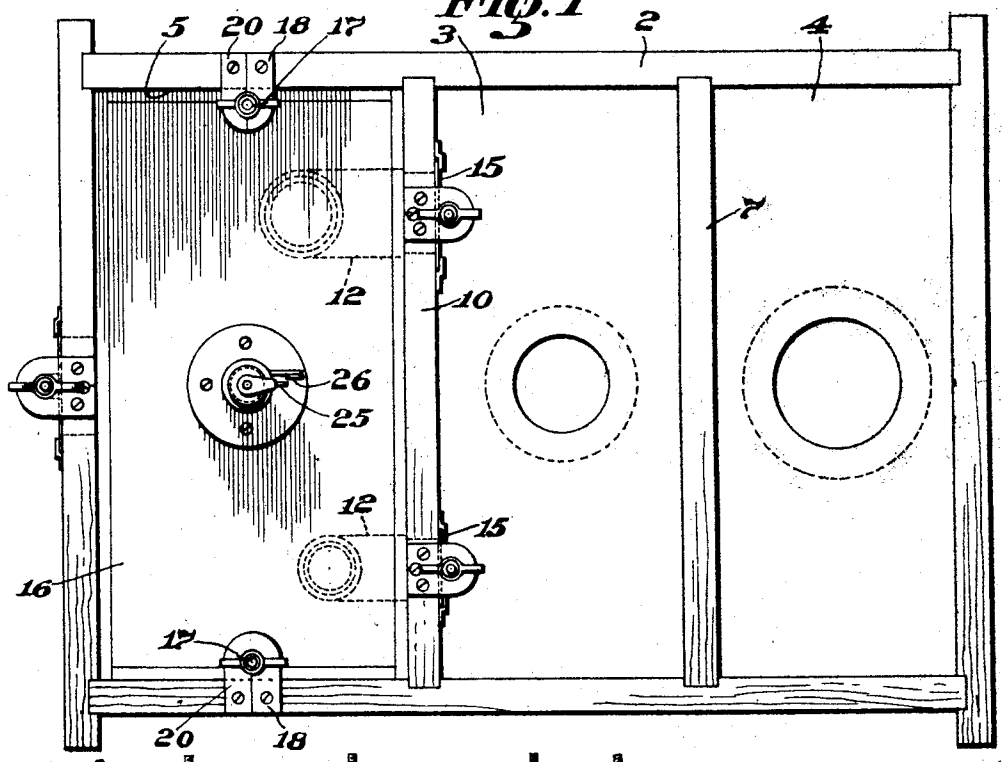
Dec. 12, 1933. E. POIRIER 1,939,411

WEIGHT REGULATING APPARATUS FOR PAPER STOCK

Filed Feb. 23, 1933 2 Sheets-Sheet 1

Fig. 1



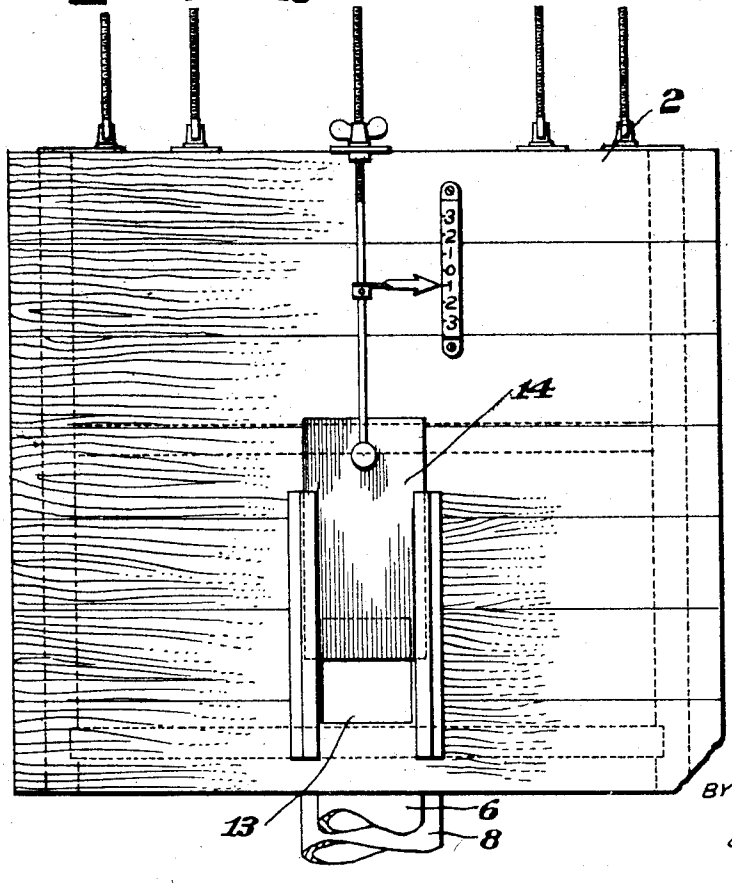


Fig. 2

INVENTOR:
Ernest Poirier,
BY
J. J. McCready,
ATTORNEY.

Dec. 12, 1933. E. POIRIER 1,939,411

WEIGHT REGULATING APPARATUS FOR PAPER STOCK

Filed Feb. 23, 1933 2 Sheets-Sheet 2

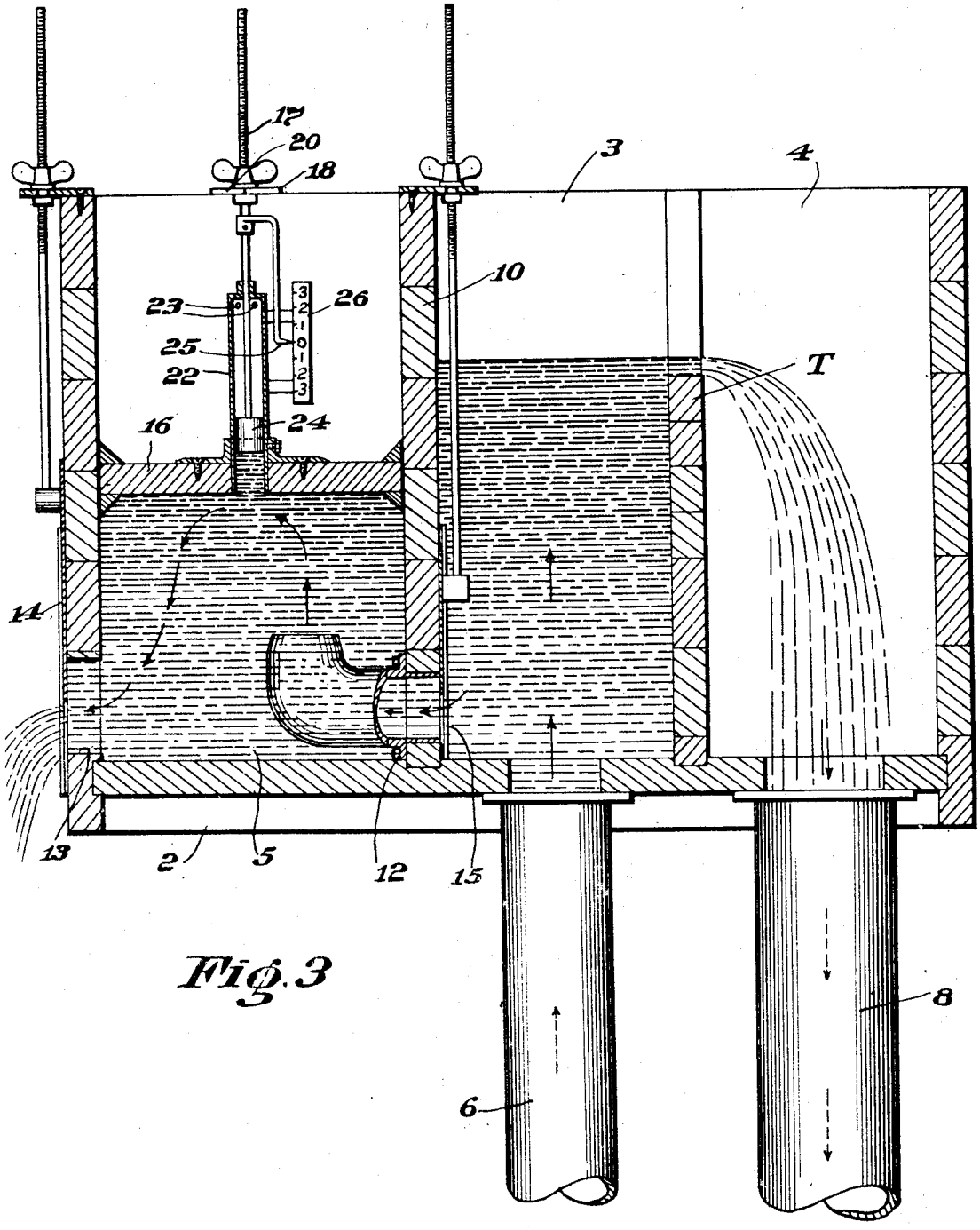


Fig. 3

INVENTOR:
Ernest Poirier,
BY
J. H. McCready,
Its ATTORNEY.

Patented Dec. 12, 1933 1,939,411

UNITED STATES PATENT OFFICE

1,939,411

WEIGHT REGULATING APPARATUS FOR PAPER STOCK

Ernest Poirier, Waterville, Maine

Application February 23, 1933. Serial No. 657,987

15 Claims. (Cl. 92—46)

This invention relates to processes and apparatus for use in the manufacture of paper.

It aims to improve processes and apparatus of this type with a view to reducing the care and skill required in the paper making operation, and affording a better control of this process. The invention is more especially concerned with the control of, or compensation for, variations in the consistency of the paper making stock.

As is well understood by those skilled in this art, the stock or pulp when delivered to the paper making wire consists of a very high percentage of water with a relatively low proportion of solid constituents, such as fiber, fillers, and the like. While the practice varies in different mills, and to some extent with different grades of paper, it is common for the stock to contain only from 2½% to 3½%, by weight, of solid constituents, the remainder of the stock consisting of water. Much of the variation which occurs in the formation of the final sheet is due to the fact that the consistency of the stock delivered to the paper making wire changes from time to time as the process continues. The machine tender watches the weight of the web closely and if he finds that the sheet is running thin or light in weight, he makes suitable changes in the rate of delivery of stock to the wire to correct this difficulty. On the other hand, if the sheet begins to run heavy he reduces the feed of stock.

While much care is given to the preparation of the stock for the purpose of making it as uniform as possible and avoiding variations of the character just mentioned, it seems to be practically impossible to maintain an absolutely uniform consistency for any great length of time. Consequently, the production of a final sheet having the desired degree of evenness and uniformity requires a great deal of care, judgment and experience on the part of the machine tender.

The present invention deals especially with these considerations, and it aims to improve both the processes and the methods of controlling the flow of stock to the paper machine so as to compensate in a relatively large measure for these variations in consistency and thus to relieve the machine tender of much of the care and attention required on his part.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a plan view of an apparatus constructed in accordance with this invention;

Fig. 2 is a front elevation of the apparatus shown in Fig. 1; and

Fig. 3 is a vertical, central, sectional view of the apparatus shown in Fig. 1.

The construction shown comprises a headbox 2 which is divided into three compartments consisting of a central supply compartment or chamber 3, an overflow compartment 4, and a discharge compartment 5. The paper making stock is pumped from the stuff chests or other preparating apparatus through the supply pipe 6 to the supply compartment 3 in which a substantially constant level is maintained by means of a wier 7, (the height of which can be adjusted) a surplus of stock being delivered to this chamber so that it constantly overflows the wier, and the surplus stock is carried away through the pipe 8. Due to this arrangement an approximately constant hydraulic head is maintained continuously in the supply compartment 3.

A partition 10 separates the supply compartment from the delivery compartment, and the stock is conducted from the former to the latter by one or more curved inlet pipes 12. In the particular arrangement shown two such pipes are provided, but the number and their size necessarily will depend upon the requirements of individual installations. The stock is discharged from the compartment 5 through an outlet aperture 13 leading from the bottom of the chamber. Preferably a gate 14 adjustable vertically, as shown in the drawings, is provided to vary the size of the discharge outlet, as desired. Similar gates 15—15 may be associated with the inlets 12—12, although gates at these points usually are not necessary.

This apparatus is somewhat like those which have been used heretofore to control the flow of pulp, although headboxes of the common form have only the two chambers or compartments corresponding to those shown at 3 and 4, and the provision of a chamber corresponding to that shown at 5 has not, so far as I have been aware, been used prior to my invention. Usually the stock discharged from the outlet 13 flows through a pulp screen and then is delivered directly to the paper making wire.

It will be observed that the inlet through which the stock flows into the compartment 5, whether consisting of a single or multiple opening, offers a relatively restricted passage for the stock, and consequently imposes a definite resistance upon

the flow of the stock therethrough. The outlet 13 also is similarly restricted and likewise offers a fixed resistance, which can be varied approximately as desired, to the discharge of the stock from the delivery compartment. This compartment, therefore, acts as a container or reservoir through which the stock is flowing continuously.

It will be observed that since the inflow of stock is produced by gravity and under a substantially constant head, the rate of flow through the inlet 12 and outlet 13 would, if unaffected by other factors, be substantially constant so long as the consistency of the stock remained constant and unvarying. The inlet 12 and outlet 13 from the discharge chamber are so constructed, arranged and proportioned that with a stock of constant consistency the liquid would, if allowed to do so, rise in the delivery chamber 5 to a certain definite height somewhat lower than that of the liquid level maintained in the supply compartment 3, and so long as the consistency remained unchanged, this level in the compartment 5 would remain constant. If, however, the stock becomes thicker or, in other words, the proportion of solid constituents increases, then the level of the stock in the chamber 5 would drop somewhat due to the fact that its flow through the inlet pipe or pipes 12 is affected slightly more by the curved shape of these pipes and their dimensions than is the outflow through the outlet 13. This drop in head in the chamber 5 increases the difference in head betwen the two chambers 3 and 5, and since the flow between these chambers is caused by such difference in head, while the discharge from the chamber 5 is controlled solely by the head in this chamber, an equilibrium is established almost immediately at a different level in the chamber 5. If, on the other hand, the consistency of the stock decreases or, in other words, the proportion of solid constituents is reduced, a reversal of the action just described occurs and a new level is established in the chamber 5 which is slightly higher than that previously maintained. The net result is that the stock will be discharged through the outlet 13 at a reduced rate when the consistency of the stock increases, and will be increased when the consistency of the stock is reduced. In other words, the discharge of stock from the outlet 13 will vary inversely with the change in consistency.

My experiments, however, indicate that this variation which occurs automatically in such an arrangement is not directly proportional to the change in consistency. In order to approximate this result more closely, I have mounted a horizontal plate or diaphragm 16, Fig. 3, at an intermediate point in the compartment 5 and have equipped it with screw threaded rods 17—17 at its opposite ends extending through stationary brackets 18—18 and provided with thumb screws 20—20 which are rotatably mounted in said brackets so that by turning these thumb screws the diaphragm or plate 16 can be raised or lowered, as desired, and held in its adjusted position. This adjusting arrangement is similar to that provided for the gates 14 and 15. Ordinarily the diaphragm 16 is set so that it is approximately at or is normally slightly below the level which would automatically be maintained in the chamber 5 when the stock is at the desired consistency and if the diaphragm were not present. The liquid compartment is vented so that any air or gas which otherwise might be trapped therein can escape freely, such venting being provided partly by the loose fit around the edges, and more especially by the pipe 22 supported in the diaphragm, this pipe having holes 23 at its upper end. Consequently, the location of the diaphragm in this manner will not substantially affect the level of the stock in the compartment 5 so long as its consistency remains constant and at the desired value. If now the consistency should rise or be increased, the action which occurs in the container 5 would be exactly like that previously described, and the rate of discharge of the stock would be decreased so that the delivery of solid constituents would be maintained somewhere near constant, or at least the variations in the delivery of said constituents would be substantially reduced. On the other hand, if the consistency of the stock should be decreased it would flow more freely through the inlet pipe or pipes 12 into the container 5, thus tending to raise the hydrostatic level in this chamber. Such rise in level of the main body of stock in said chamber is prevented, however, by the presence of the diaphragm 16. It should be observed that the inlet pipe or pipes are curved so as to discharge the stock upwardly against the diaphragm and divert it away from the outlet. The streams of stock so striking the diaphragm are deflected or rebound. Such deflection, with the momentum of the stock, apparently creates in the stock a back pressure which aids the hydrostatic pressure in increasing the rate of discharge of stock through the outlet 13. This back pressure increases as the consistency decreases. Whatever may be the cause for the action which occurs under these conditions, my experiments have definitely established that the rate of discharge is increased over and above that which would occur if the diaphragm 16 were not present.

In addition to the action just described, the rate of discharge of the stock also is controlled to some extent by the fact that an increase in hydrostatic pressure is produced in the chamber 5 due apparently to the fact that the liquid can rise in the pipe 22 to subtantially the same hydrostatic level which would be maintained in this chamber with the reduced consistency if the diaphragm 16 were not present.

The apparatus thus operates automatically to compensate, at least in a great measure, for the changes in consistency of the stock flowing through it. While the degree of compensation so produced may not be absolutely complete, nevertheless it is sufficient to reduce very substantially the variations in the rate of delivery of solid constituents to the paper making wire. Since these are the materials of which the sheet is composed, the result is to reduce substantially the variations which otherwise would occur in the composition of the sheet.

As above indicated, the level to which the liquid rises in the tube or pipe 22 will vary with changes in the consistency of the stock. Consequently, by mounting a float 24 so that it can slide freely in the tube 22 and supporting a pointer 25 on this float to run over a graduated scale 26, the apparatus may be made to give continuously a measure or indication of the consistency of the stock flowing through it.

An apparatus of this type is useful not only in controlling the flow of stock to the paper machine, but also in the process of mixing stock, two or more devices of this kind being used to control the flow of the respective liquid constituents fed to the stock mixing tank or chest.

For some purposes this apparatus when used alone produces a satisfactory degree of compen-

sation for variations in the consistency of the stock. For other purposes, however, an apparatus like that shown in my pending application Serial No. 563,038, filed Sept. 19, 1931, now matured into Patent No. 1,893,678, granted Jan. 10, 1933 will be found more suitable. And in still other situations a combination of the two will be found to give the best results, the headbox shown in connection with my earlier application being replaced by the apparatus shown in this case. An important advantage produced by such a combination is the fact that it will take care of a wider variation in consistency without requiring adjustment than will either apparatus when used alone.

While I have herein shown and described a preferred embodiment of my invention, it will be understood that the invention may be embodied in other forms and that the method may be practiced with the aid of other apparatus without departing from the spirit or scope of the invention.

Having thus described my invention, what I desire to claim as new is:

1. That improvement in methods of compensating for variations in the consistency of successive portions of a stream of paper making stock, which consists in continuously flowing a stream of said stock through a container under a substantially constant head, opposing such resistances to the flow of said stock into and out of said container that the rise of stock in the container will decrease with an increase in consistency and will increase with a decrease in consistency, and preventing the main body of stock in said container from rising to a normal height when its consistency drops below a predetermined value.

2. That improvement in methods of compensating for variations in the consistency of successive portions of a stream of paper making stock, which consists in continuously flowing a stream of said stock through a container under a substantially constant head, opposing such resistances to the flow of said stock into and out of said container that the rise of stock in the container will decrease with an increase in consistency and will increase with a decrease in consistency, directing the incoming stock away from the outlet for said container, and preventing the main body of stock in said container from rising to a normal height when its consistency drops below a predetermined value.

3. That improvement in methods of compensating for variations in the consistency of successive portions of a stream of paper making stock, which consists in continuously flowing a stream of said stock through a container under a substantially constant head, opposing such resistances to the flow of said stock into and out of said container that the rise of stock in the container will decrease with an increase in consistency and will increase with a decrease in consistency, preventing the main body of stock in said container from rising to a normal height when its consistency drops below a predetermined value, and discharging the stock from said container at a rate controlled partly by the hydrostatic head of the stock in the container and partly by said restriction of the rise in said main body of stock.

4. That improvement in methods of compensating for variations in the consistency of successive portions of a stream of paper making stock, which consists in continuously flowing a stream of said stock through a container under a substantially constant head, opposing such resistances to the flow of said stock into and out of said container that the rise of stock in the container will decrease with an increase in consistency and will increase with a decrease in consistency, permitting the escape of air and gases from the surface of the body of stock in said container, directing the incoming stock away from the outlet of said container, and preventing the main body of stock in said container from rising to a normal height when the consistency of the stock drops below a predetermined value.

5. That improvement in methods of compensating for variations in the consistency of successive portions of a stream of paper making stock, which consists in continuously flowing a stream of said stock through a container under a substantially constant head, opposing such resistances to the flow of said stock into and out of said container that the rise of stock in the container will decrease with an increase in consistency and will increase with a decrease in consistency, and directing the stock flowing into said container away from the outlet therefor and against a wall from which it rebounds, whereby it sets up a back pressure in said container varying with the rate of inflow and said back pressure tends to increase the rate of outflow.

6. That improvement in methods of compensating for variations in the consistency of successive portions of a stream of paper making stock, which consists in continuously flowing a stream of said stock through a container under a substantially constant head, opposing such resistances to the flow of said stock into and out of said container that the rise of stock in the container will decrease with an increase in consistency and will increase with a decrease in consistency, permitting a small part only of the surface of the body of stock from rising to a normal hydrostatic level in said container when the consistency of the stock drops below a predetermined value and preventing the greater part of said body of stock from rising to said normal level when its consistency is abnormally low, whereby the rate of discharge of the stock from said container will be controlled jointly by the hydrostatic head in said container and also by the reaction in the stock created by restricting the rise of the main body of said stock as above described.

7. In an apparatus of the character described, the combination of a container having an inlet and an outlet for the flow therethrough of paper stock, means for producing a continuous flow of stock under a constant head through said inlet into said container, the inlet and outlet for said container being constructed and proportioned to maintain a head of stock in said container which tends to vary with changes in the consistency of the stock flowing therethrough, and said inlet being constructed and arranged to direct the incoming stock away from said outlet and toward a wall of said container, whereby the rate of discharge of the stock from said container will vary inversely with changes in the consistency of said stock.

8. In an apparatus of the character described, the combination of a container having inlet and discharge openings adjacent to the bottom thereof, means for producing a continuous flow of stock under a constant head through said inlet and into said container, the inlet and outlet for said container being constructed and proportioned to maintain a head of stock in said container which tends to vary with changes in

the consistency of the stock flowing therethrough, said inlet being shaped and positioned to direct the incoming stock upwardly away from said outlet, a diaphragm located at an intermediate height in said container and so positioned that the incoming stock is directed against it, and means for venting the upper part of said container.

9. In an apparatus of the character described, the combination of a container having inlet and discharge openings adjacent to the bottom thereof, means for producing a continuous flow of stock under a constant head through said inlet and into said container, the inlet and outlet for said container being constructed and proportioned to maintain a head of stock in said container which tends to vary with changes in the consistency of the stock flowing therethrough, said inlet being shaped and positioned to direct the incoming stock upwardly away from said outlet, a diaphragm located at an intermediate height in said container and so positioned that the incoming stock is directed against it, and means adjustable to vary the resistance offered by said outlet to the discharge of stock therethrough.

10. In an apparatus of the character described, the combination of a container having inlet and discharge openings adjacent to the bottom thereof, means for producing a continuous flow of stock under a constant head through said inlet and into said container, the inlet and outlet for said container being constructed and proportioned to maintain a head of stock in said container which tends to vary with changes in the consistency of the stock flowing therethrough, said inlet being shaped and positioned to direct the incoming stock upwardly away from said outlet, a diaphragm located at an intermediate height in said container and so positioned that the incoming stock is directed against it, and means supporting said diaphragm for adjustment toward and from said inlet.

11. In an apparatus of the character described, the combination of a headbox having supply and delivery compartments therein, a wier for controlling the height of stock in the supply compartment, an inlet for conducting stock from said supply compartment to said delivery compartment, an outlet through which the stock is discharged from the delivery compartment, said inlet and outlet offering such resistances to the flow of stock into and out of the delivery compartment as to cause the level to which the stock tends to rise in the latter compartment to vary with changes in consistency of said stock, and a diaphragm located in said delivery compartment at such a level as to restrict the rise of the main body of the stock therein when the consistency of the stock drops below a predetermined value.

12. In an apparatus of the character described, the combination of a headbox having supply and delivery compartments therein, a wier for controlling the height of stock in the supply compartment, an inlet for conducting stock from said supply compartment to said delivery compartment, an outlet through which the stock is discharged from the delivery compartment, said inlet and outlet offering such resistances to the flow of stock into and out of the delivery compartment as to cause the level to which the stock tends to rise in the latter compartment to vary with changes in consistency of said stock, and a diaphragm located in said delivery compartment at approximately the height to which the stock will rise therein when the consistency of the stock is at the desired value.

13. In an apparatus of the character described, the combination of a headbox having supply and delivery compartments therein, a wier for controlling the height of stock in the supply compartment, an inlet for conducting stock from said supply compartment to said delivery compartment, an outlet through which the stock is discharged from the delivery compartment, said inlet and outlet offering such resistances to the flow of stock into and out of the delivery compartment as to cause the level to which the stock tends to rise in the latter compartment to vary with changes in consistency of said stock, and a diaphragm located in said delivery compartment at such a level as to restrict the rise of the main body of the stock therein when the consistency of the stock drops below a predetermined value, said inlet being shaped and positioned to direct the incoming stock against said diaphragm.

14. In an apparatus of the character described, the combination of a headbox having supply and delivery compartments therein, a wier for controlling the height of stock in the supply compartment, an inlet for conducting stock from said supply compartment to said delivery compartment, an outlet through which the stock is discharged from the delivery compartment, said inlet and outlet offering such resistances to the flow of stock into and out of the delivery compartment as to cause the level to which the stock tends to rise in the latter compartment to vary with changes in consistency of said stock, and a diaphragm located in said delivery compartment at such a level as to restrict the rise of the main body of the stock therein when the consistency of the stock drops below a predetermined value, and a liquid conductor connected with said delivery compartment and in which the stock is caused to rise to a normal hydrostatic level unrestricted by said diaphragm.

15. In an apparatus of the character described, the combination of a headbox having supply and delivery compartments therein, a wier for controlling the height of stock in the supply compartment, an inlet for conducting stock from said supply compartment to said delivery compartment, an outlet through which the stock is discharged from the delivery compartment, said inlet and outlet offering such resistances to the flow of stock into and out of the delivery compartment as to cause the level to which the stock tends to rise in the latter compartment to vary with changes in consistency of said stock, a diaphragm located in said delivery compartment at such a level as to restrict the rise of the main body of the stock therein when the consistency of the stock drops below a predetermined value, and means connected with said delivery compartment for indicating changes in the hydrostatic level of the stock in the latter compartment.

ERNEST POIRIER.