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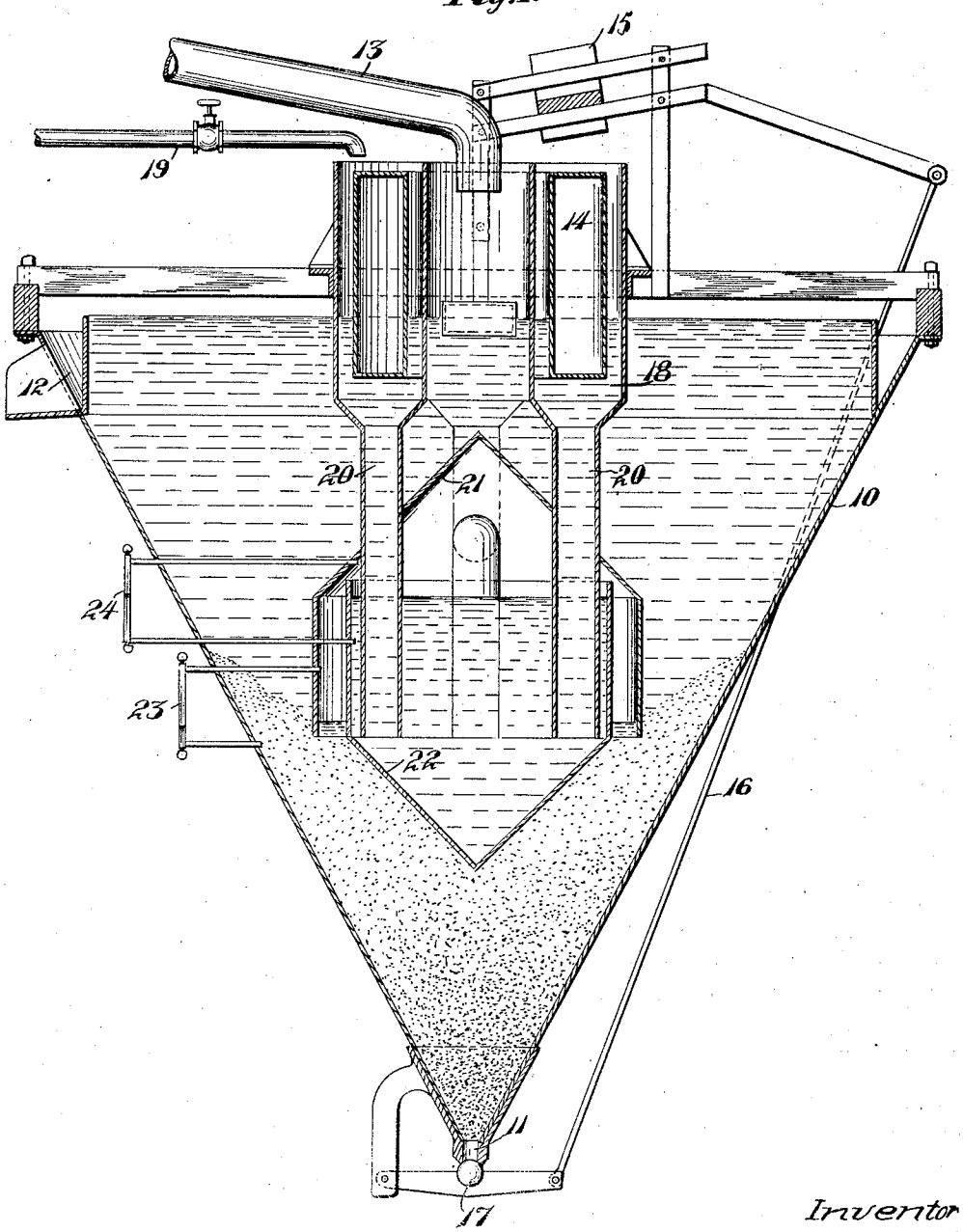
SLIME PULP THICKENER.

APPLICATION FILED OCT. 10, 1918.

1,350,204. Patented Aug. 17, 1920.

2 SHEETS—SHEET 1.

Fig. 1.



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SLIME PULP THICKENER.

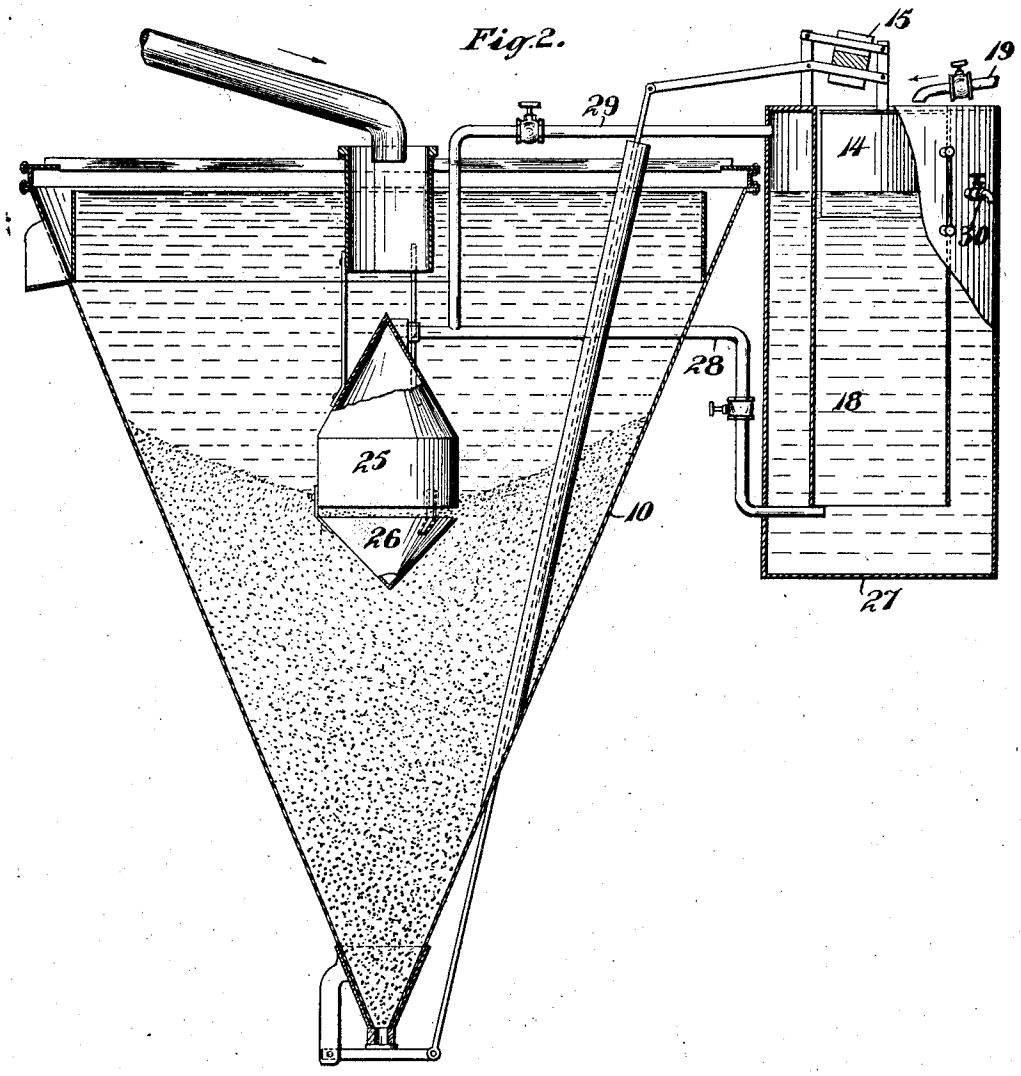
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2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

CHARLES ALLEN, OF EL PASO, TEXAS.

SLIME-PULP THICKENER.

1,350,204. Specification of Letters Patent. Patented Aug. 17, 1920.

Original application filed June 9, 1917, Serial No. 173,785. Divided and this application filed October 10, 1918. Serial No. 257,624.

To all whom it may concern:

Be it known that I, CHARLES ALLEN, a citizen of the United States, residing at El Paso, in the county of El Paso and State of Texas, have invented new and useful Improvements in Slime-Pulp Thickeners, of which the following is a specification.

This invention relates to a device for thickening slime or pulp, and particularly pertains to a structure similar to that disclosed in my co-pending application entitled, "Slime pulp thickener," Serial Number 173,785, filed June 9, 1917, and of which the present application is a division.

Thickening, which is a partial dewatering of finely divided solids in suspension, is almost universally used in the treatment of ores by wet milling processes, and in its every application it is of prime importance that the degree of thickening be uniform; that is, that the discharge of the thickened slime be always of the same density. Thickeners heretofore used depend upon the volume of pulp fed to the cone or tank for regulation of the size of the discharge orifice. The results are very unsatisfactory, inasmuch as the proportion of liquids to solids in the material discharged varies with the volume of slime pulp fed to the thickener.

In the present invention, the volume of slime pulp in the thickener in no manner alters the proportion of liquids to solids in the products discharged, within the limits of the capacity of the machine. The degree of thickening is controlled, and for whatever degree of thickening the device is adjusted, that degree of thickening is automatically maintained.

In slime pulp, the finely divided solids move freely without appreciably affecting the fluidity by friction among themselves. Such a pulp has the properties of a liquid so long as the solids are kept in suspension. When the pulp is composed of water and solid particles of greater specific gravity than water, the specific gravity of the pulp increases with all increases in the quantity of solids in suspension in the pulp. This pulp may therefore be considered as a liquid of greater density than water.

In my invention I employ what may be termed two compartments having in one compartment a liquid, and in the other a mixture of liquid and solids or pulp. The variations in the density of the pulp, due to the presence of more or less solids in suspension, act to raise and lower the column of liquid, which column of liquid carries a float operatively connected to a valve at the bottom of the tank controlling the discharge orifice. When the pulp attains a certain density the valve is automatically opened to permit the discharge of the thickened pulp through the bottom orifice, and when the density of the pulp falls below a critical point, the valve is automatically operated to close the orifice. Hence the degree of thickening of the pulp discharged through the automatically controlled orifice is practically the same under all conditions or variations in the volume of slime pulp fed into the tank. The volume of thickened slime discharged through the orifice may vary considerably, but the density of the thickened slime discharged remains practically constant. This is the reverse of the thickeners ordinarily used in which the volume of thickened slime discharged remains constant while the density of the discharge varies with the quantity fed into the thickener.

The invention is illustrated by way of example in the accompanying drawing in which—

Figure 1 is a view in vertical section taken centrally of one form of the invention.

Fig. 2 is a view in vertical section taken centrally of another form of the invention, showing the actuating mechanism as disposed exteriorly of the tank.

Referring more particularly to the drawing, the apparatus is shown as comprising a tank 10 in the shape of an inverted cone having a discharge orifice 11 at its bottom for carrying off the thickened product. A launder 12 is arranged around the top of the tank for carrying off clear liquid which overflows the rim of the tank. A conduit 13 is provided to supply slime pulp to the center of the tank. The outlet 11 of the tank is indirectly controlled by a float 14 having variable buoyancy due to the application of adjustable weights 15. This float is provided with operable connections 16 which extend downwardly and engage the mechanism of a valve 17 controlling the discharge orifice 11. In the present instance the float is circular, being positioned within an annular chamber 18 which has outer and inner cencentrically spaced walls forming

the float chamber, at the same time separating it from a central, vertical opening through which the pulp passes to the tank from the conduit 13. The float chamber 18 is of sufficient height to extend to a level considerably above that of the rim of the tank and further extends downwardly to a level below the rim of the tank. This chamber is supplied with clear water through an inlet supply pipe 19.

In Fig. 1 the float chamber is supplied with pipes 20 which extend downwardly through the conical top wall of the bell 21. The lower ends of these pipes terminate within an inverted conical receptacle 22 which telescopes into the bell 21, the telescoping walls of the two members being spaced in relation to each other. The conical end of the receptacle 22 projects downwardly into the body of the pulp. When the device is in operation the receptacle 22 as well as the tubes 20 and the float chamber 18 are filled with clear water. The overflow of water from the receptacle 22 is prevented by an air cushion within the bell 21, the open bottom of which is sealed by the pulp within the tank. To prepare for the thickening operation, clear water is admitted through the pipe 19 until the tank overflows, thereby filling the float chamber to the level of the overflow lip of tank 10, tubes 20 and the receptacle 22. The float is adjusted and the slime to be thickened is turned into the tank through the conduit 13. As the slime thickens, its density increases, the level of the dense liquid passing above the mouth of the bell 21. The air within the bell is then compressed and acts upon the body of water in the receptacle 22 to raise the level of the same within the float chamber, thus lifting the float and opening the discharge valve.

The air cushion within the bell prevents the commingling of the slime with the clear water. This arrangement produces a structure not liable to readily wear or break and has proven to be exceedingly sensitive to the variations in the density of the slime. It will be understood that when the density of the slime increases to sufficiently affect the clear water within the float chamber and to raise its level, the float 14 will be lifted to lower the valve member 17 and open the discharge orifice 11. If desired, a water gage 23 may be provided for the bell and a similar gage 24 provided for the receptacle, as shown in the drawing.

The form of the invention disclosed in Fig. 2 embodies the use of a bell 25, similar in construction and operation to that shown in my co-pending application entitled Slime pulp thickener, S. No. 256,968, filed Oct 5, 1918. This bell is of small dimensions as compared with the tank and its upper portion represents a conical shell superimposed upon a cylindrical shell portion, the mouth of said cylindrical portion being open. An inverted conical shell 26 is suspended beneath the member 25 and is spaced slightly therefrom to allow communication between the interior of the bell with the tank and reducing the possibility of contaminating the clear water contained within the bell. In the present case, however, other means are shown for preventing contamination of the clear water than those disclosed in Fig. 1 of the drawing or my co-pending application above mentioned. It will be noted that the float chamber 18 is cylindrical and is disposed exteriorly of the tank, there to receive a float 14. Both of these members are located within a supplemental tank 27. This tank communicates with the apex of the bell 25 by means of a valved pipe 28 which enters the lower end of the tank and terminates beneath the open mouth of the float chamber 18. Communicating with the pipe 28 is a pipe 29 which extends therefrom and through an opening in the top of the supplemental tank 27. This pipe is valved and thereby insures that when an air cushion is to be used in transmitting the pressure of one column of liquid to the other or where the air is dispensed with and water transmission is used, the pipe 28 may be employed. In operation of the device shown in Fig. 2, when it is desired to employ the air cushion, the valve in the pipe 28 is opened and the valve in the pipe 29 is closed. The float chamber and connected parts are then filled with clear water through the supply pipe 19 until the tank 10 overflows, whereupon the valve in the pipe 28 is closed and the valve in the pipe 29 opened. The air compressed above the level of water in the closed tank 27 forms a cushion and acts through the pipe 29 to expel water from the bell 25 until an air cushion is formed therein. This cushion in the bell 25 is sealed by the water in the lower end of the bell. The slime to be thickened is then turned into the settling tank and the thickening then proceeds in the manner common to devices of this character.

Variations in the density of the pulp above the bottom of the bell 25 will be transmitted through the air column to the surface of the water in the tank 27, thereby raising the level of the water in the float chamber 18 and actuating the discharge valve. If no air cushion is to be used in the supplementary tank 27, the valve in the pipe 29 is closed and the valve in the pipe 28 permanently opened. Any excess of air pressure in the upper portion of the tank 27 will be expelled through a controllable vent 30. The effect of the difference in the density of the two columns is thus transmitted to the water through pipe 28, the bell 25

being in this instance entirely filled with water.

It will thus be seen that I make use of a hydrostatic balance between two liquids of different densities to automatically control the discharge of the thickened product. Among the advantages of this system may be mentioned: First, that until the thickening has progressed to a certain definite density the orifice through which the thickened product is discharged remains closed, but as soon as the thickening has reached the desired point, the orifice is automatically opened. Second, if while the thickened product is being discharged, the degree of thickening falls below the required consistency, the discharge valve is automatically closed. Third, if the thickened product being discharged, increases or decreases in consistency beyond what is desired, the discharge valve is automatically moved to partial opening or closing position in order to restore the discharged product to the required consistency. Fourth, the relative proportion of solids to water in the thickened product discharged is under perfect control by simply altering the float line of the actuating float, and for whatever proportion of water to solids the float is weighted, that proportion is automatically maintained. This means that the density of the thickened product discharged remains practically the same under all working conditions. It will be understood, of course, that the actuating float may be so built as to give a definite degree of thickening without varying the buoyancy thereof and hence the adjustable weights 15 may be omitted for a certain class of thickening, but means whereby the float line of the actuating float may be altered must be used in order to be able to adjust the thickener to various degrees of thickening.

Various changes in the construction and arrangement of the several parts herein shown and described may be employed without departing from the spirit of my invention as disclosed in the appended claims.

It is understood wherever the word "water" is used that I include in that term any other liquid or solution employed in practical milling operations and with pulp to be subjected to my process.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A slime pulp thickener comprising a tank having a discharge orifice in the bottom thereof, a valve member normally closing said orifice, a float chamber, a float supported upon the liquid therein, operating mechanism between the valve and the float, means whereby variation in the density of the pulp within the tank will affect the liquid within the float chamber to raise the float and an air-cell between said chamber and said means, whereby communication between the contents of tank and the contents of float chamber will be prevented.

2. A thickener for slime pulp comprising a tank having a controllable discharge orifice in its bottom for the escape of settled material, a chamber communicating with said tank and adapted to receive a fluid of lighter density than the pulp, a separating medium between the fluid and pulp capable of transmitting the pressure of the pulp to the fluid whereby variation in the density of the pulp is registered by the raising and lowering of the fluid in the chamber, and means actuated by the rise and fall of the fluid for controlling the size of the discharge orifice.

3. A thickener for slime pulp comprising a tank having a controllable discharge orifice in its bottom for the escape of settled material, a chamber communicating with said tank and adapted to receive a fluid of lighter density than the pulp, a cushion of air between the pulp in the tank and the fluid in said chamber adapted to transmit the pressure of the pulp to the fluid whereby variations in the density of the pulp are registered by the raising and the lowering of the fluid in the chamber, and means actuated by the rise and fall of the fluid for controlling the size of the discharge orifice.

4. A thickener for slime pulp comprising a tank having a controllable discharge orifice in the bottom for the escape of settled material, a chamber communicating with said tank and adapted to receive clear water, a separating medium between the water and pulp capable of transmitting the pressure of the pulp to the water whereby variation in the density of the pulp is registered by the rise and wall of the water in the chamber, and a float carried by the water in said chamber for controlling the size of the discharge orifice.

5. A thickener for slime pulp comprising a tank having a controllable discharge orifice in the bottom for the escape of settled material, a chamber communicating with said tank and adapted to receive clear water, a separating medium between the water and pulp capable of transmitting the pressure of the pulp to the water whereby variation in the density of the pulp is registered by the rise and fall of the water in the chamber, and means for adjusting the buoyancy of the float whereby the density of the discharged material is regulated.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES ALLEN.

Witnesses:
J. L. ELY,
EDMUND SHAW.