

June 10, 1930.

J. W. PEARL

1,762,585

ANALYZER

Filed Jan. 17, 1927

2 Sheets-Sheet 1

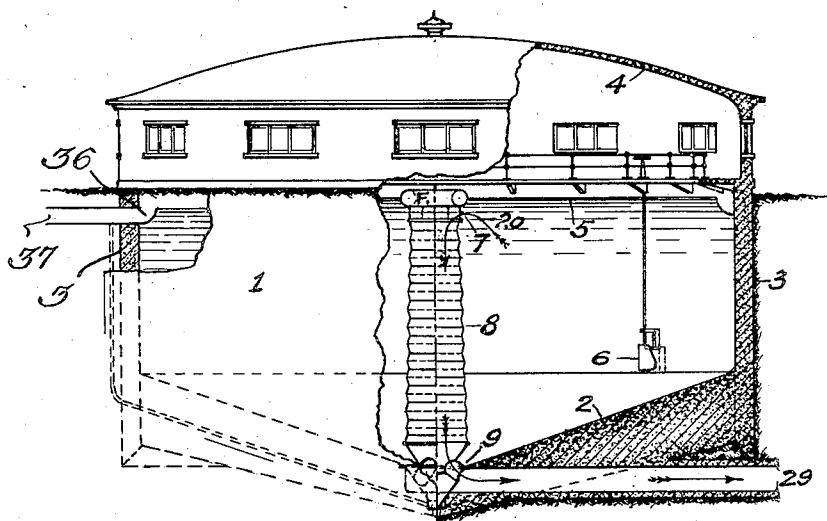


Fig. 1.

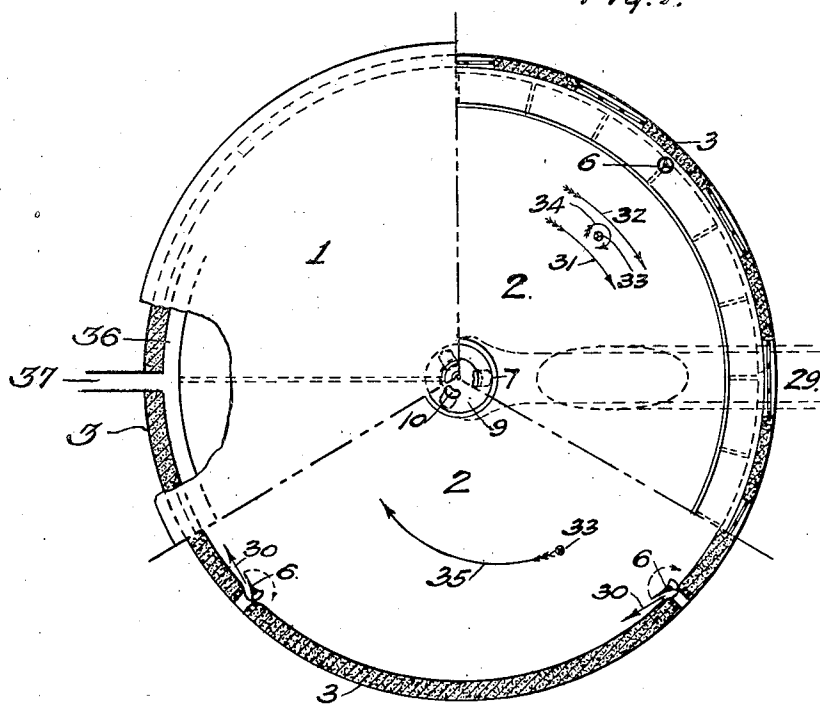


Fig. 2.

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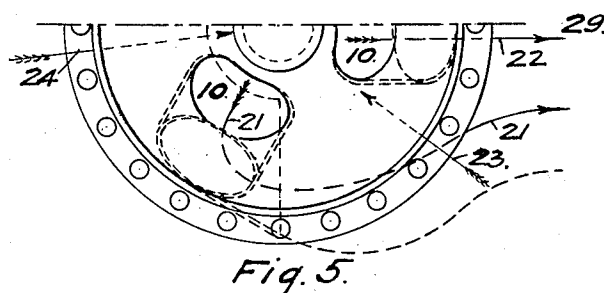
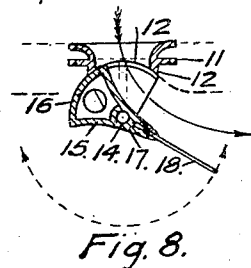
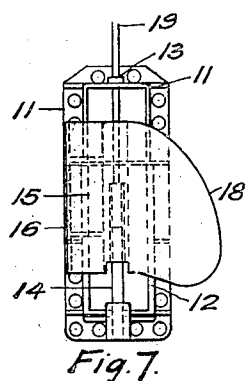
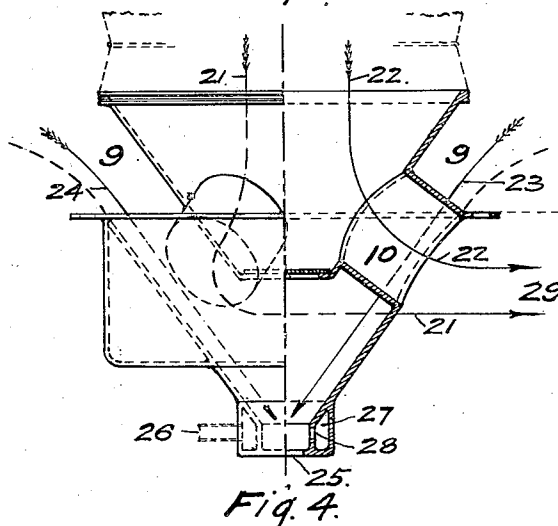
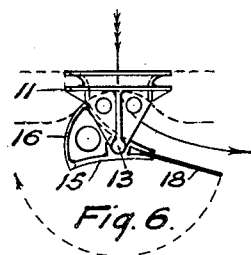
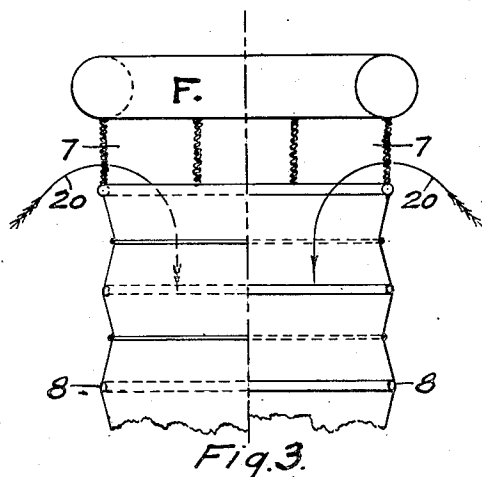
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ANALYZER

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2 Sheets-Sheet 2



Witnesses.

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ANALYZER

Application filed January 17, 1927. Serial No. 161,691.

The object of the invention is to accelerate the separation of solids, such as dust, silt, sediment or a precipitate produced by heat, cold, mechanical or chemical action, suspended in a fluid; or the separation of two fluids of different densities; and to assemble the materials separated at central or other convenient locations for removal; to produce in one basin the various velocities required to move the heavier particles to a central outlet for cleaning and disposal; to extend the range of sedimentation to particles too small or too light to settle out of a motionless fluid, and to provide for continuous or intermittent operation and the removal of the dregs as may be most convenient.

The object may be to purify either the lighter or denser of the ingredients, or both of them, and is attained by producing various velocities, gradually reduced to the point where the difference between the friction of rest and the friction of motion permits more effective action of the force of gravitation.

The invention consists of novel features and parts and combination of parts, as will be fully described hereinafter and pointed out in the claims.

The construction used to produce the results desired is shown in the accompanying drawings, forming a part of the specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1, is an elevation of a cylindrical basin with a portion of the right-hand side removed to show the interior construction, sloping bottom and inlet gates, a portion of the wall at the left-hand side is broken away to show gutter and outlet.

Figure 2, is a plan view of the basin showing the roof on the upper-left one third; a horizontal section through the windows on the upper-right one third; a horizontal section of the basin through the inlet gates and a view of the bottom are shown on the lower one third of the figure, a portion of the roof is broken away at left-hand side to show gutter and outlet.

Figure 3, is an elevation of the upper part

of the outlet conduit and float; showing on the left-hand side an elevation and on the right-hand side a section, all at an enlarged scale.

Figure 4, is an elevation of the lower part of the outlet conduit and sump at the bottom of the basin, at an enlarged scale, showing on the left-hand side an elevation and on the right-hand side a vertical section of the outlet conduit and sump for the collection of the dregs and passages through the sump for the discharge of purified fluids.

Figure 5, is a plan view of the parts shown in elevation in Figure 4.

Figure 6, is a plan view of the frame for an inlet gate used to admit material to be treated and to control the direction and velocity of the fluid contents of the basin.

Figure 7, is an elevation of the frame for an inlet gate showing the gate raised to admit fluid in a radial direction at the bottom of the inlet, while fluid entering at the top of the inlet gate is deflected to a tangential direction by the vane on the gate.

Figure 8, is a horizontal section through the frame, inlet gate and vane at the inlet opening.

The apparatus is described in detail as follows:—

Referring to the drawings, 1 represents a basin, tank or reservoir which constitutes the body of improved analyzer. The bottom 2, and the sides 3, may be constructed of any material suitable for use with the fluids and solids to be analyzed; the basin may have a top or roof 4, for some processes and for others it may have no top and be operated free and open to atmospheric pressure. In either case it shall be adapted to have a free surface 5 at the top, where the frictional resistance to the moving contents is at a minimum.

When the materials to be purified require a closed container, a space for oil, air, or a suitable vapor or gas shall be provided between the surface 5, and the top 4, of a closed basin.

The basin as shown by Fig. 1 and Fig. 2, is equipped with a plurality of inlet gates 6, located near the bottom thereof and pref-

erably of equal size and equally spaced around the periphery of the basin; the size and number used to be adjusted to the size of basin, the physical properties of the materials treated and the refinement required in the finished product. One or more inlet gates may be closed as required to increase the velocity through the other inlets and concentrate the flow on any accumulation of sediment or to clean up the bottom of the basin.

In addition to serving as inlets for material to be purified in the basin, the inlet gates 6, also shown in detail by Figs. 6, 7 and 8, are utilized to produce rotation of the material passing through the analyzer and to regulate the velocity and direction the ingredients will take as they move along to their respective outlets at 7 and 9.

The inlet gate 6, consists of frame 11, attached to the side of basin 3, and is provided with a seat 12, and bearings 13 and 14, for close operating contact with the gate; gate 15, has a seat 16, an axis or bore 17, vane 18, and stem 19, extended to a convenient location for operation.

Figure 7, shows the gate at a mid-position vertically, with reference to the frame, and from this position the gate may be rotated on the bearings 13 and 14 to deflect the flow of incoming material to the right or to the left, or to any intermediate direction, while at the same time the gate may be traversed vertically to admit any desired proportion of the incoming material directly toward the center of the basin. By the numerous vertical and horizontal combinations of movements available with these gates, and the pressure applied to the incoming material, the flow of material may be directed to secure the best results for a great variety of purposes.

The basin is equipped with an annular outlet 7, located at the center and near the top for the removal of the lighter purified fluid; and an annular outlet 9, located at the center and below the bottom for the removal of the heavier fluids and any solid material or dregs having a greater specific gravity than the fluids.

The basin may be equipped with a gutter 36, at the periphery and an outlet 37, through the wall 3, for the removal of scum and other material of lower specific gravity than the lighter purified fluid removed at 7.

The outlet 7, shown at a larger scale in Fig. 3, may be fixed in position, or vertically adjustable by suitable mechanism, or automatically controlled as shown by the float F.

From outlet 7, the fluid is preferably carried downward through tube 8, and passages 10 through the sump construction, shown by Fig. 4, and Fig. 5, and discharged through conduit 29, as indicated by arrows 20, 21

and 22. From outlet 7, the fluid may also be carried upward and discharged through a conduit by any well known means.

The outlet tube 8, may be made of sheet rubber reinforced and held to form desired by hoops, or be made of other suitable fabric; it may be made to adjust vertically by the bellows like construction shown or by sliding joints as commonly utilized for varying the length of tubes; or it may be made of suitable wood or metal with or without adjustable features.

The sump shown by Figs. 4 and 5, is a conical shaped hopper to receive the material passing through the annular outlet 9, and promote the flow as indicated by the arrows 23 and 24, and concentrate it over the central outlet 25. The sump may be equipped with an inlet for pipe 26, an annular chamber 27, and orifices 28, for the injection of air, water or other fluid at a suitable pressure to break any obstructions, agitate the contents of the sump and promote free flow through the outlet 25.

The cylindrical sides of the basin and the conical bottom are not essential features of the invention; spiral, oval, rectangular or other regular or irregular forms may be used, although cylindrical sides and a conical bottom are most logical and efficient.

Other forms of inlet gates, outlets or discharge conduits may be used without departing from the essential features of the invention, provided the movements imparted to the fluids and solids within the basin are substantially as set forth in description and claims, are for the purpose intended, and are produced without the aid of mechanically operated mechanism.

In the body of a fluid in motion that contains particles of other matter of greater density, it is well known that the velocity necessary to maintain the denser particles in suspension and transportation is greater than the velocity required to roll or slide the denser particles along the bottom of the container.

When in a moving fluid a particle of slightly greater density than the surrounding fluid touches the bottom of the container, the particle may be rotated on a horizontal or on a vertical axis, but it almost invariably will be rotated on an inclined axis that varies with the irregularities in the form of the particle, and also from instant to instant as the particle tends to follow the path of least resistance.

In a fluid moving in a circular, or approximately circular, path and at a velocity slightly less than that required to maintain the denser particles in suspension, the denser particles will be partially supported on the container and will be rolled along the bottom thereof; but the denser particles, instead of following the direction of the fluid

immediately above them will be rotated and rolled in a curved or sharply spiral path toward the center of rotation of the fluids. This is a fact that is not so generally known, or recognized, though it can be readily demonstrated.

For the efficient operation of an analyzer it is necessary to avoid, so far as possible, all "short circuits" of currents, eddies, counter currents, irregularities and obstructions in the path of the moving materials; and to control the velocity and direction of the moving fluids.

The operation of this analyzer is described as follows:—

A mixture of material entering the basin through a plurality of inlet gates 6, in the direction indicated by the arrows 30, will produce rotation of the entire body of fluid in the basin; the rotation of this entire mass of material in the basin will prevent a "short circuit" or flowing directly to outlets 7 or 9; the continuous displacement at the periphery by material entering at the inlet gates will prevent flowing in a truly circular path and force the fluids to take a spiral-like path to the outlets 7 and 9.

The energy necessary to produce and maintain rotation of the entire body of fluid is supplied by the weight and velocity of the material entering at the inlet gates; it follows, that each successive film of fluid from the periphery toward the center of the basin will transmit a diminished amount of energy. Also, in each successive film of fluid from the center toward the periphery the velocity will be increased directly as radii of curvature of the path of the two successive films, plus the velocity consumed in overcoming the friction between the two films.

A particle 33, however small it may be, suspended between two contiguous films that are traveling at slightly different velocities, as indicated by arrows 31 and 32, in Fig. 2, will be rotated as indicated by arrow 34.

The rotation of a particle, as 33, suspended in a fluid changes the resistance to movement of the particle, with reference to the fluids surrounding it, from the friction of rest to the friction of motion and thereby accelerates the movement of the lighter parts to the top and the heavier parts to the bottom of the basin.

As a particle arrives at and touches the bottom of the basin, the increased friction at the point of contact will cause a change in the direction of the axis of rotation of the particle and the particle 33, will now take another spiral path which is deflected at a considerable angle with the path of the fluid immediately above it and toward the center of the basin as indicated by the arrow 35.

As the operation is continued the lighter products are carried to the top and to the

outlet 7; the heavier products are carried to the outlet 9, and any scum or product lighter than the lightest fluid may be floated to the outlet at the periphery of the basin.

The further analysis of the products from either or all of the outlets of a basin may be effected by passing them through a series of basins operated at velocities adjusted to produce the purity desired.

I am aware that prior to my invention separators have been made to operate at high velocities and to separate various materials of different specific gravity by centrifugal forces; and I do not claim any parts or combination of parts acting in like manner.

I claim:

1. An analyzer for fluids or fluids and solids in which is combined a basin adapted to have a free surface at the top of the lightest fluid contents, a plurality of adjustable inlet gates adapted to rotate about a vertical axis near the periphery of the basin to control the direction and velocity of the incoming materials and the direction and velocity of rotation of the contents of the basin, an outlet near the free surface at the center of the basin for the removal of the lightest fluid product, a sump and outlet at the center of the basin for the collection and removal of heavy fluid and solid products, and a gutter and outlet at the free surface and periphery of the basin for the removal of scum and floating solids.

2. An analyzer for fluids or fluids and solids in which is combined a basin adapted to have a free surface at the top of the lightest fluid contents, a plurality of adjustable inlet gates adapted to rotate about a vertical axis near the periphery of the basin to control the direction and velocity of the incoming materials and the direction and velocity of rotation of the contents of the basin, an outlet near the free surface at the center of the basin for the removal of the lightest fluid product, a sump and outlet at the center of the basin for the collection and removal of heavy fluid and solid products.

3. An analyzer for fluids or fluids and solids in which is combined a basin having a plurality of adjustable inlet gates adapted to rotate about a vertical axis near the periphery of the basin to control the direction and velocity of the incoming materials and the direction and velocity of rotation of the contents of the basin, an outlet near the upper surface of fluids and the center of the basin for the removal of the lightest products and a sump and outlet at the center of the basin for the collection and removal of the heavier products.

4. An analyzer for fluids or fluids and solids in which is combined a basin having a plurality of adjustable inlet gates adapted to rotate about a vertical axis near the periphery of the basin to control the direction

and velocity of the incoming materials and the direction and velocity of rotation of the contents of the basin, an outlet near the upper surface of fluids and the center of the basin for the removal of the lightest products and an outlet at the center of the bottom for the removal of the heavier products.

5. An analyzer for fluids or fluids and solids in which is combined a basin, a plurality of adjustable inlet gates near the periphery of the basin adapted to swing in a substantially horizontal plane to vary the direction of incoming material and thereby control the rate of rotation of the contents of the basin, an outlet at the center of the basin and near the upper surface of the contents under treatment and an outlet at the center of the bottom of the basin.

6. An analyzer for fluids or fluids and solids in which is combined a basin adapted to have a free surface at the top of the lightest fluid contents, a plurality of inlet gates near the periphery of the basin angularly adjustable relatively to the basin wall to an extent to reverse the direction of flow of the incoming material and the direction and velocity of rotation of the contents of the basin, an outlet near the free surface at the center of the basin for the removal of the lightest fluid product, a sump and outlet at the center of the basin for the collection and removal of the heavy fluid and solid products and an outlet and gutter at the free surface and periphery of the basin for the removal of scum and floating solids.

All substantially as described and for the purpose set forth.

In testimony whereof I have signed this specification on this twentieth day of December, 1926.

JAMES W. PEARL.

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