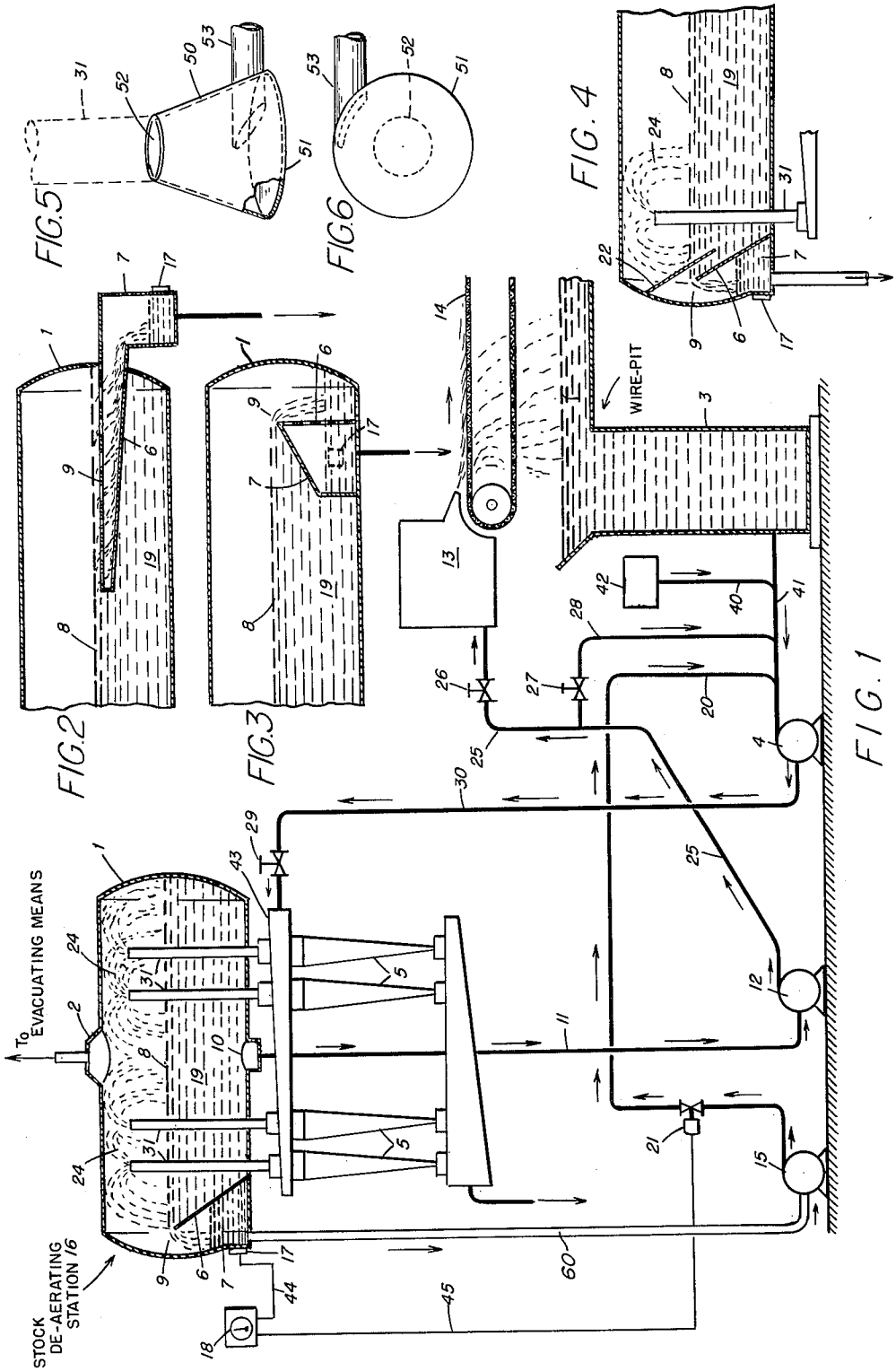
Sept. 21, 1965 R. G. KAISER ETAL 3,206,917

DEAERATED STOCK FLOW CONTROL

Filed Oct. 4, 1961 2 Sheets-Sheet 1

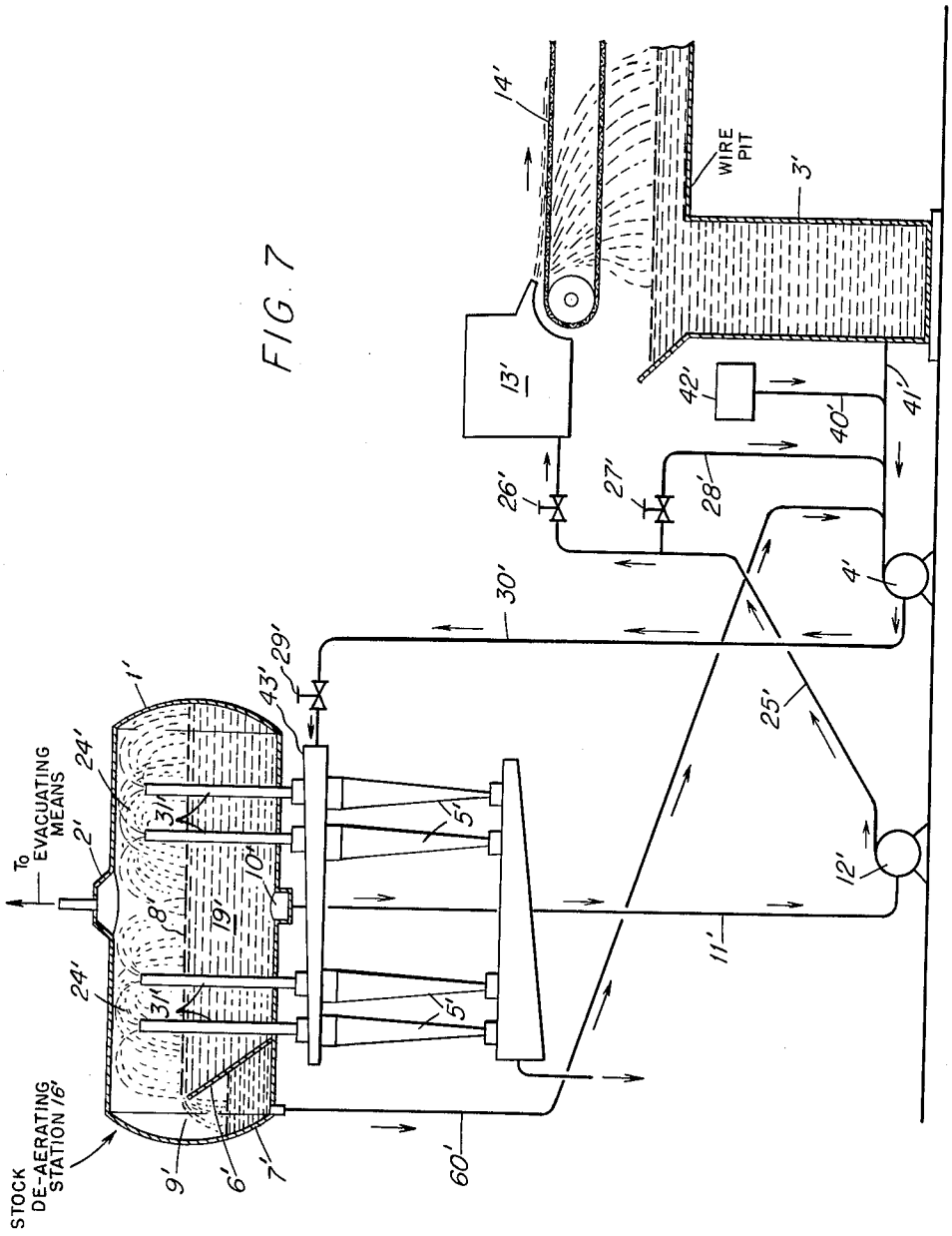


Sept. 21, 1965 R. G. KAISER ETAL 3,206,917

DEAERATED STOCK FLOW CONTROL

Filed Oct. 4, 1961 2 Sheets-Sheet 2

FIG. 7



United States Patent Office 3,206,917 Patented Sept. 21, 1965

3,206,917

DEAERATED STOCK FLOW CONTROL

Robert G. Kaiser, Ho-Ho-Kus, N.J., and John C. Stewart, North Tarrytown, N.Y., assignors to Clark & Vicario Corporation, North Tarrytown, N.Y., a corporation of New York

Filed Oct. 4, 1961, Ser. No. 142,987
10 Claims. (Cl. 55—41)

This invention relates to papermaking, and concerns apparatus and method for assuring a substantially constant flow of deaerated papermaking stock, which may also be de-dirted, from a deaerating station.

In current papermaking practice, an aqueous suspension of cellulosic papermaking stock is fed to the headbox of a papermaking machine, whence the stock is supplied to the wire of the machine. It is important that the flow of stock to the headbox be carefully regulated and substantially uniform, else the weight and caliper of the paper made by the machine is subject to unacceptable variation. Particularly with the advent of increasingly rapid machine speeds, the necessity for more accurate control assuring constant flow of stock to the headbox has become of commensurately greater importance.

More modern methods of papermaking take advantage of the discovery that a superior product is obtained by deaerating the aqueous cellulosic suspension of stock before it reaches the machine. Method and apparatus for accomplishing such deaeration are disclosed in U.S. Patents 2,614,656, 2,642,950 and 2,685,937, and briefly entail atomizing a stock suspension into an enclosed tank or receiver which is maintained under significantly reduced pressure, well below atmospheric and preferably about 0.3 inch of mercury above the boiling point of the stock within the receiver. The stock is advantageously de-dirted as well as deaerated, as by the method and apparatus shown in U.S. Patents 2,717,536, 2,876,860 and 2,931,503.

In the environment of a stock deaerating station, previously known manners of regulating the flow of stock to the papermaking machine work less effectively, if at all. The significantly reduced pressure with the receiver seriously interferes with adequate regulation. For example, valving in the discharge pipe connecting receiver and headbox may be connected with displacement floats or the like within the receiver in an attempt to maintain a constant level of stock in the receiver, but it is found that such control valves tend to be in substantially constant motion, and the system tends continually to over-correct and to under-correct, causing significant variation in flow.

What has up to now been regarded as "constant" feed has thus actually been a fluctuating feed, but the fluctuations have been tolerated. Technological advancement has created a need for more refined regulation and a more carefully controlled flow. The necessity for conveying deaerated stock to the machine under vacuum has made the problem more acute.

The present invention provides a solution to this problem and assures a substantially constant flow of papermaking stock from a deaerated station operating under substantially less than atmospheric pressure. A feature of the invention is maintenance of a substantially constant level of stock in the receiver for supply to the headbox. Correlated improvements and advantages include means for rejecting foam, scum, and other undesirable fractions residing on the surface of the stock in the receiver.

A particularly important advantage of the present invention is that it permits simple and rapid changeover by the papermaker from a given grade or weight of paper to one of a different grade. Such changeovers may involve altering significantly the volume of stock fed to the headbox; presently known control systems must be manually and empirically adjusted to compensate for such substantial changes in flow, but the method and apparatus of the present invention rapidly and automatically accommodate changes in volume of the magnitude referred to. In addition, during start-up of the paper machine the transient period of level instability is greatly reduced and a stable operating level in the receiver is achieved in the shortest possible time. The resultant saving in time alone is of appreciable economic importance.

Other advantages and features of the invention will in part be obvious and will in part appear hereinafter.

In accordance with the present invention, an enclosed stock receiver in a deaerating station is equipped with evacuating means, suitably a vacuum pump, to maintain the receiver under substantially less than atmospheric pressure. The receiver cooperates with means admitting feed stock thereto as an atomized spray and is adapted to collect the resultant deaerated stock in a pond within said receiver. Means are provided to withdraw product deaerated stock from the pond within the receiver. Weir means are provided within the receiver and are positioned with the upper terminus of the weir at or slightly below the desired level of the pond of product deaerated stock within the receiver in such manner that excess product stock above the desired pond level overflows the weir.

A closed chamber having a capacity substantially less than that of the receiver communicates with the receiver and is adapted to receive and pool stock overflowing the weir for recycling. Recycle stock return means are provided to convey the recycle stock from the pool in the closed chamber to the receiver. At least a slight excess of feed stock is supplied to the receiver over that which is withdrawn as product deaerated stock, resulting in continual overflow of excess stock to the chamber for recycling. Means are provided to regulate the rate of flow of the recycle stock from the chamber to the receiver responsively to the level of the recycle stock pool in the chamber, suitably by employment of recycle stock pool level sensing means operatively connected to valve means located in the recycle stock return means conveying the recycle stock to the receiver. In this manner the level of the recycle stock pool is held substantially constant at a predetermined level or within predetermined limits.

It is desirable that the total volume of feed stock to the receiver (fresh stock plus recycle stock) not be subject to wide variation and it is accordingly preferred that an increase in the volume of recycle stock be accompanied by a decrease in the amount of fresh stock supplied, and conversely. This may be accomplished in accordance with the invention by supplying recycle stock to the intake side of the feed pump at a point ahead of the fresh stock intake.

Variations in flow of product deaerated stock from the receiver are principally due to an inconstant level of product stock forming the pond in the receiver, either through inadequate regulation or through "hunting" or other fluctuation as control devices measure the pond level and seek to restore or maintain the proper level by continually compensating for changes. The present invention maintains the level of the pond of stock substantially constant at or slightly above the predetermined height of the upper terminus of the weir, and avoids pond level sensing devices and associated control equipment and consequently avoids such seeking. Under equilibrium conditions the rate of excess stock overflowing the weir is constant, as is the level of recycle stock in the chamber. Imbalance in the system (e.g., when the discharge rate is altered) is rapidly and automatically corrected either by

an increase or decrease in the recycle rate, and the variation in pond level within the receiver is merely the variation in head overflowing the weir, at most an inch or so. Thus, the volume of overflow stock, while small in relation to the high capacity receiver, is large in relation to the small capacity chamber and causes a correspondingly significant in recycle stock pool level. The effect of change of pond level within the receiver is thus magnified in the pooled recycle stock level within the chamber, and correction is rapidly and automatically made by responsive alteration of the recycle rate. Thus the magnitude of any permitted variation in flow rate from the receiver pond is extremely small, and the variation itself is promptly eliminated.

While the degree of refinement of control and sensing devices is subject to variance and may readily be selected by one skilled in the art to meet a given set of circumstances, it is an advantage of the present invention that less refined and consequently less expensive control devices may be employed herein. Any fluctuation in level occurs in the overflow chamber pool and does not have any significant effect on the rate of flow of product stock from the receiver. Such fluctuations or "hunting" of the chamber pool level is not disadvantageous; the level of stock in the receiver, which is important, does not change significantly.

The invention may readily be apprehended by reference to the accompanying drawing in which FIG. 1 is a schematic representation of a control system in accordance with the invention, FIGS. 2, 3 and 4 show equivalent arrangements of the weir means within receiver, and FIGS. 5 and 6 illustrate a preferred nozzle for introducing stock into the receiver. FIGURE 7 is a schematic representation of an alternative arrangement of a control system similar to that shown in FIGURE 1.

Referring now particularly to FIG. 1, a stock deaerating station **16** is provided with an enclosed receiver **1** connected through port **2** to suitable vacuum-inducing means for maintaining the interior of the receiver under substantially less than atmospheric pressure. Pump **4** draws dilution white water from wire pit or silo **3** and new thick stock from stock preparation chest or other source **42** in desired proportion by appropriate adjustment of values or other means of regulation (not shown) in accordance with known practice. The resulting mixture is pumped through conduit **30** to header **43** for introduction to receiver **1**.

Feed stock is atomized into receiver **1** from header **43** by appropriate nozzles, suitably of the type shown in FIGS. 5 and 6. In FIG. 1 are shown hydrocyclones **5**, which de-dirt the feed stock and atomize it into receiver **1** through inlet pipes **31**. The nozzle of FIG. 5 may be substituted for hydrocyclones **5**, or the stock may be directly admitted to the receiver through inlet pipes **31**, so long as the feed stock is atomizingly admitted. Deaerating conditions are enhanced by the use of nozzles or hydrocyclones. A pond or reservoir **19** of deaerated stock is collected in receiver **1**. Inlet pipes **31** extend upwardly through pond **19** and admit atomized feed stock above the level **8** of pond **19**.

Product stock is withdrawn from receiver **1** through port **10**, located at or near the bottom of receiver **1**, by conduit **11** and pump **12** is fed through conduit **25** to headbox **13** and thence to the wire **14** of a papermaking machine. Papermaker's valve **26** is located in conduit **25** and permits regulation of the rate of flow of stock by the papermaker according to the demand for the particular weight of paper being made.

At least a slightly greater amount of stock is fed to the receiver through header **43** and inlet pipes **31** than is withdrawn through port **10**. Conveniently, the feed may be slightly greater than the maximum demand of the papermaking machine. Valve **29** in conduit **30** may be employed to regulate the flow of feed stock to the appropriate or desired volume.

There is provided within receiver **1** a weir **6**, the weir being so positioned as to permit excess stock to overflow its upper terminus **9** for recycling. Recycle stock overflowing the weir passes to chamber **7**, which is adapted to receive and pool overflow stock. Recycle stock from chamber **7** is returned at a controlled rate to receiver **1**, as hereinafter more fully appears. In FIG. 1, chamber **7** is shown communicating by means of a conduit **60** to the intake side of pump **15**. Alternatively, if desired, chamber **7** may communicate by a barometric drop leg to the intake side of pump **4** for regulated return of overflow stock to the receiver, as shown in FIG. 7.

In FIG. 1, recycle stock is returned to receiver **1** from chamber **7** by pump **15** and conduit **20**. Valve **21** in conduit **20** is operatively connected with sensing means **17**, which senses and is responsive to the level of the pool of recycle stock in chamber **7**, so that the flow of recycle stock from chamber **7** is controlled responsively to the level of the pool within the chamber. Sensing means **17** may be any of a variety of devices, illustratively a float, differential pressure cell, or the like. The sensing means **17** may conveniently operate through control instrument **18** by pneumatic or electrical means **44** and **45** to regulate valve **21** responsively to changes in the level of the pool recycle stock within chamber **7** to maintain that level substantially constant or within predetermined limits.

In a preferred embodiment of the invention recycle stock is conveyed from chamber **7** through conduit **20** to the intake side of feed-pump **4**, which supplies stock to receiver **1**. Particularly when the recycle stock is introduced at a point ahead of the fresh stock, as shown in FIG. 1, a lesser variation in volume of feed stock supplied to the receiver is obtained. Under this arrangement, all recycle stock is fed back to the receiver and the required amount of fresh stock is drawn as needed. Fluctuations caused by movement of valve **21** are thus compensated by the flow of fresh stock into the system; the flow of product stock from the receiver is unaffected. Equivalent arrangements to that illustrated will be apparent to those skilled in the art. Since the recycle stock has been deaerated, greater efficiency is obtained by assuring its return to the receiver.

FIG. 4 shows an alternative embodiment of an overflow weir of the type shown in FIG. 1. According to this embodiment a weir **6** having an upper terminus **9** is provided as before, with the addition of a baffle plate **22** extending downwardly from a point above weir **6**, said baffle plate **22** terminating below the level **8** of the stock in the receiver **1**. The stock in receiver **1** which overflows the top **9** of weir **6** is thus drawn from a point below the surface **8** of the stock. In this manner scum and other undesirable surface matter not drawn off to chamber **7**, and possible interference with the operation of pump **15** and other pumps which may be employed in the system is thereby avoided. A venting aperture (not shown) is provided in baffle **22** and located at a point well above level **8** of the stock in receiver **1** to equalize pressure on either side of the baffle. Baffle **22** serves also to prevent stock spray **24** emitted from inlet pipe **31** from being diverted into chamber **7** and is particularly useful where a plurality of inlets are provided to admit stock to receiver **1**.

A preferred nozzle for use in conjunction with inlet pipes **31** for introducing the feed stock to receiver **1** as a spray is shown in FIGS. 5 and 6 and comprises a hollow truncated cone **50** having a solid base **51** and an open top **52** adapted to fit inlet pipe **31**. Supply pipe **53**, adapted to convey feed stock to the nozzle from header **43**, is fitted to cone **50** so that entering stock will be admitted under pressure tangentially. In operating a swirling action ensues within cone **50** and the feed stock cyclonically rises through the nozzle and feed pipe **31** and atomizingly enters the receiver.

In operation of the disclosed system, white water from

pit 3 and thick stock from chest 42 are fed, along with recycle stock from conduit 20, through pump 4, conduit 30, header 43 and inlet pipes 31 into receiver 1. Concurrently, stock is withdrawn from receiver 1 through port 10 and conduit 11 by the action of pump 12 and is sent to headbox 13 of the papermaking machine. By reason of the relatively greater flow of stock into the receiver, a certain amount of stock overflows the upper terminus 9 of weir 6 within receiver 1 into a pool in chamber 7, whence it is forced by pump 15 and pump 4 back into receiver 1. The amount of stock so recycled is regulated by valve 21 in conduit 20 on the effluent side of pump 15, valve 21 being operatively controlled responsively to sensor 17, which measures the level of the recycle stock pool in chamber 7. Under equilibrium conditions the amount of stock overflowing weir 6 is constant and equal to the amount of stock drawn from chamber 7. Valve 21 maintains a constant aperture or opens and closes slightly.

Assuming that the papermaker desires to increase the consistency of the furnish to the headbox, he will manually or otherwise partially close papermaker's valve 26. As a result less stock is drawn from receiver 1 through port 10 and an imbalance in flow rates results. An increased amount of stock overflows the upper terminus 9 of weir 6 into chamber 7, and the consequent rise in the level of the recycle stock pool in chamber 7 is detected by sensor 17. Valve 21 in conduit 20 in the effluent side of pump 15 opens responsively to the rise of the recycle stock pool level in chamber 7, permitting recycle stock to flow from the chamber at a greater rate. The recycle stock is fed back to receiver 1 through pump 4, a lesser amount of white water being drawn from wire pit 3. Should control 18 have overcompensated so that the level of the pool in chamber 7 falls below a predetermined level, valve 21 will be responsively closed partially. In this manner the level of the recycle stock pool in leg 7 is held at a predetermined point or within predetermined limits.

If, conversely, the papermaker should desire to decrease the consistency of the furnish to the headbox and thus open valve 26, a greater amount of stock is drawn from receiver 1 through port 10 with the result that the amount of stock overflowing the upper terminus 9 of weir 6 decreases. The level of stock in chamber 7 falls and valve 21 in conduit 20 responsively closes. Less recycle stock is thus supplied to pump 4 and a greater volume of white water is consequently drawn from wire pit 3. As the volume of stock overflowing the weir increases, the level of the pool in chamber 7 rises and valve 21 responsively opens partially, causing equilibrium to be restored.

While some over-compensation or under-compensation may occur in the responsive operation of valve 21, the level of recycle stock in chamber 7 is affected but the level of stock in receiver 1 is not significantly changed. By virtue of the relatively small capacity of the chamber as compared with the receiver, a major increase or decrease of recycle stock level in the chamber corresponds to a change of but a very small fraction of an inch in the level of stock in the receiver. Very sensitive control of stock level may therefore be achieved by the practice of invention.

From the foregoing discussion it will be seen that the present invention serves to maintain a constant level of stock in receiver 1 when the system is in equilibrium, and it further causes the system repaidly to be restored to equilibrium when such equilibrium is disrupted as by a change in setting of papermaker's valve 26. Achieving a new balance of flow to the papermaking machine requires a discrete amount of time, during which no useful production can be achieved. It is consequently of great importance that the system of the present invention rapidly restores the system to equilibrium.

In one embodiment of the invention, which is to be taken as illustrative and not in a limiting sense, receiver 1 has a diameter of 6 feet and a length of 14 feet and a pond capacity of 3500 gallons. The upper terminus 9 of weir 6 is located approximately 3 inches below the center line of the receiver. The maximum liquid level over the top of the weir is approximately 6 inches, and the minimum approximately 1 inch, with the normal liquid level approximately 3 inches above the top of the weir. The pool capacity of the chamber 7 is about 250 gallons. The average flow of stock over the weir into chamber 7 is approximately 10–15% of the total flow and the balance of flow through port 10 to pump 12 is about 85–90% of the total flow.

In FIGS. 2 and 3 are shown equivalent arrangements of weir means within the receiver. In FIG. 2 the weir is probe-shaped and its upper surface 9 may have a channel or may be provided with slots or holes through which recycle stock flows to chamber 7. Sensor 17 is provided to sense the level of the pool of recycle stock in chamber 7. In FIG. 3 chamber 7 is located within receiver 1 and the weir 6 is provided with apertures communicating with the chamber to permit accesses of recycle stock thereto. Sensor 17 is indicated as mounted on the outside wall of the receiver but communicating with chamber 7 to sense the level of the pool of recycle stock therein.

An optional arrangement is shown in FIG. 1 whereby a conduit 28 shunts a portion of the product deaerated stock from conduit 25 to the intake side of pump 4, the amount so diverted being regulated by valve 27. Stock so delivered is recycled to receiver 1 and the use of a portion of the product stock for recycle decreases the amount of the recycle stock overflowing weir 6 and passing through pump 15. This arrangement takes part of the load off pump 15 and permits use of a less expensive, lower capacity pump in the 15 position.

We claim:

1. A method of treating papermaking stock suspension, which comprises admitting an air-containing aqueous suspension of papermaking stock as an atomized spray to an evacuated space within an enclosed stock receiver maintained under a vacuum sufficient to deaerate stock sprayed thereinto, collecting stock suspension thereby deaerated as a pond in the receiver, withdrawing, deaerated stock suspension from the pond at a lesser rate than the rate at which the aqueous stock suspension is admitted to the receiver, conveying the deaerated stock suspension withdrawn from the pond to a point of use, maintaining the pond of collected deaerated stock suspension at a constant level by weir means defining the maximum height of the pond, and recycling suspension overflowing the weir to the pond in the receiver.

2. A method for providing a constant flow of deaerated aqueous papermaking stock from a stock deaerating station, which comprises maintaining an enclosed stock receiver under a vacuum sufficient to deaerate papermaking stock subsequently sprayed thereinto, pumping a mixture of fresh air-containing aqueous papermaking stock and a recycle stock to the receiver and spraying said stock mixture into the upper portion of the receiver, collecting the stock sprayed into the receiver as a pond within the lower portion of the receiver, withdrawing collected stock from the pond at a lesser rate than the rate at which stock is sprayed into the receiver and conveying the withdrawn collected stock to a point of use, admitting stock from the pond overflowing a weir within the receiver to a chamber also maintained under vacuum sufficient to deaerate papermaking stock, withdrawing overflowed stock from the chamber and returning the withdrawn overflowed stock to the receiver as the recycle stock and mixing the withdrawn overflowed stock with fresh air-containing aqueous papermaking stock to provide the mixture being pumped to the receiver.

3. Apparatus for providing a constant flow of de-

aerated aqueous papermaking stock to a point of use, comprising an enclosed stock receiver adapted to collect deaerated papermaking stock as a pond therein and provide a space above the pond, evacuating means in communication with the space above the pond in said receiver for maintaining the receiver under a vacuum sufficient to deaerate papermaking stock subsequently sprayed thereinto, means for spraying air-containing aqueous papermaking stock into the evacuated space in said receiver, means for withdrawing deaerated stock collected as a pond in said receiver and for conveying the withdrawn stock to said point of use, means communicating with the receiver for withdrawing stock from the pond including weir means maintained under a vacuum sufficient to deaerate paper making stock by said evacuating means defining the maximum height of the pond of collected stock, and means for returning stock overflowing said weir means to the pond of deaerated stock collected in said receiver.

4. Apparatus according to claim 3 wherein the means for returning stock overflowing said weir means to the pond of deaerated stock collected in said receiver includes pump means, a barometric drop leg connecting said receiver to the input side of said pump means and adapted to convey stock overflowing said weir means to said pump means, and conduit means connecting the output side of said pump means to said means for spraying air-containing aqueous papermaking stock into the evacuated space in said receiver.

5. Apparatus according to claim 3 wherein the means for returning stock overflowing said weir means to the pond of deaerated stock collected in said receiver includes first pump means, first conduit means connecting said receiver to the intake side of said first pump means and adapted to convey stock overflowing said weir means to said first pump means, second pump means, second conduit means connecting the output side of said first pump means to the input side of said second pump means, and third conduit means connecting the output side of said second pump means to said spraying means.

6. Apparatus according to claim 3 including baffle means cooperating with said weir means to prevent surface stock, foam and spray from overflowing said weir means.

7. Apparatus for providing a constant flow of deaerated papermaking stock from a stock deaerating station, comprising an enclosed stock receiver, evacuating means in communication with the upper interior portion of said receiver for maintaining said receiver under a vacuum sufficient to deaerate papermaking stock sprayed thereinto, means for spraying papermaking stock into the upper portion of said receiver, compartment means in the lower portion of said receiver adapted to collect as a pond stock sprayed into the upper portion of said receiver, means for withdrawing stock from the pond thereof collected in said compartment means and for conveying stock so withdrawn to a point of use, a chamber closed to the atmosphere and maintained under vacuum sufficient to deaerate papermaking stock by said evacuating means, means defining a flow way between the receiver compartment means and the chamber including weir means permitting overflow of stock from the pond to the chamber, and means for returning overflowed stock from the chamber to the receiver compartment means.

8. Apparatus according to claim 7 including baffle means cooperating with said weir means to prevent surface stock, foam and spray from overflowing said weir means.

9. Apparatus for providing a constant flow of deaerated aqueous papermaking stock from a stock deaerating station, comprising an enclosed stock receiver adapted to collect deaerated stock as a pond therein, evacuating means in communication with said receiver for maintaining the receiver under a vacuum sufficient to deaerate papermaking stock subsequently sprayed thereinto, means for spraying air-containing aqueous papermaking stock into said receiver above the pond of deaerated stock collected therein and cooperating stock-feeding pump means and associated conduit means for conveying air-containing aqueous papermaking stock to said spraying means, a discharge conduit from said receiver for withdrawing and conveying to a point of use deaerated stock from the pond thereof collected in said receiver, weir means in said receiver having an upper terminus slightly below the desired level of the pond of collected deaerated stock, a chamber closed to the atmosphere and maintained under vacuum by said evacuating means and communicating with said receiver and adapted to receive and collect as a pool stock from the pond overflowing said weir means, conduit means for conveying pooled overflowed stock from said chamber to the intake side of said stock-feeding pump means and means regulating the flow of pooled overflowed stock from said chamber responsively to the level of overflowed stock pooled in said chamber.

10. Apparatus for providing a constant flow of deaerated aqueous papermaking stock from a stock deaerating station to a point of use, comprising an enclosed stock receiver adapted to collect deaerated stock as a pond in its lower portion, evacuating means in communication with the upper portion of said receiver for maintaining the receiver under a vacuum sufficient to deaerate papermaking stock subsequently sprayed thereinto, hydrocyclone means adapted to classify aqueous papermaking stock into dirt-rich and dirt-poor fractions and spray the dirt-poor fraction into the upper portion of said receiver, stock-feeding pump means and cooperating conduit means for supplying air-containing aqueous papermaking stock to said hydrocyclone means, conduit means from said receiver and cooperating pump means and valve means for regulatably conveying deaerated stock from a pond thereof collected in the lower portion of said receiver to said point of use, a chamber closed to the atmosphere and maintained under vacuum sufficient to deaerate papermaking stock by said evacuating means, weir means in said receiver permitting overflow of deaerated stock from the pond to said chamber, and means for conveying overflowed stock from said chamber to the intake side of said stock-feeding pump means.

References Cited by the Examiner

UNITED STATES PATENTS

18,293	9/57	Naughten	210—538
2,487,876	11/49	Johnson	55—169
2,546,259	3/51	McNeil	55—204
2,762,451	9/56	McNeil	55—204
2,787,451	4/57	Lavery	55—166
2,911,067	11/59	Bludworth et al.	55—38
2,920,763	1/60	Lind et al.	210—55 X
2,934,141	4/60	Ikavalko	162—339
3,095,348	6/63	Goldsmith	55—191
3,131,117	4/64	Hickey	55—189
3,163,508	12/64	Tuck et al.	55—204

FOREIGN PATENTS

189,047	2/57	Austria.
85,252	3/58	Denmark.
510,713	10/30	Germany.

REUBEN FRIEDMAN, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,206,917 September 21, 1965

Robert G. Kaiser et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 61, for "deaerated" read -- deaerating --; column 3, line 7, after "significant" insert -- change --; line 44, for "values" read -- valves --; column 5, line 68, for "repaidly" read -- rapidly --; column 6, line 23, for "accesses" read -- access --; line 31, for "delivered" read -- diverted --; line 44, after "withdrawing" strike out the comma; column 8, line 55, for "2,546,259 3/51 McNeil----55-204" read -- 2,546,259 3/51 Fenn----55-229 --.

Signed and sealed this 5th day of April 1966.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents