W. G. HOWELL.

CENTRIFUGAL LIQUID PURIFIER.

APPLICATION FILED DEC. 13, 1917.

1,257,235.

Patented Feb. 19, 1918.

2 SHEETS—SHEET 1.

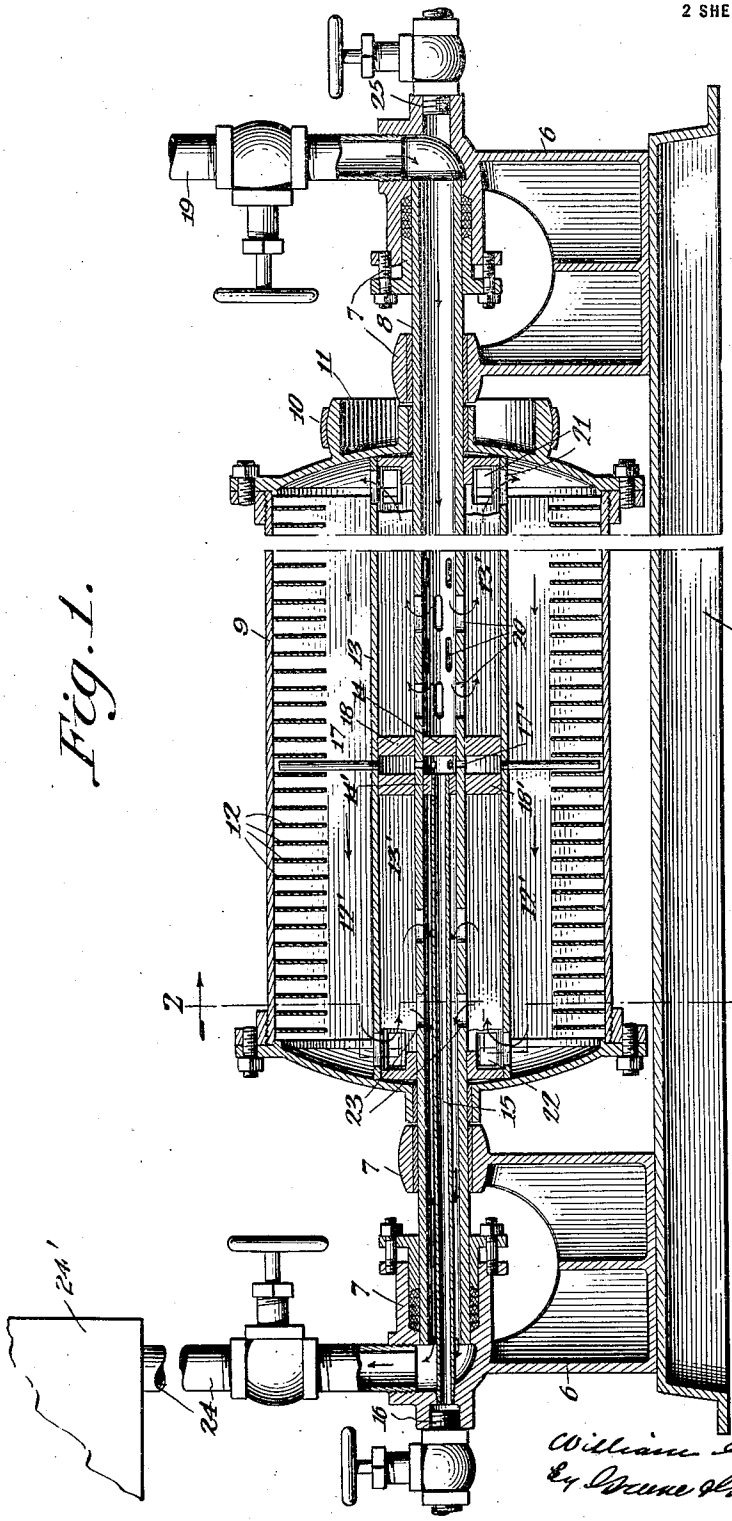


Fig. 1.

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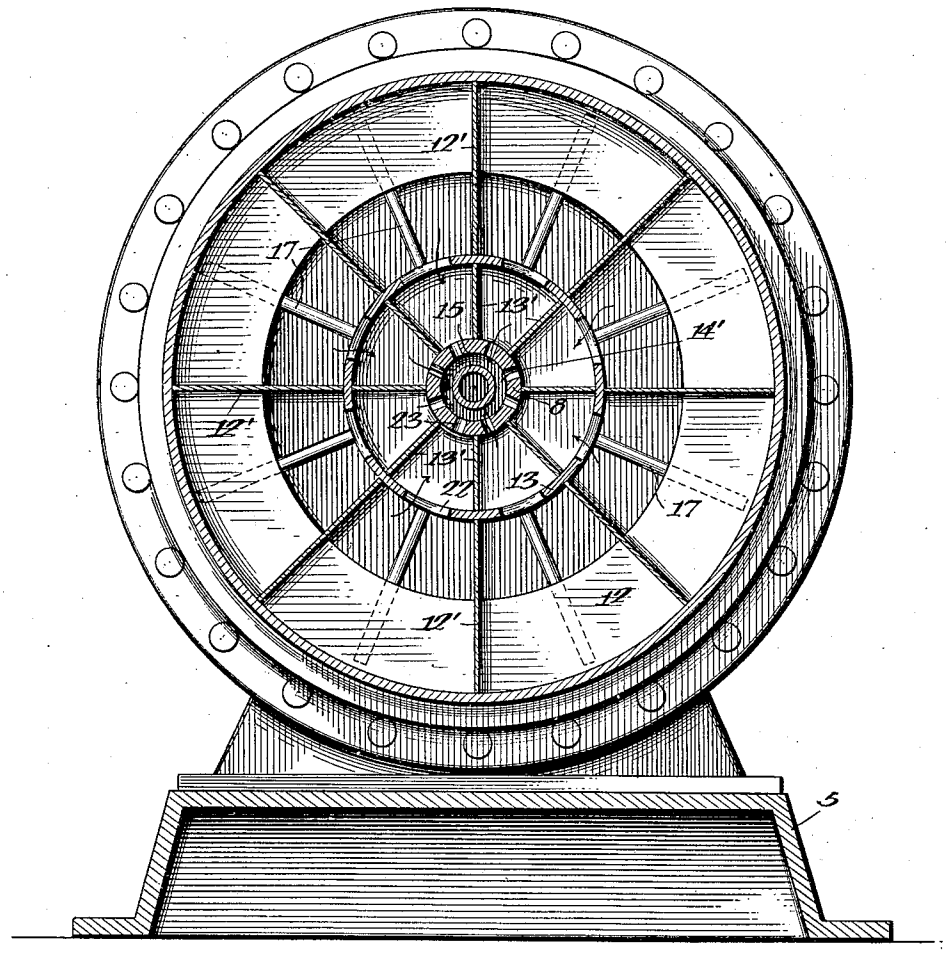
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2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

WILLIAM G. HOWELL, OF WARRENTON, VIRGINIA.

CENTRIFUGAL LIQUID-PURIFIER.

1,257,235. Specification of Letters Patent. Patented Feb. 19, 1918.

Application filed December 13, 1917. Serial No. 206,920.

To all whom it may concern:

Be it known that I, WILLIAM G. HOWELL, a citizen of the United States, and resident of Warrenton, in the county of Fauquier and State of Virginia, have invented certain new and useful Improvements in Centrifugal Liquid-Purifiers, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to employing centrifugal force for removing sedimentary matter from liquids. In specific gravity, such matter often differs but little from the liquid in which it is suspended. For certain uses, the water need not be completely freed from sediment, but for drinking purposes it must be made clear. So far as I am aware, centrifugal systems have not gone into permanent practical use, partly no doubt because it has not proved practicable to use fully effective speed, to avoid bad results from wear, to secure a very large output, and at the same time to avoid prohibitive cost.

I have found it highly advantageous, under proper conditions, to give the advancing stream of water the form of a small hollow cylinder and to rotate this thin cylindrical body at unusually high speed, centrifugal force increasing with the square of the speed of travel about the axis of rotation, and the elimination of matter in suspension depending upon this speed and upon the time during which centrifugal force acts upon the suspended particles.

In the accompanying drawings,

Figure 1 is a vertical axial section of the apparatus.

Fig. 2 is a section on the line 2—2, Fig. 1.

In these figures, 5 represents any suitable base and 6 rigid supports rising therefrom and provided with alined bearings 7 for the rotary hollow shaft 8 of a drum 9 which is driven by a belt 10 and a pulley 11 rigidly fixed to the head of the drum. The interior of the drum is provided with numerous spaced annular ribs or diaphragms 12 extending inwardly to some distance from the drum wall and further provided with a concentric hollow cylinder 13 extending from end to end of the drum. The space between the cylinder and drum wall is divided by a series of regularly spaced radial longitudinal partitions or ribs 12′ which extend between the ribs 12 approximately to the drum wall, and the cylinder is similarly divided by longitudinal partitions 13′. The hollow shaft is provided with transverse partitions 14, 14′ which are spaced apart, and from the compartment thus formed a small axial tube 15 leads outward and communicates with a pipe 16. From the same compartment pipes 17 project radially into the pockets formed by the annular and longitudinal ribs 12, 12′. The annular space between the hollow shaft and the hollow cylinder is divided, like the shaft, by transverse partitions 18, 18′, registering with the partitions 14, 14′, respectively, and apertures 17′ connect the two compartments between the two sets of partitions. Water to be acted upon enters the hollow shaft through a valved pipe 19, passes to the partition 14, flows outward through apertures 20 into the hollow cylinder and back to openings 21 by which it enters the subdivided drum space outside the hollow cylinder. Thence it passes to the opposite end of the drum, through openings 22 into the corresponding compartment of the hollow cylinder, through apertures 23 into the analogous compartment in the hollow shaft, whence it escapes through a valved pipe 24 forming a conduit for pure water to pass to an elevated container 24′.

The longitudinal partitions in the hollow cylinder compel the entering water to rotate with the apparatus before it enters the annular outer separating space in the drum, and the like partitions in the latter space prevent any lag in rotation during separation.

Centrifugal force varies with the distance from the axis and this construction separates from the more central body a thin cylindrical body of water at some distance from the axis and prevents any portion of this outer stratum from mixing with the more central impure body, the travel of which about the axis is comparatively slow. In effect, therefore, a stream of water continually flowing through the supply pipe is expanded to form a thin hollow cylindrical body and rotated at very high velocity, whereby practically all matters mechanically suspended are thrown to the outer part of said body. That such matter may not still go on with the longitudinally advancing water, the numerous pockets are provided, and from these no sediment escapes so long as rapid rotation continues. Varying the length of the receptacle and reversing, repeatedly, the

direction of the water entering the same reduce the rate of flow for a given entering pressure, and this reduction has been experimentally made such as to give the best results, the separation of sediment depending on time as well as the degree of centrifugal force.

When a large amount of sediment has accumulated in the pockets, the inflow and discharge pipes 19, 24 are closed, a valved discharge pipe 25 is opened to allow part of the water in the drum 9 to escape, the air inlet pipe 16 being also opened to admit air through 15, 17', 17, and then, the pipe 25 being closed if desired, the drum is rotated at relatively slow speed so that the splashing of the remaining water may wash the sediment from the pockets. This agitation of the water loosens the sediment which, when the pipe 25 is open, is quickly discharged. If further cleansing is desired, the pipe 24 may be opened so that the flow of washout water will be through all parts to which impure water is admitted and sediment will thus be washed out by a strong controlled current of pure water.

When the washing is completed, the parts are restored to initial position and operated as first set forth.

It may be noted that the entire body of water and the containing parts rotate together, there being no slip or water friction other than that due to the relatively slow longitudinal advance of the rotating water, that consequently the power required for high speed rotation is very slight, and that since the speed can readily be made as high as is desired, the apparatus may be small. There is no mixing of pure and impure water, even after wear, there are practically as many purifiers as there are pockets and the product is delivered rapidly and entirely clear when any natural water with which I am acquainted is used. The apertures or passages 20, 21, 22 progressively increase in size of course, so that the same amount of water may pass although the speed decreases. It may be further noted that use of many small pockets prevents dislodging of mud by eddy currents.

What I claim is:

1. In a liquid purifier, the combination with a conduit for flowing liquid to be purified, of means for retarding the normal rate of flow and changing the form of the flowing mass to that of a relatively large thin hollow cylinder, means for rapidly rotating the mass about its axes while it slowly advances in its changed form, and means for collecting the sediment thrown outward by rotation.

2. In a centrifugal liquid purifier, the combination with a liquid receptacle having a partition dividing it into an axial chamber and a relatively thin annular compartment communicating with said chamber near one end and discharging near the opposite end, of means for rapidly rotating the receptacle and means for continuously introducing liquid into said chamber.

3. In a centrifugal liquid purifier, the combination with an elongated receptacle divided longitudinally into an axial chamber transversely divided and surrounded by a narrow annular separating compartment communicating near one end with said chamber and discharging near the opposite end, means for discharging liquid into said chamber at a distance from the end first mentioned, and means for rapidly rotating said receptacle.

4. The combination with an elongated closed approximately horizontal receptacle divided by a fixed wall into an axial chamber and a relatively narrow annular peripheral compartment having near its ends respectively, an inlet from said chamber and an outlet and formed with peripheral sediment-receiving pockets, means for delivering liquid in said chamber at a distance from said inlet through which alone it can escape, and means for rotating the receptacle.

5. The combination with a closed receptacle mounted upon a hollow shaft internally divided by a transverse partition and provided with lateral discharge apertures near said partition, of a closed receptacle mounted upon and concentric with said shaft, means for introducing liquid into the portion of the shaft provided with said apertures, a sleeve concentric with the shaft and dividing the closed space surrounding it into an inner annular chamber and an outer annular separating compartment communicating with said chamber near the end opposite said apertures and discharging at the opposite end, and means for rapidly rotating the receptacle.

6. In combination with a closed elongated, approximately horizontal receptacle longitudinally divided into three concentric chambers by a hollow shaft and a larger hollow cylinder, partitions dividing the inner and intermediate chambers transversely, means for introducing liquid at one end of the shaft and for discharging liquid at the opposite end of the shaft, said shaft and hollow cylinder being laterally perforated on opposite sides of their transverse partitions, substantially as set forth.

7. The combination with an approximately horizontal closed receptacle, of a hollow shaft extending axially through the receptacle and having a transverse partition at some distance from the ends of the receptacle, a hollow concentric cylinder dividing the receptacle space outside the shaft and provided with lateral perforations near its ends, a transverse partition dividing the annular space between the shaft and hollow

cylinder, means for rapidly rotating the receptacle, a valved conduit for introducing liquid at one end of the shaft, and a valved conduit for discharging liquid at the opposite end of the shaft.

8. The combination with an approximately horizontal closed receptacle, of a hollow shaft extending axially through the receptacle and having a transverse partition at some distance from the ends of the receptacle, a hollow concentric cylinder dividing the receptacle space outside the shaft and provided with lateral perforations near its ends, a transverse partition dividing the annular space between the shaft and hollow cylinder, means for rapidly rotating the receptacle, a valved conduit for introducing liquid at one end of the shaft, a valved conduit for discharging liquid at the opposite end of the shaft, and distinct means for introducing reversely moving washout liquid to pass through all parts to which nonpurified water has access.

9. The combination with a rotary receptacle having internal peripheral pockets and suitable discharge openings, of an axial conduit extending into the same and laterally perforated near the closed inner end of its passage, and a concentric larger conduit closed at its inner end and laterally perforated near its opposite end, whereby liquid admitted to the inner conduit is twice reversed in direction as it passes from the admission to the discharge end of the apparatus.

In testimony whereof I hereunto affix my signature.

W. G. HOWELL.