

April 14, 1931.

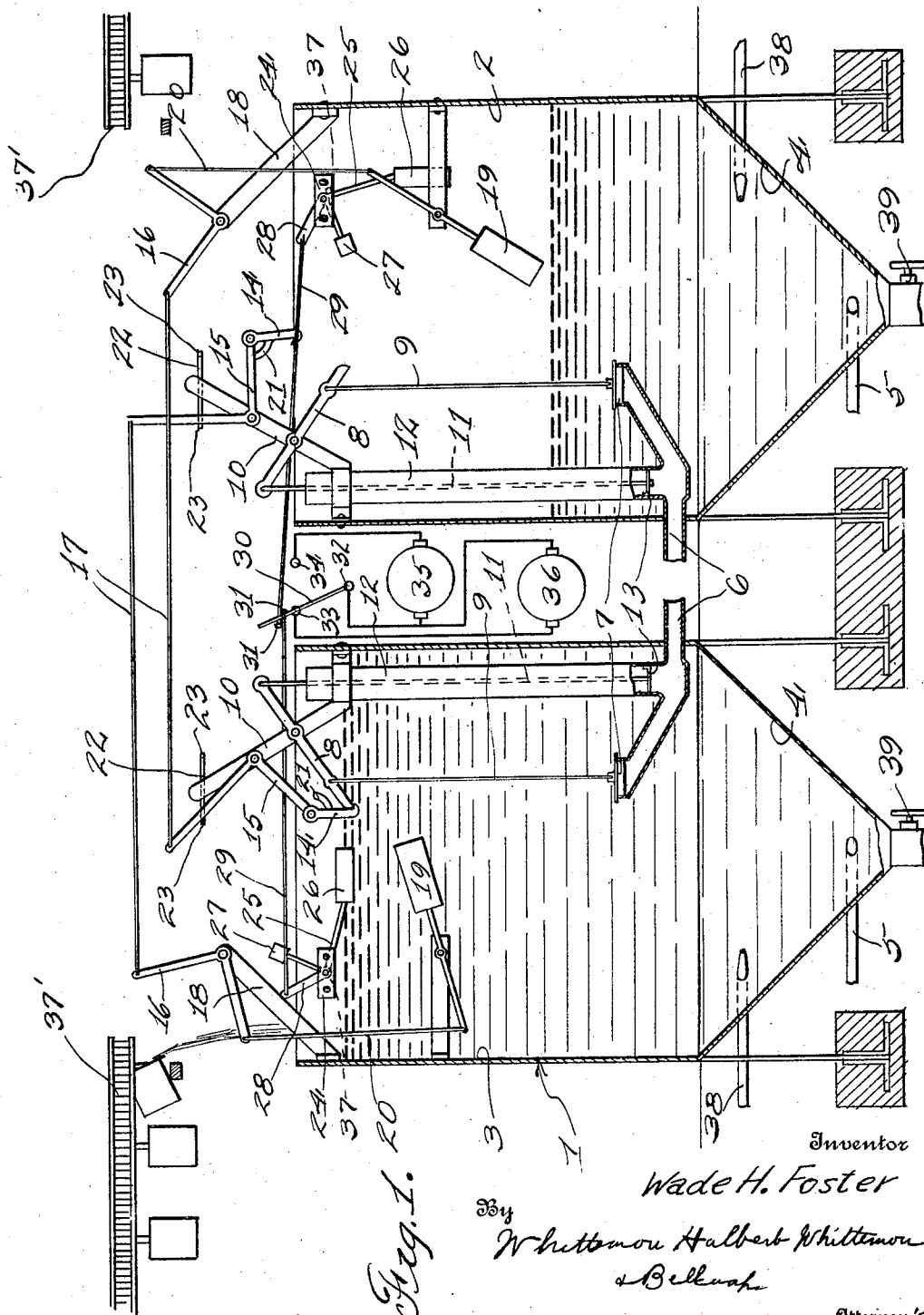
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LIQUID PURIFICATION APPARATUS

Filed March 7, 1927

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

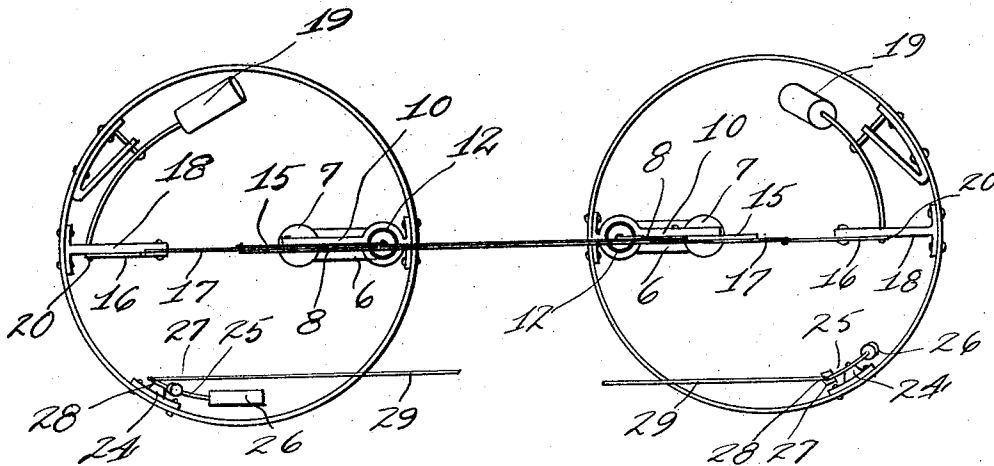


Fig. 2.

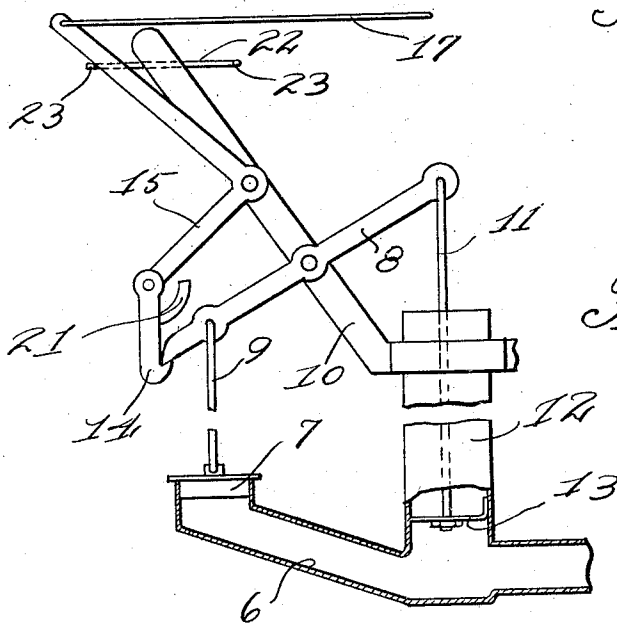


Fig. 3.

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LIQUID-PURIFICATION APPARATUS

Application filed March 7, 1927. Serial No. 173,544.

This application relates generally to liquid purification apparatus and refers more particularly to that type of apparatus in which a plurality of tanks are used for purifying the liquid.

One of the objects of the present invention is the provision of a pair of tanks in which the filling and emptying thereof is controlled by the liquid to be purified.

Another object is to provide means for filling the tanks from the bottom portions thereof in such a manner that there will be a thorough agitating and mixing of the incoming liquid with certain chemicals which are introduced from the top of the tanks for precipitating the contaminated material out of the liquid.

Further objects of the invention reside in the novel features of construction and combinations and arrangements of parts as more fully hereinafter set forth.

In the drawings:

Figure 1 is a side elevation of my invention with portions of the walls of the tanks broken away.

Figure 2 is a plan view thereof.

Figure 3 is an enlarged view of the draining valve and means for controlling the same.

In the accompanying drawings wherein like characters of reference indicate like parts the numeral 1 generally designates my liquid purifying apparatus consisting of a pair of tanks 2 and 3 which are designed to alternately receive the liquid to be purified, one tank being adapted to receive the liquid while the other tank is draining a quantity of the liquid in a purified condition. As shown each tank is preferably provided with a conical bottom portion 4 through which the liquid is introduced into the tank in the form of a jet by means of the pipe 5. Each tank is also provided with a drain pipe 6 extending through a wall of the tank preferably above the conical bottom 4 and having

a valve 7 seating upon the inner end thereof. As shown this valve 7 is pivotally connected to an arm 8 by means of a vertically extending rod 9, the arm 8 being pivotally mounted upon a stationary support 10 attached to the tank.

The arm 8 is also connected to another vertically extending rod 11 which is located within and guided by an upstanding pipe 12 communicating with the drain pipe 6 and acting as an overflow pipe for the tank. To the lower end of the rod 11 is attached a baffle 13 which as shown in Figure 3 is positioned wholly within the pipe 12 when the valve is seated but which partially extends within the upper end of the drain pipe 6, when the valve is unseated.

As shown the rod 9 is connected to the arm 8 intermediate the pivot point thereof, the end portion of said arm adjacent to the rod 9 being adapted to engage a hook 14 which is pivotally mounted upon one end of a bell-crank lever 15. This lever is movably mounted on the support 10 above the arm 8 and is connected to another bell-crank lever 16 by means of a rod 17. As shown the lever 16 is mounted upon a support 18 attached to the other tank, this tank also housing a float 19 which is connected to the bell-crank lever 16 by the rod 20.

Each tank is provided with the above described cooperating parts which are adapted to function in the following manner. Assuming that the liquid is being introduced into the bottom of tank 2 with the valve 7 in closed position, the liquid will continue to rise therein and eventually come into contact with the float 19 which is shown in lowered position. The initial movement thereof will naturally be comparatively slow so that the hook 14 in the tank 3 will slowly lift the arm 8 before it is disengaged therefrom. This will raise the valve 7 slowly off its seat and allow the purifying liquid in tank 3 to start draining off. The

lifting of the valve 7 causes the lowering of the rod 11 within the pipe 12 together with the baffle 13. As soon as the flow of liquid has gotten under way it will automatically hold the baffle 13 in its lowered position and thereby prevent the valve 7 from seating until all of the liquid has escaped from the tank 3.

For preventing each hook 14 from falling back upon the arm 9 after it is disengaged therefrom, I provide an arcuate projection 21 upon the upper end of the hook which will contact with an arm of the bell-crank lever 15 when said lever is moved to a straight up and down position. I also provide a cross bar 22 upon the upper end portion of the support 10 and mount thereon laterally projecting lugs 23 for limiting the movement of the bell-crank lever therebetween.

After the tank 3 has been drained and the tank 2 filled, the above described operation is repeated by filling tank 3 and emptying tank 2. For pumping the liquid into the tanks, I provide the following automatic means. In each tank, near the top portion thereof and above the float 19 I provide a support 24 upon which is pivotally mounted a bell-crank lever 25, the lower arm thereof supporting a large float 26, while to the upper arm is attached a smaller float 27. Each lever 25 is provided with an arm 28 rigidly connected thereto at the pivot point of the lever and which is pivotally connected to a sliding contact rod 29. Each rod 29 is adapted to slide through an aperture in the switch rod 30 and is provided with an enlarged end portion 31 for preventing the rod from becoming disengaged from the switch rod 30. This switch rod is adapted to pivot about the point 32 and contact alternately with the switch members 33 and 34 for controlling the motors 35 and 36 respectively, which operate suitable pumps (not shown) for filling the tanks 2 and 3.

It is necessary that there be a quick make and break contact between the switch members so as to prevent arcing. For accomplishing this, I provide a stop 37 upon the support 24 so positioned that when the float 26 is in its downward position as shown in tank 2, it will be held past its center of gravity because of the weight of the smaller float 27.

Assuming that the tank is being filled and that the liquid has raised the float 19 so that the liquid in tank 3 is draining off, the float 26 because of its being held off-center will not be moved when the liquid first comes into contact with it. In fact no movement will be imparted to the large float until the small float 27 is actuated by the liquid. Then there will be a very small movement of the float 26 until it passes its center of

gravity whereupon it will be quickly lifted to its raised position.

The initial slow movement of the float 26 will have no effect upon the switch 31 as the rod 29 will slide through the aperture within the switch rod and the parts are so regulated that the enlarged portion 30 will not come into engagement with the switch rod until after the upward movement of the float 26, so that the switch rod will be shifted quickly to stop the motor 35 and start up the motor 36. It will thus be seen that I have provided means for shifting the pumping of the fluid from one tank to the other which is automatically controlled by a liquid arising within each tank.

While I have not shown any other controlling means for pumping the liquid into the tanks, if it is found that the present arrangement is not desirable I may add a multiple valve arrangement controlled by the floats 26 and 27. In that event of course only one motor need be used for operating a single pump.

One of the principal faults of the tanks now in use and employing chemicals for precipitating out the impurities in the liquid is that the chemicals are not thoroughly mixed with the inflowing liquid. The result is that the liquid is by no means absolutely purified which of course is a very unsatisfactory condition. With the present invention providing chemicals are used these objectionable features are entirely eliminated by thoroughly mixing the chemicals with the inflowing liquid.

Any suitable means such as the rotary conveyor 37' may be employed for disposing the chemicals such as lime and copperas into the top of each tank either before or during the filling operation. Just before a tank is filled, and before the liquid has come to rest, a jet of air is inserted from the bottom of the tank by means of a pipe 38. This produces a final stirring up of the liquid and chemicals, so that practically little or no chemical finds its way to the bottom of the tank. As is apparent the introduction of the liquid into the bottom of each tank results in a thorough stirring up of the same with the chemicals that are inserted from the top of the tank, and provides an efficient apparatus which far surpasses the type of tanks in which the liquid is introduced from the top.

Another advantage gained by this construction is that the sludge which settles upon the conical bottom of each tank, because of being gummy and spongy acts as a filter for the inflowing liquid and takes up much of the impurities from the liquid as it enters the tank.

The filling operation of each tank consumes about one hour which is sufficient time in which the liquid is at rest and for allow-

ing the impure matter to settle to the bottom of the tank. The drain outlet 6 is located far enough above the conical bottom so that only the clear pure liquid is drained off from the tank. It will be apparent that my apparatus may be operated without the use of chemicals and that the impure matter will have sufficient time to settle out of the liquid and to the bottom of the tanks before the drain valves are opened.

When the tanks are installed it is preferable that the portions thereof comprising the conical bottoms be placed below the ground level as shown in the drawings. For removing the sludge from the bottom of each tank, there is provided a valved outlet pipe 39 extending from the apex of each cone to the ground level. The frequency with which the sludge is to be emptied of course depends upon the constancy with which the impure liquid is introduced into the tanks.

While it is believed that from the foregoing description, the nature and advantage of my invention will be readily understood, I desire to have it understood that I do not limit myself to what is herein shown and described and that such changes may be resorted to when desired as fall within the scope of the claims.

What I claim as my invention is:

1. In a liquid purification apparatus, the combination with a pair of open tanks, of means for alternately introducing the liquid to be purified directly into each of said tanks, means for purifying the said liquid and means within each tank for alternately controlling the flow of purified liquid from the said tanks.

2. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified directly into the bottom of each tank, means for purifying the said liquid and float controlled means within each tank for alternately controlling the flow of purified liquid from the said tanks.

3. In a liquid purification apparatus, the combination with a pair of tanks, of means for introducing the liquid to be purified directly into the bottom of each tank, means for introducing a purifying substance into each tank, means within each tank for controlling the filling of the other tank and separate means within each tank for controlling the draining of the other tank.

4. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into the bottom of said tanks, means for purifying said liquid and means for alternately controlling the flow of purified liquid from said tanks including drain pipes leading from said tanks, valves for controlling the passage of liquid into said

drain pipes and floats within said tanks operated by the inflowing liquid for alternately unseating said valves.

5. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into the bottom of said tanks, means for purifying said liquid and means for alternately controlling the flow of purified liquid from said tanks including drain pipes leading from said tanks, valves within said tanks for closing said drain pipes, arms pivotally mounted upon said tanks and connected to said valves, hooks for engaging end portions of said arms and float operated means for disengaging said hooks from said arms for unseating said valves.

6. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into the bottom of said tanks, means for purifying said liquid and means for alternately controlling the flow of purified liquid from said tanks including drain pipes leading from said tanks, valves within said tanks for closing said drain pipes, arms pivotally mounted upon said tanks and connected to said valves, hooks for engaging end portions of said arms, float operated means for disengaging said hooks from said arms for unseating said valves, and means for holding said valve in open position while the liquid is draining from the tanks.

7. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into the bottom of said tanks, means for purifying said liquid and means for alternately controlling the flow of purified liquid from said tanks including drain pipes leading from said tanks, valves within said tanks for closing said drain pipes, arms pivotally mounted upon said tanks and connected to said valves, hooks for engaging end portions of said arms, float operated means for disengaging said hooks from said arms for unseating said valves, means for holding said valves in open position while the liquid is draining from the tanks, said valve holding means being controlled by the outdraining liquid.

8. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into the bottom of each tank, means for purifying said liquid and means in each tank for alternately controlling the flow of purified liquid from said tank comprising a drain pipe leading from the tank, a valve for controlling the flow of liquid from said drain pipe, an overflow pipe within the tank communicating with said drain pipe, a pivotally mounted arm supported by said tank and connected to said valve, a float operated hook for engaging one end of said arm for

lifting said drain valve off its seat and a baffle connected to said pivotally mounted arm and adapted to be lowered and held in said lowered position by the outflowing liquid when the said drain valve is lifted off its seat.

9. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into the bottom of each tank, means for purifying said liquid and means in each tank for alternately controlling the flow of purified liquid from said tank comprising a drain pipe leading from the tank, a valve for controlling the flow of liquid from said drain pipe, an overflow pipe within the tank communicating with said drain pipe, a baffle movable within said overflow pipe, an arm pivotally mounted upon said tank intermediate its ends and connected upon one side of its pivot point to said drain valve and upon the opposite said thereof to said baffle and a float controlled hook for engaging said arm for lifting said drain valve and lowering said baffle, said baffle being adapted to be held in its lowered position by the outflowing liquid during the draining of the tank.

10. A liquid purification apparatus comprising a tank having a conical shaped bottom, means for introducing the impure liquid through the conical bottom in the form of a spray, means for introducing a purifying chemical into the top of said tank during the filling operation, means for introducing a jet of air into the bottom of said tank before the liquid comes to rest so as to provide a final mixing of the liquid and chemical and means for draining the pure liquid from said tank.

11. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into said tanks, and means controlled by the inflowing liquid of one tank for allowing the liquid in the other tank to lie at rest before it is drained off, while the first mentioned tank is being filled.

12. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into the bottom of each tank including a pump for each tank, a motor for operating each pump, a switch for each motor, a slidable switch rod for operating each switch, a pair of pivotally mounted floats within each tank spaced from each other but operably connected to said rod, one of said floats being adapted to hold the other float past its center of gravity so that the action of the inflowing liquid will not effect the movement thereof until the other float is lifted.

13. In a liquid purification apparatus, the combination with a pair of tanks, of means

for alternately introducing the liquid to be purified into the bottom of said tanks, means for purifying said liquid and means for alternately controlling the flow of purified liquid from said tanks including drain pipes leading from said tanks, valves for controlling the passage of liquid into said drain pipes, and a float within each tank adapted to be operated by the inflowing liquid for unseating the valve in the other tank.

14. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into the bottom of said tanks, means for purifying said liquid and means for alternately controlling the flow of purified liquid from said tanks including drain pipes leading from said tanks, valves within said tanks for closing said drain pipes, arms pivotally mounted upon said tanks and connected to said valves, hooks for engaging end portions of said arms and float operated means within each tank for disengaging the hook from the arm in the other tank, for unseating its respective valve.

15. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into the bottom of said tanks, means for purifying said liquid, and means for alternately controlling the flow of purified liquid from said tanks including drain pipes leading from said tanks, valves for controlling the passage of liquid into said drain pipes, means within each tank adapted to be operated by the inflowing liquid for unseating the valve in the other tank, and means controlled by the outflowing liquid for retaining said valve in its unseated position.

16. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into each tank, said means including a pump for each tank, motors for operating said pumps, switches for controlling the motor circuits, and means in each tank controlled by the inflowing liquid in the other tank for opening one switch and closing the other.

17. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into each tank, said means including a pump for each tank, motors for operating said pumps, switches for controlling the motor circuits, and floats in said tanks connected to said switches and operable by the inflowing liquid to open one switch and close the other.

18. In a liquid purification apparatus, the combination with a pair of tanks, of means for alternately introducing the liquid to be purified into said tanks, means for introducing a purifying substance into said tanks,

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and means for alternately controlling the
flow of purified liquid from said tanks in-
cluding drain pipes leading therefrom,
valves for controlling the passage of liquid
into said drain pipes, and means extending
into each tank and adapted to be operated
by the inflowing liquid for unseating the
valve in the other tank.

In testimony whereof, I affix my signa-
ture.

WADE H. FOSTER.