn, a screen separating said upper and lower parts, an elevated, sealed, white water storage tank, first conduit means

connecting the top of said tank to the lower part of said vat, said first conduit means extending horizontally from the lower part of said vat and then upwardly to said tank, means for creating a vacuum in said tank to withdraw white water from slurry deposited in the upper part of said vat through said screen, the lower part of said vat, and said first conduit means into said tank whereby to form a mat of fibres on said screen, overflow means including an overflow funnel in said tank, an outlet from said funnel, and an outwardly opening check valve in said outlet for sealing said overflow means when a vacuum is drawn in said tank, operable to divert a portion of the elevated white water from said tank, second conduit means leading from the bottom of said tank to the lower part of the vat whereby the remainder of the elevated white water may return to said lower part when the vacuum in said tank is broken, a vent valve communicating with said tank above said overflow funnel, and means responsive to the lowering of the liquid level in said vat to a point beneath said screen for opening said vent valve.

2. Apparatus for forming a fibre mat by withdrawing white water from a slurry of fibres, comprising a forming vat including an upwardly open, upper part into which a charge of slurry may be directed and a lower part through which white water may be drawn, a screen separating said upper and lower parts, an elevated, sealed, white water storage tank, large conduit means connecting the top of said tank to the lower part of said vat, said large conduit means extending horizontally from said lower part of the vat and then upwardly to said tank, means for creating a vacuum in said tank to withdraw white water from slurry deposited in the upper part of said vat through said screen, the lower part of said vat, and said large conduit means into said tank whereby to deposit a mat of fibres on said screen, overflow means including an overflow funnel in said tank, an outlet from said funnel, and an outwardly opening check valve in said outlet for sealing said overflow means when a vacuum is drawn in said tank, operable to divert a portion of the elevated white water from said tank, second conduit means leading from the bottom of said tank to the lower part of the vat whereby the remainder of the elevated white water may return to said lower part when the vacuum in said tank is broken, a vent valve communicating with said tank above said overflow funnel, and means responsive to the lowering of the liquid level in said vat to a point beneath said screen for opening said vent valve, said second conduit means being constantly open so that some white water is elevated therethrough into said tank as long as sufficient vacuum exists.

3. Apparatus for forming a fibre mat by withdrawing white water from a slurry of fibres, comprising a forming vat including an upwardly open, upper part into which a charge of slurry may be directed and a lower part through which white water may be drawn, a screen separating said upper and lower parts, an elevated, sealed, white water storage tank, large conduit means connecting the top of said tank to the lower part of said vat, said large conduit means extending horizontally from said lower part and then upwardly to said tank, means for creating a vacuum in said tank to withdraw white water from slurry deposited in the upper part of said vat through said screen, the lower part of said vat, and said large conduit means into said tank whereby to

deposit a mat of fibres on said screen, overflow means including an overflow funnel in said tank, an outlet from said funnel, and an outwardly opening check valve in said outlet for sealing said overflow means when a vacuum is drawn in said tank, operable to divert a portion of the elevated white water from said tank, second conduit means leading from the bottom of said tank to the lower part of the vat whereby the remainder of the elevated white water may return to said lower part when the vacuum in said tank is broken, a vent valve communicating with said tank above said overflow funnel, and means responsive to the lowering of the liquid level in said vat to a point beneath said screen for opening said vent valve, and a regulating valve in said second conduit means for controlling the rate of flow there-through.

4. Apparatus for forming a fibre mat by withdrawing white water from a slurry of fibres, comprising a forming vat including an upwardly open, upper part into which a charge of slurry may be directed and a lower part through which white water may be drawn, a screen separating said upper and lower parts, an elevated, sealed, white water storage tank, first conduit means connecting the top of said tank to the lower part of said vat, said first conduit means extending horizontally from said lower part and then upwardly to said tank, means for creating a vacuum in said tank to withdraw white water from slurry deposited in the upper part of said vat through said screen, the lower part of said vat, and said first conduit means into said tank whereby to form a mat of fibres on said screen, overflow means including an overflow funnel in said tank, an outlet from said funnel, and an outwardly opening check valve in said outlet for sealing said overflow means when a vacuum is drawn in said tank, operable to divert a portion of the elevated white water from said tank, second conduit means leading from the bottom of said tank to the lower part of the vat whereby the remainder of the elevated white water may return to said lower part when the vacuum in said tank is broken, a vent valve communicating with said tank above said overflow funnel, and means responsive to the lowering of the liquid level in said vat to a point beneath said screen for opening said vent valve, said second conduit means comprising a large, vertical portion depending from said tank, and said overflow funnel comprising a lower portion extending loosely into said large, vertical portion whereby white water may enter said second conduit means around the lower end of said funnel as well as over the upper edge of said funnel.

RALPH CHAPMAN.

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