Oct. 11, 1927. 1,644,854

E. L. OLIVER

PULP THICKENER

Filed May 11, 1926 3 Sheets-Sheet 1

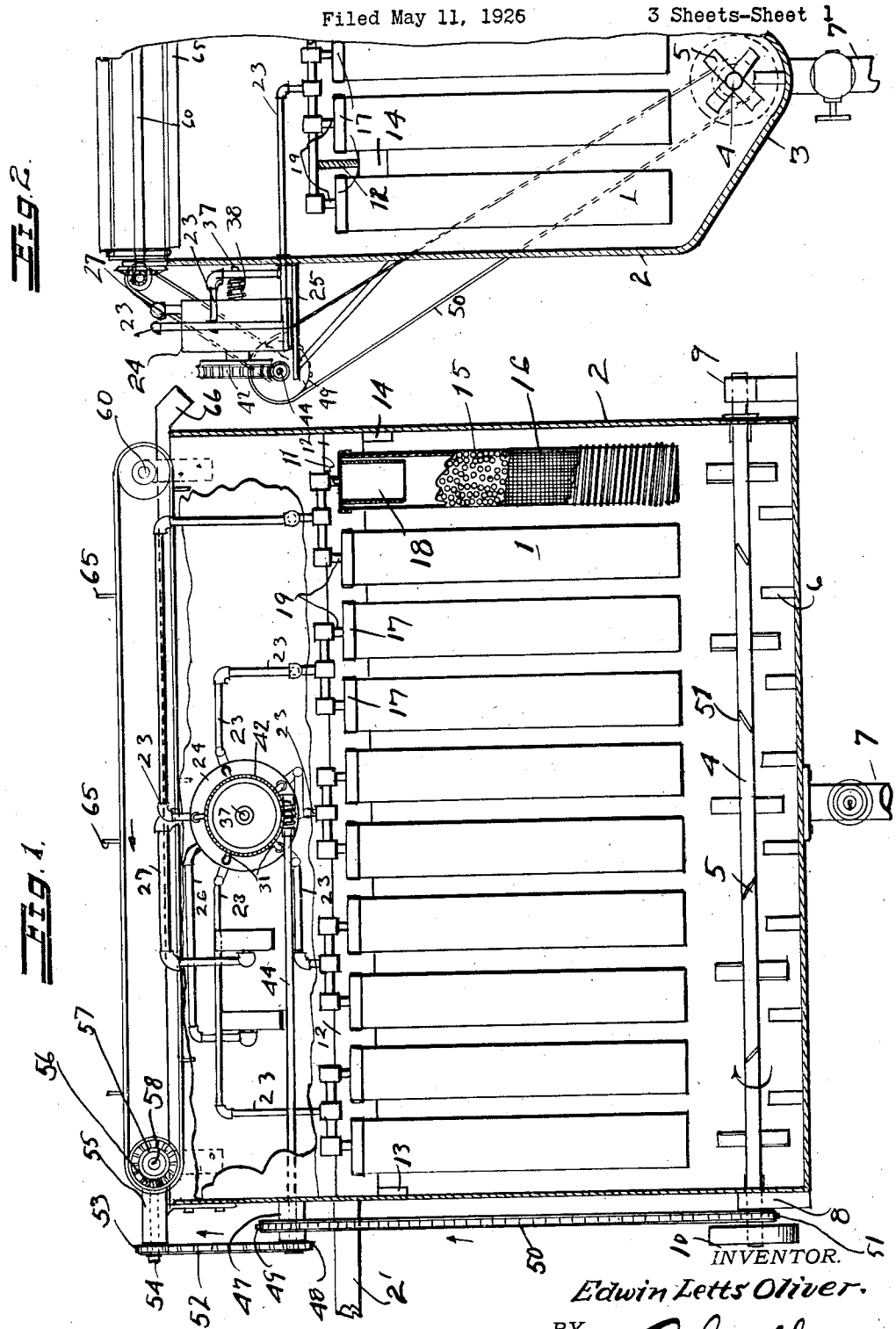


Fig. 2.

Fig. 1.

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3 Sheets-Sheet 2

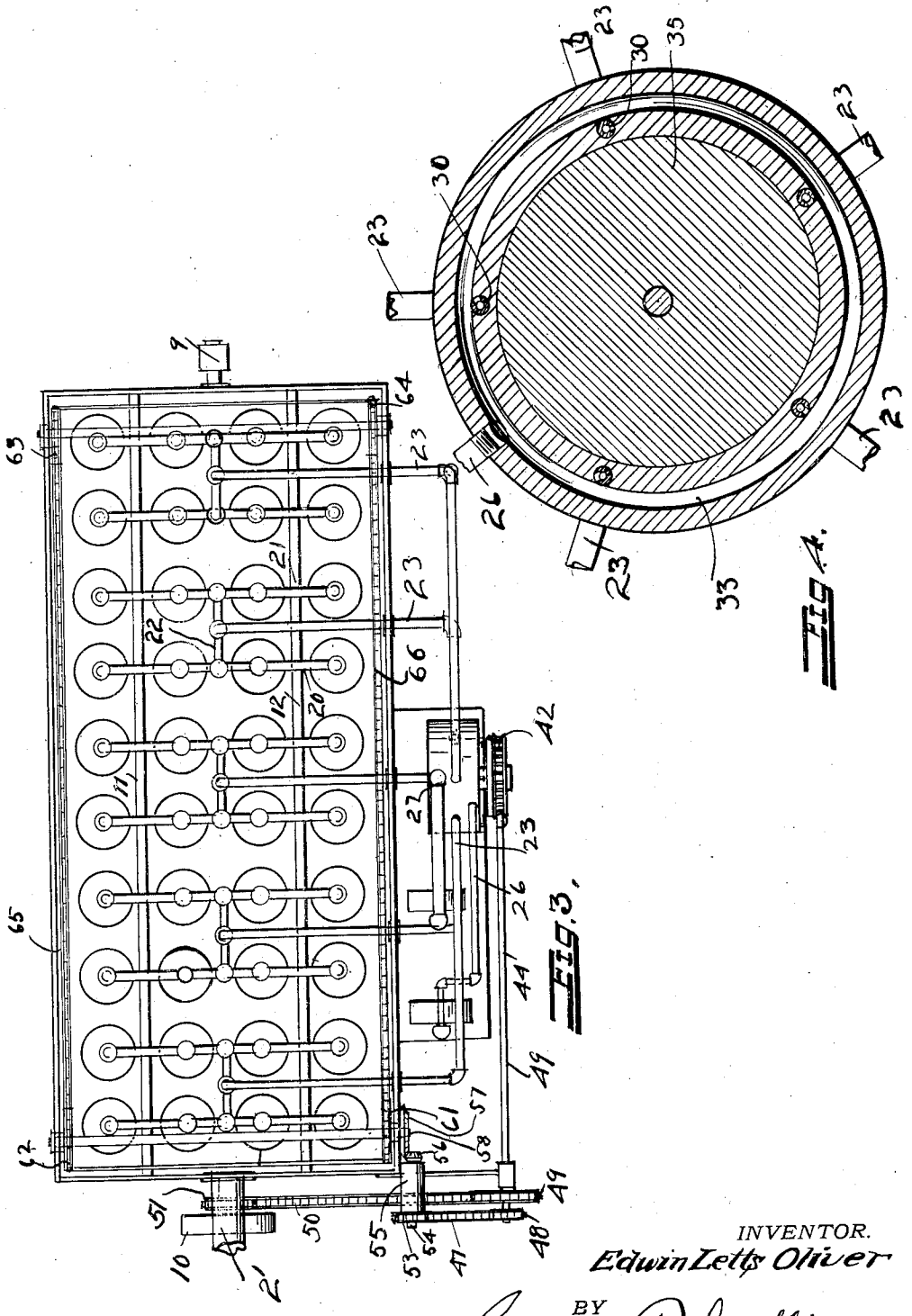


FIG. 4.

FIG. 3.

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3 Sheets-Sheet 3

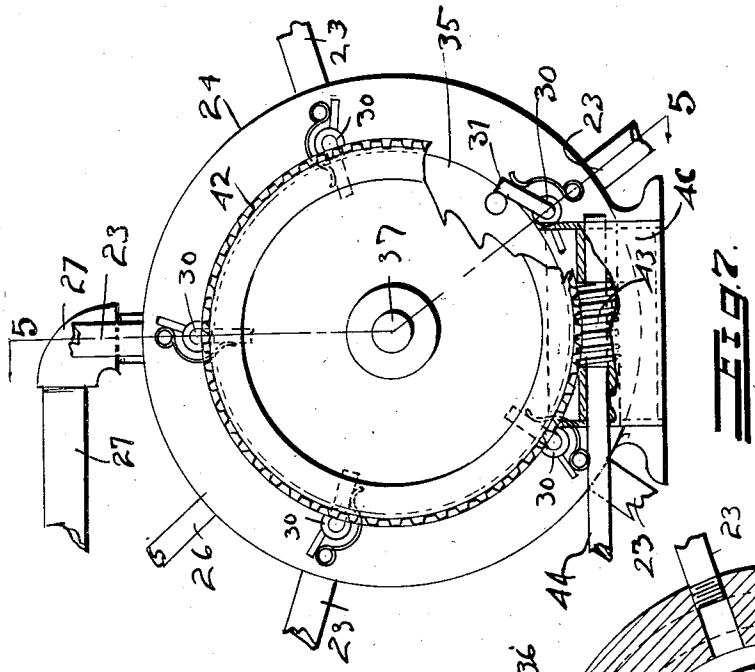


Fig. 7.

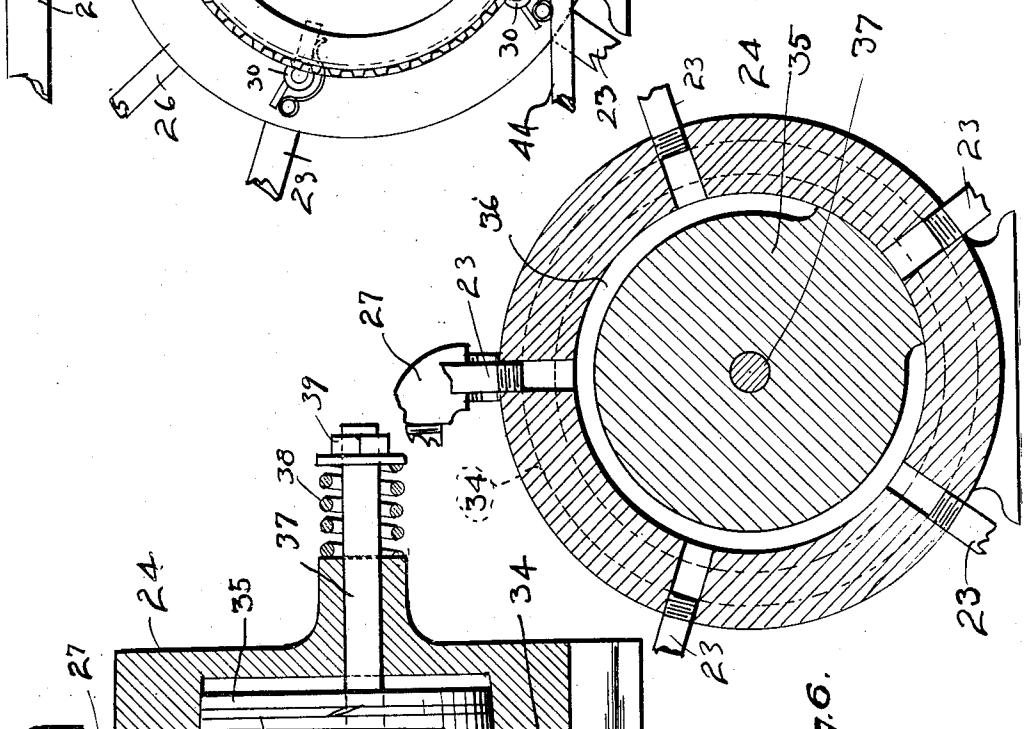


Fig. 6.

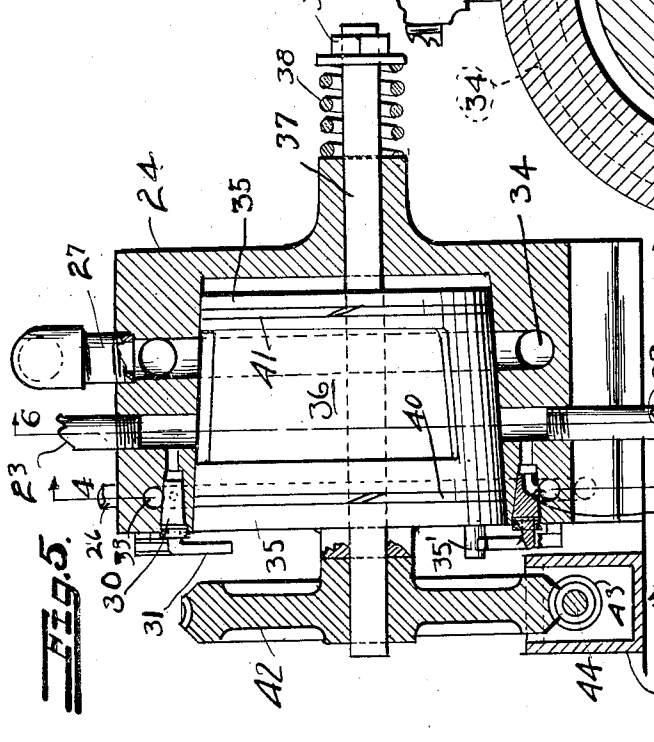


Fig. 5.

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Patented Oct. 11, 1927. 1,644,854

UNITED STATES PATENT OFFICE.

EDWIN LETTS OLIVER, OF OAKLAND, CALIFORNIA, ASSIGNOR TO OLIVER CONTINUOUS FILTER COMPANY, OF OAKLAND, CALIFORNIA, A CORPORATION OF CALIFORNIA.

PULP THICKENER.

Application filed May 11, 1926. Serial No. 108,254.

This invention relates to a pulp thickener in which a series of tubes are used to collect the filtrate, the tubes remaining submerged at all times, and being periodically cleaned by a blast of air, or fluid under any suitable pressure. In some instances special gases must be used, as in filtering gasoline, alcohol, etc.

Another object of the invention is to provide means whereby the entire area of the tube may be covered with filter cloth while there is a short pipe inside the filter to insure forcing a considerable quantity of liquid through the filter before the blast of fluid or air can pass through said filter thereby more efficiently cleaning the filter each time.

Another object of the invention is to produce a valve casing which will reduce the piping and make for simpler operation, a cage or plug valve on the high pressure side being used for each set of filters, thus allowing a continuous drive for the valve with a single trip mechanism for the blast valves.

Another object is to produce a valve which will be substantially balanced in action, thereby reducing its wear as well as the power to run it.

Another object of the invention is to provide a submerged pulp feed and an endless conveyor to carry off foam.

Another object of the invention is to provide conveyor and breaker blades in the tank bottom which will discharge the thickened pulp from the tank.

Another object of the invention is to install the valve for acting on the filters successively, below the pulp level thereby making itself priming when air has been admitted to the system. For convenience of illustration the valve has been shown near the top of the tank but in practice it may be located at any place where it is below the pulp level.

Another object of the invention is to simplify the construction and operation of the apparatus.

Another object of the invention is to provide a filter which is capable of handling various kinds of filtrates and pulps, the filtering material used thereon being changed as may be necessary owing to the pulp or precipitate to be handled, and in some instances the filter units may be covered with wire windings or any other suitable means, to prevent the filter septum from being dislodged from the filter units.

Other objects of the invention will appear as the description proceeds.

An embodiment of the invention is shown in the accompanying drawings in which the same reference numeral is applied to the same portion throughout the several figures of the drawings and of which there may be modifications:

Figure 1 is a vertical sectional view of the apparatus, one side of the tank being cut down to show the valve casing, the filters being in five separate sets.

Figure 2 is a sectional view in end elevation of a portion of the apparatus.

Figure 3 is a plan view of the complete apparatus, the conveyor being omitted at the bottom of the tank,

Figure 4 is a vertical sectional view of the valve casing to show the high pressure air passages, the vacuum passage being substantially the same at a different place in the casing,

Figure 5 is a longitudinal sectional view of the valve casing gear showing its drive taken on line 5—5 of Figure 7,

Figure 6 is a transverse section of the valve casing showing the vacuum air passage therein in dotted lines and,

Figure 7 is a view in end elevation of the valve casing and its drive gear.

The thickener filter elements 1 are installed in a tank 2 which has a bottom 3 sloping to the conveyor 4 with the inclined blades 5 and fixed breaker blades 6. The blades on the conveyer incline so the material will be discharged toward the center of the tank as indicated at 5, 5 Figure 1, a pipe 7 leading the pulp to a suitable location.

The conveyor has suitable bearings 8 and 9 at the ends of the tank and it is driven by a belt passing around the pulley 10.

The filter elements are arranged in sets of any desired number with any desired number of elements in each set. In the present case eight elements are connected together and there are five sets. The number of elements in a set will be determined by

convenience of handling an entire set when it is desired to remove them from the tank to renew the filter surfaces, or to make other repairs.

It will be understood that the series of pipes forming the several filter units are made as large as is necessary to suitably support the filter tubes when they are lifted out of the tank filled with water or pulp.

The sets of tubes are supported on two rails 11 and 12 extending lengthwise of the tank, said rails being in turn supported by cleats 13 and 14 at the ends of the tank.

Each filter tube is made of perforated sheet metal 15 covered with a filter fabric 16 and the latter is then covered with wire or other windings to retain the filter cloth when the blow occurs. Each tube has a cap 17 to which a smaller short inner tube 18 is secured, said inner tube being for the purpose of providing a supply of filtrate to blow through the filter prior to the time the air can pass through the filter fabric.

Each tube is supported by a short nipple 19 which nipples are connected with suitable fittings to the transverse pipes 20, 21, and to the pipe 22 at the center of the tank; the latter pipes each being connected to the pipes 23 of which there are five extending to the valve casing. The valve casing 24 is mounted on a bracket 25 at the side of the tank and below the water level.

The valve casing 24 has two circular passageways cast therein, while there are five holes to receive the pipes 23 and two holes to receive the pipes 26, 27.

Installed in five openings adjacent the passage for the compressed air in the valve casing are five plug valves 30, said plugs being arranged so their plug handles 32 will be in a given position when the turn of the valve is made.

The compressed air passage is shown at 33 while the vacuum passage is shown at 34.

The distributor valve 35 is frusto-conical with a port 36 to provide the moving connection between the filter tubes and the main vacuum pipe 27 which is connected to the passage 34.

The valve 35 is supported by a shaft 37 spring 38 and lock nut 39 holding the valve snug in the casing.

The valve is provided with two packing rings 40, 41 and with a blank space to close the passageway to the filter sets when one of the blast valves is opened.

The valve 35 is driven by a very slow moving worm wheel 42 in turn driven by the worm 43 on the shaft 44. The valve 35 has a pin 35′ at the blank portion to open the blow valves successively.

The shaft 44 is journalled in a double bearing 46 which also has a chamber to hold grease for the worm 43, and in a bearing 47 at the end of the tank 2. The shaft 44 has two sprocket gears 48, 49 one of which receives power from the chain 50 passing under the gear 51 on the shaft 4, while power is transmitted from the gear 48 to the chain 52, gear 53 and shaft 54. The shaft 54 is journalled in a bearing 55 at the top of the tank 2, and the same shaft has a bevel gear 56 to drive the bevel gear 57 on the shaft 58.

The shafts 58 and 60 each carry two sprocket wheels as indicated at 61 to 64 inclusive and sprocket chains 65—66 pass over said wheels to support a plurality of rakes 65 to rake off any foam that may collect on the top of the pulp being treated. The discharge being through a launder 66 at one end of the tank.

Where the material being collected is lighter than the pulp the rakes 65 serve to discharge it through the launder 66 the same as the foam is ordinarily discharged. The present case is intended to feed the material into the receptacle 2 through the submerged feed pipe 2′, any excess water or foam being discharged at the launder 66, while heavy slimes are discharged through the pipe 7.

The operation of the apparatus is as follows: Assuming the tank to be filled with pulp to be treated, a vacuum pump connected to the pipe line 27 is started and the pulley at the bottom of the tank is rotated in the direction indicated by the arrow, Figure 1. This will cause the conveyor to break up and move all the semi-solid material that may be collected in the tank, toward the center to be discharged from the pipe 7 at the same time the rakes 67 will be operated to discharge any floating material through the launder 66, while the valve 35 is rotated. As long as its port 36 produces a passageway between the pipes 23 and 27 liquid will be drawn through the filter elements causing the solid materials to collect thereon. As soon as the port 36 passes one of these pipes, as indicated in Figure 7, the pin carried by the valve will strike one of the valve arms 32 thereby opening it, and causing a blast of air to pass into one of the pipes 23. This will cause a surge of the liquid in the filter 2 and there will be no escape of air from the filter 2 until all of the liquid in the inner tube 18 has been displaced. This will insure the complete removal from the outside of the filter of the material collected thereon and the tube 18 may be made as long or as short as may be deemed necessary for the cleaning of the filter surface. As the distributing valve passes the valve operating arm the spring will cause the valve to be closed and the filter will again be in action as soon as the port 36 reaches the opening into which one of the pipes 23 is inserted.

Having thus described my invention, what I desire to secure by Letters Patent of the United States is as follows, but modifications may be made in carrying out the inven-

tion as shown in the drawings and in the above particularly described form thereof, within the purview of the annexed claims:

1. A pulp thickener comprising a series of tubular filter elements having their entire length covered with a foraminous material, means to apply a pressure below atmospheric thereto, means to apply a pressure above atmospheric thereto, both of said pressures being applied successively, and a depending tube inside of, and at the top of each filter tube, said depending tube having annular space between it and said filter tube to cause a considerable quantity of the liquid within the filter tube to pass through the foraminous surface before the air or fluid blast can reach the same.

2. A pulp thickener comprising a receptacle for the pulp, a plurality of tubular filter units therein each covered throughout its entire length with a foraminous filtering material, pipe connections and a distributer valve adapted to successively apply pressure lower than and greater than atmospheric to the several filtering units, a depending tube attached to the upper portion of each filter unit and spaced from the inside walls thereof inside the same whereby a considerable percentage of the liquid within the filter tube will be expelled therefrom prior to the time any air or fluid from the blast can reach the filter surface.

3. An apparatus of the class described comprising a receptacle for the pulp to be filtered, a series of tubular filter units therein each covered throughout with a foraminous filtering material, a smaller depending tube in the tops of said units, a distributing valve placed below the level of the liquid in said receptacle, means to rotate said valve and pipe connections whereby upon its rotation a pressure below atmospheric and a pressure above atmospheric will be successively applied to said filter tubes in sets.

4. An apparatus of the class described comprising a pulp receptacle, a series of filter tubes therein, smaller depending tubes in the tops of said filter tubes, a conveyor adapted to cause the solid material within the receptacle to be carried toward the discharge and to be broken up into small pieces whereby a substantially uniform pulp may be discharged from the receptacle and rotary means for periodically applying high and low pressures to said tubes, the distributing valve being arranged below the level of the pulp in the tank.

5. A pulp thickener comprising a receptacle for the pulp having a discharge opening, a conveyor and breaker in the bottom of said receptacle to cause the discharge therefrom of the solid materials collected therein, a series of tubular filter elements each being covered throughout with a foraminous filtering material, each of said elements having a depending tube from the top thereof, a rotary distributer valve, and means whereby said valve will alternately cause the application of pressures below and above atmospheric to the several filter units, and means to insure the passage through the filter in the reverse direction of a considerable quantity of the liquid contained therein when a blast is applied thereto.

6. A pulp thickener comprising a receptacle for the pulp, a pipe to discharge the thickened material, a launder for the overflow, means to rake the foam collected into the launder, a series of tubular filter elements in said receptacle, a casing having openings thereto to receive pressures above and below atmospheric respectively, and means to apply said pressures to the filter units successively.

7. A valve for pulp thickeners comprising a casing having two peripheral passageways to receive simultaneously pressures above and below atmospheric, a series of valves carried by said casing communicating with one of said passageways, a pipe extending from one of said openings to a source of air or fluid pressure supply, and the other extending to a vacuum pump and a tapered rotary valve in said casing, said valve having a wide port to open all but one of the passageways to the vacuum pump, said valve having a blank to allow the other passageways to be blown with air, or fluid at a pressure above atmospheric whenever desired.

8. A pulp thickener comprising a receptacle, a series of tubular filters therein, depending tubes from the tops of said filters, a fixed casing having openings therein to receive pressures above and below atmospheric, a rotary valve in said casing, said valve having an arm to operate the other valves in succession, and means whereby a large proportion of the time all of the filters will have a pressure above atmospheric applied thereto.

9. An apparatus of the class described, comprising a receptacle for the pulp to be filtered, a series of tubular filter units therein each covered throughout with a foraminous filter material, a depending tube within the filter units but not in contact with the walls thereof to cause a considerable quantity of the liquid therein to be forced through the foraminous material when pressure is placed thereon, a distributing valve and a casing therefor, and means whereby the pressures on the valve unit may be alternately and successively reversed.

10. An apparatus of the class described comprising a pulp receptacle, filter units therein, each unit having a depending tube from the top thereof, a conveyor therein adapted to cause the solid materials to be carried toward a discharge opening, and

rotary means below the level of the pulp in said receptacle for periodically reversing the pressures within said filter units.

11. An apparatus of the class described comprising a pulp receptacle, filter units therein, each unit having a depending tube from the top thereof, a conveyor to cause the solid material within the receptacle to be carried toward a discharge opening, and means arranged below the level of the pulp in the tank for periodically reversing the pressure within said filter units.

In testimony whereof I have hereunto set my hand this 3rd day of May A. D. 1926.

EDWIN LETTS OLIVER.