

Oct. 2, 1951

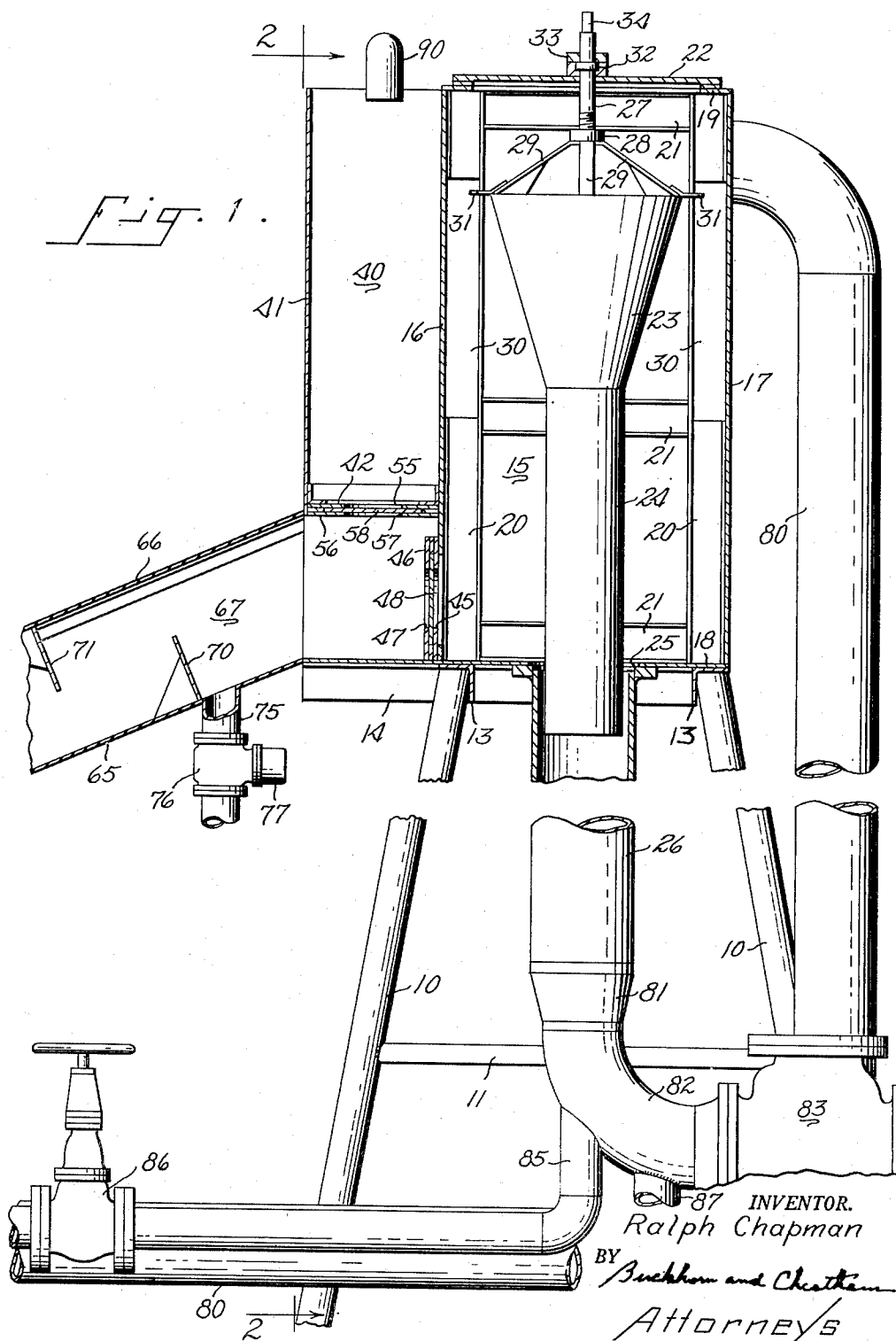
R. CHAPMAN

2,570,099

FORMING TOWER WITH SLIDING VALVE

Filed Dec. 20, 1948

2 Sheets-Sheet 1



Oct. 2, 1951

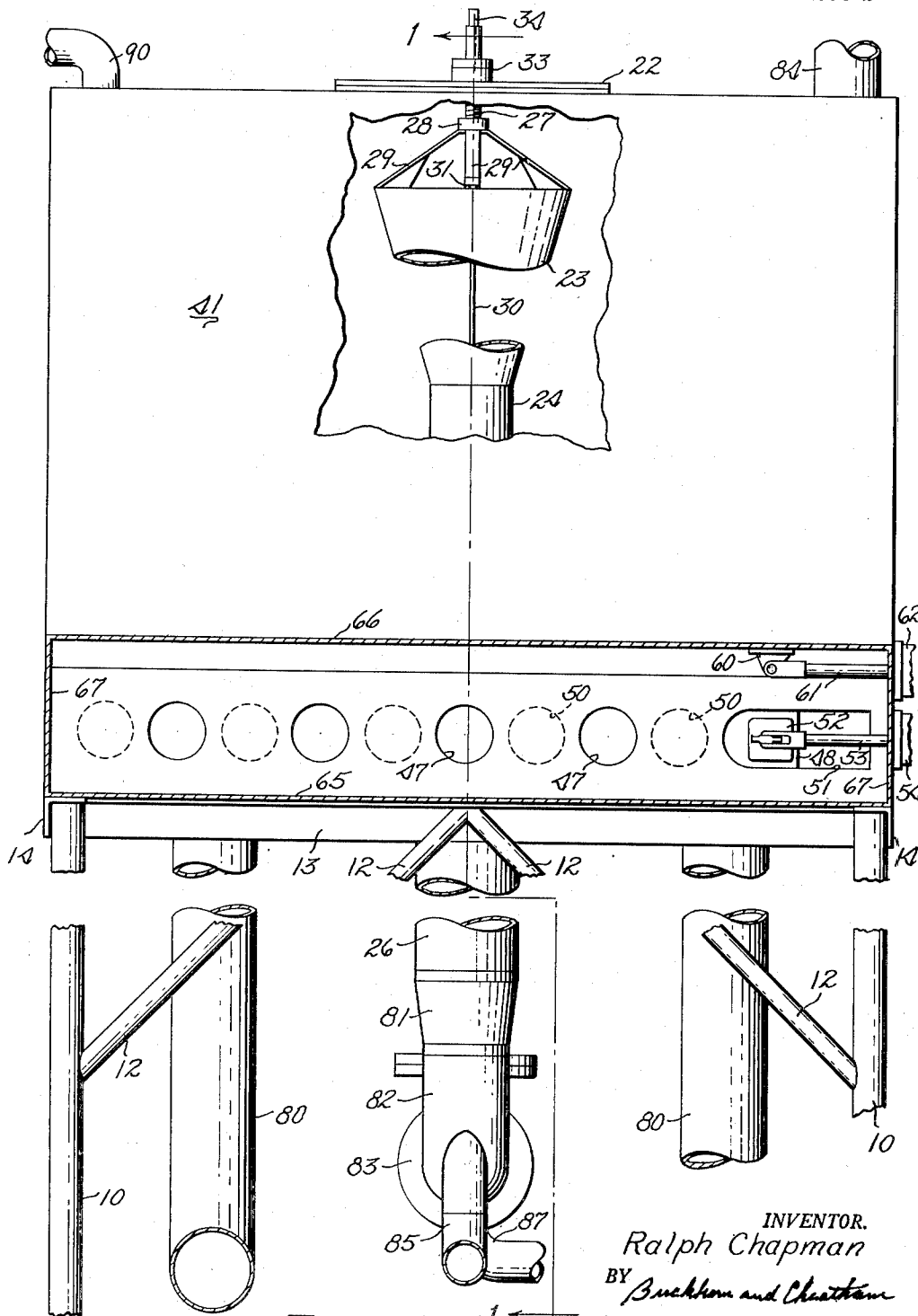
R. CHAPMAN

2,570,099

FORMING TOWER WITH SLIDING VALVE

Filed Dec. 20, 1948

2 Sheets-Sheet 2



INVENTOR.
Ralph Chapman
BY *Buckhorn and Cheatham*
Attorneys

UNITED STATES PATENT OFFICE

2,570,099

FORMING TOWER WITH SLIDING VALVE

Ralph Chapman, Corvallis, Oreg., assignor to
Chapman Forest Utilization, Inc., Corvallis,
Oreg., a corporation of Oregon

Application December 20, 1948, Serial No. 66,175

8 Claims. (Cl. 259—4)

1

My present invention comprises an improvement in a forming tower for fibre board making machines, the same being an improvement upon the structure disclosed and claimed in my copending application, Serial No. 20,333, filed April 10, 1948. In the aforesaid copending application apparatus and a method whereby a measured charge of thick fiber slurry may be diluted with white water separated from a preceding charge of slurry are disclosed. The amount of white water mixed with the slurry may be accurately controlled by an adjustable overflow device. Means are disclosed whereby the slurry and white water are intimately mixed upon discharge into a mat-forming deckle box including a fixed lower portion below a forming screen and a vertically reciprocating upper part or deckle box frame above the screen. Means are also disclosed whereby the forming tower and deckle box are controlled in interlocked relation to other equipment including an intermittently movable, endless forming screen and a cold press to which the formed wet mats are delivered when the deckle box frame is raised, the cold press acting to express excess water from the formed mat prior to delivery of the mat to a forming press in which heat and pressure may be applied to the mat to consolidate it into an artificial board. It is disclosed in the aforesaid application that certain fibrous material may be utilized alone, or fibers may be used in combination with binding materials such as phenolic resins which are converted into an insoluble, infusible state under the action of heat and pressure. The present invention has to do with improving the operation of the forming tower whereby a more uniform mat may be formed by the deckle box and screen.

An object of the present invention is to reduce the size and cost of the forming tower by utilizing less rigid plates and bracing them by suitable internal bracing structure.

A further object of the present invention is to provide means whereby more thorough and intimate mixing of the salvaged white water and thick slurry is achieved in a more rapid manner, thus increasing the number of forming operations which may be performed in a given time.

A further object of the present invention is to provide an improved forming tower whereby a portion of the white water drawn from one batch of diluted slurry is returned to the lower portion of the deckle box up to the level of the forming screen so that the dumping of the succeeding batch of diluted slurry into the upper deckle box frame will not cause an initial rush of fiber-bearing

2

ing slurry through portions of the screen, which in the prior apparatus sometimes resulted in uneven formation.

A further object of the present invention is to reduce the cost and increase the efficiency of the apparatus by eliminating a number of large, expensive, and relatively slow acting valves incorporated in the previous equipment.

A further object of the present invention is to provide improved valve means and discharge means for directing the slurry mixture into the deckle box whereby more intimate mixture of the fibers with the resinous substances, et cetera, retained in the white water is achieved.

A further object of the present invention is to provide means whereby the flow of the slurry mixture into the deckle box is abruptly terminated, thus eliminating possibility of a trickle of water dropping onto the formed wet mat just prior to the raising of the deckle box frame and withdrawal of the mat therefrom. In the prior apparatus such trickles from the forming tower sometimes caused the formation of pits in the wet mat which showed up in the board even after final compression and consolidation.

The present application is a companion application to an application filed concurrently herewith entitled "Deckle Box With White Water Return," Serial No. 66,176, filed December 20, 1948. Inventive concepts not herein claimed are fully illustrated, described and claimed in the aforesaid concurrently filed application.

The objects and advantages of the present invention may be more clearly ascertained by inspection of 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 distinctly pointed out in the appended claims.

In the drawings—

Fig. 1 is a vertical section taken through the improved forming tower substantially along line 1—1 of Fig. 2; and

Fig. 2 is a front view of the forming tower taken substantially from the plane of the line 2—2 of Fig. 1, with parts of the apparatus broken away to illustrate details.

The forming tower preferably comprises a plurality of supporting legs 10 braced by suitable braces 11 and struts 12. The legs and struts support a horizontal frame including longitudinal angle bars 13 and lateral angle bars 14. The frame supports a closed, large tank into which the white water is returned and an attached smaller tank into which the thick slurry of fibers

3

is dumped. The frame also supports a discharge flume from which liquid material may be discharged from the tanks into the deckle box (not shown). The closed tank includes side walls 15, a front wall 16, a rear wall 17, a bottom 18, and a top 19. Collapse or bulging of the tank walls is prevented by welding them to suitable internal frames built up of channel or I-beams welded together and including the vertical members 20 and cross braces 21. A manhole cover 22 seals a large opening in the top wall 19 through which a funnel may be inserted into the tank, the funnel comprising the flaring portion 23 and a lower tubular stem 24. The stem portion of the funnel projects through an opening 25 in the bottom wall 18 and is received in a large overflow pipe 26 directed straight downwardly from the bottom wall at least far enough to permit reception of a large part of the stem 24. The funnel may be adjustably positioned within the tank by telescoping the stem into the overflow pipe. For this purpose the funnel is supported upon a vertical adjusting screw 27 threadedly engaging a nut 28 supported upon spider arms 29 extending from the top of the funnel. A pair of vertical guide bars 30 are mounted upon the front and rear walls 16 and 17 and a pair of guide clips 31 are mounted upon the funnel 23, the clips having forked tips adapted to embrace the edges of the guide bars 30 to prevent rotation of the funnel when the screw 27 is rotated. The screw 27 has a collar 32 thereon which is retained in a separable collar support 33 so that longitudinal movement of the screw is prevented and the funnel is supported by the enlargement 32. The upper end of the screw 27 is provided with a rectangular portion 34 onto which a crank may be slipped to permit adjustment of the funnel when desired.

The slurry tank is mounted upon the front of the closed white water tank and, for economy, the front wall 16 forms a common partition between the two tanks, the slurry tank being formed by welding end walls 40 to the wall 16 and connecting the end walls by a front wall 41 and a bottom 42. The bottom 42 is located a considerable distance above the bottom 18 which is projected forwardly to a point beneath the wall 41 so that a partially enclosed space, open at the front, is provided between the walls 16, 18, 40 and 42. The wall 16 is provided with a plurality of spaced white water outlet apertures 45 extending in a horizontal row thereacross. A valve-retaining plate 46 is mounted upon the front surface of wall 16 and spaced therefrom, the plate 46 being provided with a plurality of apertures 47 aligned with the apertures 45. A sliding dump valve 48 is retained between the wall 16 and plate 46, the same being provided with a plurality of openings 50 of the same size as the openings 45 and 47. The last opening at one end of the plate 46 is elongated to provide an operating mechanism opening 51 through which a bracket 52 attached to valve 48 extends. An actuating rod 53 is pivotally attached to the bracket 52 and extends through the end wall 40 into a valve actuator 54 which may be any suitable type of hydraulic, pneumatic, electrical or mechanical device capable of moving the valve plate when energized.

The bottom 42 of the slurry tank is provided with a plurality of aligned openings 55, and a guide plate 56 provided with matching openings 57 is mounted below the bottom 42 in spaced relation thereto. A slurry tank dump valve 58 is slidably retained between members 42 and 55 and is provided with openings (not shown)

4

adapted to be moved into registry with the fixed openings when it is desired to empty the slurry tank. The end opening adjacent one end is elongated (not shown) so that a bracket 60 may extend therethrough and be pivotally attached to an operating rod 61 extending from a motor device 62 capable of moving the valve plate 58. As will be seen from inspection of Fig. 1, it is preferred that the openings in the bottom of the slurry tank be directly above the openings in the side wall of the white water tank. Therefore, when the two valves are opened simultaneously, jets of white water will be discharged horizontally through streams of thick pulp descending vertically into the partially enclosed space, thereby causing intimate mixture of the two bodies of liquid.

A discharging flume extends from the open forward wall of the partially enclosed space, the same comprising a lower wall 65 extending from the front edge of the bottom 18, a top wall 66 extending from the lower edge of the front wall 41, and side walls 67 extending from the walls 40. The flume therefore comprises a rectangular, horizontally flattened spout capable of directing a wide stream of the mixture into an elongated deckle box or the like placed directly in front of the tower. In order to insure uniform spreading and further to mix the two liquids, a plurality of lateral baffles are preferably provided, the first baffle 70 extending vertically upward from the bottom wall 65 to a point adjacent or slightly beyond the centerline of the spout, and the second baffle 71 extending vertically downward from the top wall 66 to a point adjacent or beyond the centerline of the spout. The streams of the mixture are thus spread laterally and turbulently mixed.

After the tanks have been completely drained and the valves closed, there will still be liquid draining from the flume to a certain extent. In order to minimize this drainage, a drain pipe 75 is placed in the angle between the wall 65 and baffle 70, the same preferably being opened and closed by a valve 76 actuated by a motor device 77. The drain may lead to any desired place where the white water values may be recovered. Dripping from the portion of the flume beyond the baffle 70 will have ceased prior to the time that the formed mat is exposed upon the screen.

The deckle box or similar apparatus into which the slurry is dumped and in which the mat is formed is connected to the closed white water tank through a pair of white water return pipes 80 which extend laterally from the bottom of the forming apparatus, beneath the tower, then vertically upward and into the top of the tower through the rear wall 17. There will naturally be more white water drawn from one charge of slurry than needed, since the succeeding charge of thick slurry pumped into the slurry tank will comprise a large amount of water. The excess is drawn off through the overflow tube 26 to the extent adjustably determined by the level of the funnel 23. The large tube 26 is preferably connected to a downwardly directed reducer 81 which is connected to a laterally directed elbow 82. The elbow extends into a check valve 83 of any suitable nature such as would be provided by a flapper valve, the purpose of the check valve being to permit a vacuum to be drawn beneath the screen so that the white water will be drawn through the return tubes 80, or to open and discharge excess from the tube 26 when the vacuum in the white water tank is broken. In order to

5

draw a vacuum in the interior of the white water tower and to hold the check valve 83 firmly closed when the white water is being drawn through the screen and returned, the upper wall 19 is provided with an opening with which communicates a pipe 84 (Fig. 2) leading to a vacuum pump as disclosed in the aforesaid copending application, Serial No. 20,333, filed April 10, 1948. Vent means as also disclosed in said application may be opened at the proper time so that when the sliding gate valves are opened the white water may leave the tower through the flume and also the excess may leave the overflow tube 26 through the check valve. An important feature of the presently disclosed apparatus which will be more fully illustrated and claimed in the aforesaid application filed concurrently herewith, Serial No. 66,176, filed December 20, 1948, includes the following: It will be noticed that the internal diameter of the tube 23 is larger than the external diameter of the funnel stem 24 so that an annular space is provided through which a limited amount of white water may run. Therefore, the water which flows through the overflow tube 26 not only comes down from the top of the funnel but also includes a constant flow from the white water tank as long as there is any white water in the tank, even when the check valve 83 is held closed by vacuum pressure. The elbow 82 is provided with a pair of openings in its bottom surface. The first opening is connected to a vertical tube 85 which is substantially coaxial with the tube 26 so that liquid running down the tube 26 and directed inwardly by the reducer 81 will be to a large extent directed into the tube 85. The tube 85 is then extended horizontally forward into the bottom of the deckle box or other forming apparatus, a manually adjustable valve 86 being provided to control the rate of flow through the tube. The second opening in the elbow 82 is in the bottom of the elbow at a point where the elbow begins to turn horizontally and is connected to a second vertically directed tube 87. If a small amount of liquid is running through the overflow tube 26, such as would be represented by the escape through the annular space surrounding the stem 24, most of the liquid will be directed into either of the tubes 85 or 87. The tube 87 is directed horizontally and connected into the left-hand white water return tube 80. As disclosed in the concurrently filed application, Serial No. 66,176, filed December 20, 1948, this tube is preferably unrestricted.

Operation

With the forming apparatus about to receive a charge of slurry (in the instant apparatus the deckle box frame is down, the forming screen is at rest, the white water and slurry tanks are full, the sliding gate dump valves and vent are open, and the flume drain 75 is closed) there should be water in the lower part of the deckle box or other forming apparatus about up to the level of the screen. Some water is draining into the overflow around the funnel and running into the deckle box or forming apparatus below the screen. When the dump valves are open the two tanks drain into the flume which directs the mixture into the forming apparatus, the valves being held open for a length of time sufficient completely to empty the tanks. This time is preferably controlled by a time delay relay which is started on its timed cycle of operation by the lowering of the deckle box frame. The length of

6

time is such that the tanks would be emptied even when the funnel is elevated to its highest extent. When the time cycle is over the dump valves and the vent are closed and the flume drain 75 is opened; also a pump or valve is actuated to cause flow of slurry into the slurry tank through an inlet pipe 90. The vacuum pump, which preferably operates continuously, draws a vacuum in the interior of the white water tower and beneath the forming screen until the white water is completely drawn from the slurry through the screen and the vacuum is broken. At this point the lower part of the deckle box or forming apparatus should be partially emptied. Breaking the vacuum permits water from the overflow tube 26 to flow through the tubes 85 and 87 back into the bottom of the deckle box or forming apparatus, the amount thereof being adjustably regulated by manipulation of the hand valve 85 so that, regardless of the thickness of mat being formed as determined by the amount of slurry and white water discharged into the forming apparatus, the return to the bottom of the screen may be regulated. The return is regulated so that when a succeeding charge of mixture is dumped into the forming apparatus it will be met by water standing in the bottom half of the forming apparatus up to the level of the screen. Breaking the vacuum also permits the check valve to open so that water runs from the overflow not only to the bottom of the deckle box but to the waste drain or other place of usage of the white water excess. Breaking of the vacuum also permits control systems (not shown) to cause initiation of upward movement of the deckle box frame, to move the screen forward to remove the mat when the deckle box frame is raised to a sufficient extent, to stop the screen when the wet mat is in the cold press, to actuate the cold press, and to return the deckle box frame to its lower position when the screen has come to rest. The control circuit thereupon opens the dump valves and vent valve and closes the flume drain valve to start the next cycle of operation. The control circuit and deckle box are omitted from this application, since such control circuit and deckle box have no bearing upon the effectiveness of the disclosed and claimed invention which may be utilized for mixing thick slurry and any diluting liquid and for discharging the same into related apparatus, for cutting off after-drip as fast as possible, and for permitting the escape of excess fluid. Details of some portions of omitted apparatus will be apparent from the concurrently filed application, Serial No. 66,176, filed December 20, 1948, and are claimed therein. The apparatus may be modified in arrangement and detail as will be readily apparent to those skilled in the art, and I claim as my invention all such modifications as come within the purview of the appended claims.

I claim:

1. Apparatus for intimately mixing a pulp slurry with a diluting liquid, comprising a first tank having a front wall, a first dump valve opening across the entire width of the lower portion of said front wall, a second tank arranged immediately adjacent said front wall and having a bottom extending forwardly above said first valve, a second dump valve opening across the entire width of said bottom, and means connected to said tanks and defining a mixing chamber communicating with said tanks through said valves.

7

2. Apparatus for intimately mixing a pulp slurry with a diluting liquid, comprising a first tank having a front wall, a first sliding gate valve opening across the entire width of the lower portion of said front wall, a second tank arranged immediately adjacent said front wall and having a bottom extending forwardly above said first valve, a second sliding gate valve opening across the entire width of said bottom, and a closed flume spout including a bottom wall extending forwardly from the bottom of said first tank and a top wall extending forwardly from the bottom of said second tank.

3. A forming tower for intimately mixing a thick slurry of board-forming fibres with a second liquid such as white water, comprising a first tank having a front wall, the lower part of said front wall having a plurality of spaced openings therethrough across the entire width thereof, a dump valve gate movably arranged adjacent the lower part of said front wall and adapted upon movement simultaneously to uncover all of said spaced openings, a second tank having a plurality of spaced openings in its bottom across the entire width thereof, said second tank being disposed in front of and above the lower part of said front wall, a second dump valve gate movably mounted upon said bottom and adapted upon movement simultaneously to uncover all of the openings in said bottom, and means defining a mixing chamber and flume communicating with said tanks through said openings for receiving the contents of said tanks.

4. A forming tower for intimately mixing a thick slurry of board-forming pulp with a diluting liquid, comprising a first tank in which the diluting liquid may be retained, said first tank having a front wall, the lower part of said front wall having a plurality of spaced openings therethrough across the entire width thereof, a first plate slidably guided upon said lower part of said front wall and having a plurality of openings therethrough adapted to register with the openings in said front wall to permit escape of liquid from said first tank in a plurality of horizontal jets, a slurry tank having a plurality of openings in its bottom across the entire width thereof, said bottom being disposed above and in front of said lower part of said front wall with the openings therein being disposed above the openings in said front wall, a second plate slidably mounted upon said bottom and having a plurality of openings therethrough adapted to register with the openings in said bottom to permit the escape of slurry from said slurry tank in a plurality of vertical streams directed into the paths of the horizontal jets from said first tank, a mixing chamber defined in part by said front wall and said bottom, and a spout communicating with said chamber.

5. A forming tower for intimately mixing a thick slurry of board-forming pulp with a diluting liquid, comprising a first tank in which the diluting liquid may be retained, said first tank having a front wall, the lower part of said front wall having a plurality of spaced openings therethrough across the entire width thereof, a first plate slidably guided upon said lower part of said front wall and having a plurality of openings therethrough adapted to register with the openings in said front wall to permit escape of liquid from said first tank in a plurality of horizontal jets, a slurry tank having a plurality of openings in its bottom across the entire width thereof, said bottom being disposed above and in front of said lower part of said front wall with the

8

openings therein being disposed above the openings in said front wall, a second plate slidably mounted upon said bottom and having a plurality of openings therethrough adapted to register with the openings in said bottom to permit the escape of slurry from said slurry tank in a plurality of vertical streams directed into the paths of the horizontal jets from said first tank, and a horizontally flattened, closed mixing spout extending forwardly from said tanks in which the mixed slurry and diluting fluid may be confined.

6. A forming tower for intimately mixing a thick slurry of board-forming pulp with a diluting liquid, comprising a first tank in which the diluting liquid may be retained, said first tank having a front wall, the lower part of said front wall having a plurality of spaced openings therethrough across the entire width thereof, a first plate slidably guided upon said lower part of said front wall and having a plurality of openings therethrough adapted to register with the openings in said front wall to permit escape of liquid from said first tank in a plurality of horizontal jets, a slurry tank having a plurality of openings in its bottom across the entire width thereof, said bottom being disposed above and in front of said lower part of said front wall with the openings therein being disposed above the openings in said front wall, a second plate slidably mounted upon said bottom and having a plurality of openings therethrough adapted to register with the openings in said bottom to permit the escape of slurry from said slurry tank in a plurality of vertical streams directed into the paths of the horizontal jets from said first tank, a mixing spout including a lower wall extending forwardly from beneath the openings in said front wall, side walls, and an upper wall extending forwardly from the bottom of said slurry tank, said mixing spout walls forming a closed flume, and a plurality of baffles extending from side to side of said spout.

7. A forming tower for intimately mixing a thick slurry of board-forming pulp with a diluting liquid, comprising a first tank in which the diluting liquid may be retained, said first tank having a front wall, the lower part of said front wall having a plurality of spaced openings therethrough across the entire width thereof, a first plate slidably guided upon said lower part of said front wall and having a plurality of openings therethrough adapted to register with the openings in said front wall to permit escape of liquid from said first tank in a plurality of horizontal jets, a slurry tank having a plurality of openings in its bottom across the entire width thereof, said bottom being disposed above and in front of said lower part of said front wall with the openings therein being disposed above the openings in said front wall, a second plate slidably mounted upon said bottom and having a plurality of openings therethrough adapted to register with the openings in said bottom to permit the escape of slurry from said slurry tank in a plurality of vertical streams directed into the paths of the horizontal jets from said first tank, a mixing spout including a lower wall extending forwardly from beneath the openings in said front wall, side walls, and an upper wall extending forwardly from the bottom of said slurry tank, said mixing spout walls forming a closed flume, and a plurality of opposed baffles extending from side to side of said spout and arranged alternately upon

9

the upper and lower walls thereof and extending to the centerline thereof.

8. A forming tower for intimately mixing a thick slurry of board-making pulp with a diluting liquid, comprising a first tank in which the diluting liquid may be retained, said first tank having a front wall, the lower part of said front wall having a plurality of spaced openings there-
through across the entire width thereof, a first plate slidably guided upon said lower part of said front wall and having a plurality of openings therethrough adapted to register with the open-
ings in said front wall to permit escape of liquid from said first tank in a plurality of horizontal jets, a slurry tank having a plurality of open-
ings in its bottom across the entire width thereof, said bottom being disposed above and in front of said lower part of said front wall with the
openings therein being disposed above the open-
ings in said front wall, a second plate slidably mounted upon said bottom and having a plu-
rality of openings therethrough adapted to reg-
ister with the openings in said bottom to permit the escape of slurry from said second tank in a
plurality of vertical streams directed into the
paths of the horizontal jets from said first tank,
a mixing spout including a lower wall extending

10

forwardly from beneath the openings in said front wall, side walls, and an upper wall ex-
tending forwardly from the bottom of said sec-
ond tank, said mixing spout walls forming a
closed flume, a plurality of opposed baffles ex-
tending from side to side of said spout and ar-
ranged alternately upon the upper and lower
walls thereof and extending to the centerline
thereof, and means to drain liquid from the an-
gle between said lower wall and a baffle extend-
ing therefrom.

RALPH CHAPMAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
550,912	Fenimore	Dec. 3, 1895
2,010,239	Martin	Aug. 6, 1935
2,108,999	Sisley	Feb. 22, 1938
2,413,976	Juliano	Jan. 7, 1947
2,423,801	Sloan	July 8, 1947

FOREIGN PATENTS

Number	Country	Date
669,533	Germany	Dec. 29, 1938