No. 760,302. PATENTED MAY 17, 1904.

P. J. BOUCHER.

PURIFYING APPARATUS.

APPLICATION FILED MAR. 28, 1903.

NO MODEL.

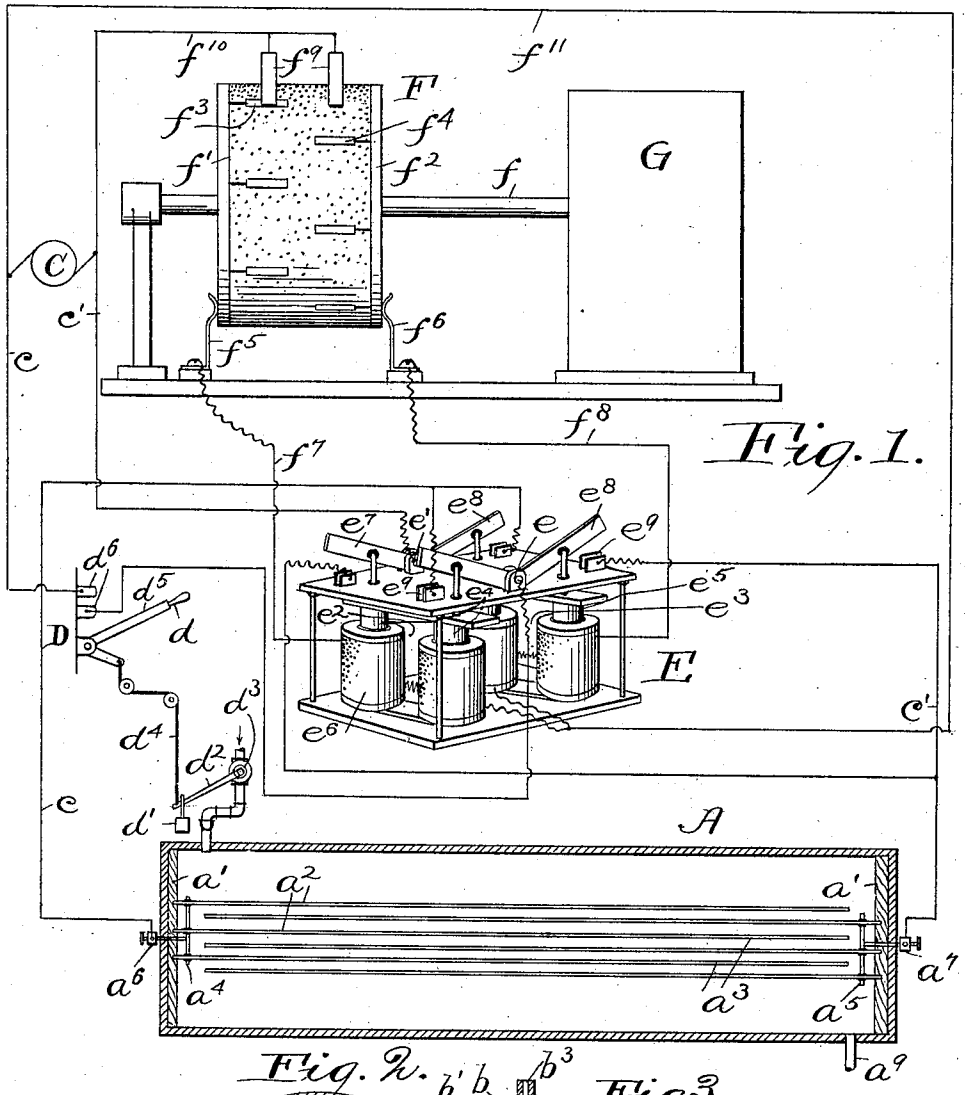



Fig. 1.

Fig. 2.

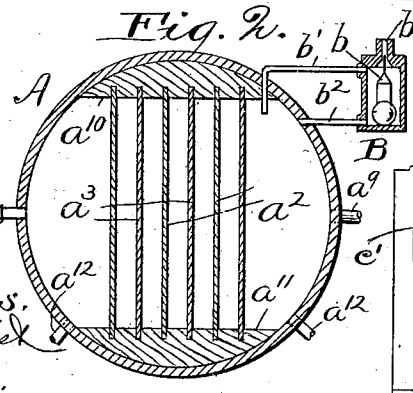
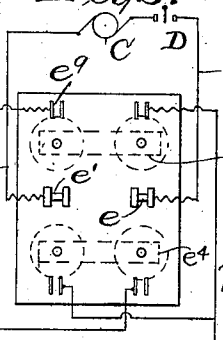



Fig. 3.




Witnesses.
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 760,302. Patented May 17, 1904.

# UNITED STATES PATENT OFFICE.

PIERRE J. BOUCHER, OF CLEVELAND, OHIO.

## PURIFYING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 760,302, dated May 17, 1904.

Application filed March 28, 1903. Serial No. 150,058. (No model.)

*To all whom it may concern:*

Be it known that I, PIERRE J. BOUCHER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Purifying Apparatus, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

It has been heretofore proposed to purify water or other liquids by means of electrolysis, and it has been found that if the electrodes be made of aluminium or iron a flocculent hydrate is produced by the electrolysis which coagulates the various impurities and allows them to be easily removed from the liquid by settling or subsequent passing of the liquid through sand or other substances. Such purifying operation, however, has not heretofore been attended with much success, owing to difficulties arising in the practical operation, these difficulties being that gas caused by the electrolysis accumulates in the tank and interferes with the action. Deposits form on the electrodes also, interfering with their action, and the electrodes unequally deteriorate. There has been trouble also from unpurified water being sometimes passed through the purifier by reason of the attendant turning on the water and forgetting to connect the electric circuit.

The object of the present invention is to provide means for obviating all these difficulties, including means for automatically relieving the gas-pressure, means for automatically reversing the current at predetermined periods of time, and means for insuring the current being turned on or off whenever the liquid is turned on or off.

I attain the above object by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a somewhat diagrammatic view of the complete apparatus, the parts being somewhat distorted, so that the water-purifying reservoir is shown in horizontal longitudinal section. Fig. 2 is a vertical section through the water-purifying reservoir and the float-valve apparatus; and Fig. 3 is a plan view of the solenoids and their connections, forming part of the apparatus for reversing the current through the purifying-reservoir.

Similar letters refer to similar parts throughout the several views.

The purifying-reservoir A is represented as a cylindrical receptacle having adjacent to the ends thereof suitable insulating-heads $a'$. To these are secured, respectively, a number of aluminium electrodes $a^2$ $a^3$, shown as plates, those secured to one of said heads extending in proximity to the other of said heads and being staggered with relation to the plates secured to said other head. These plates are maintained in their proper relation by means of insulating-segments $a^{10}$ and $a^{11}$, extending longitudinally of the reservoir. The two sets of electrodes are suitably connected, as by rods $a^4$ $a^5$, which are in turn connected to suitable binding-posts $a^6$ $a^7$, to which are attached wires $c$ $c'$, respectively.

The reservoir is provided with an inlet-pipe $a^8$ for the water to be purified, with an outlet-pipe $a^9$, and with drain-pipes $a^{12}$. The gases liberated by the electrolysis of the water accumulate in the upper portion of the reservoir, and when the pressure of the same becomes excessive it will prevent the flow of water through the reservoir. In order to overcome this difficulty, I have provided said reservoir with a casing B, having therein a float-valve $b$ and communicating with said reservoir by means of pipes $b'$ $b^2$. These pipes are shown as communicating with the reservoir near the upper portion and extending, respectively, to the upper and lower portions of said casing. When the pressure of the gases in the upper portion of the reservoir is not excessive, the level of the water within said reservoir and the casing B will seat the valve $b$; but should the pressure become excessive the level of the water in said reservoir and casing will be thereby lowered, and the float-valve $b$ will fall, and the gases may then escape through the outlet $b^3$ shown in the top of the casing. As shown, the top portion of this casing is provided with an upwardly-tapering valve-seat communicating with the outlet $b^3$. The float-valve $b$ is provided with a guide-rod extension, the proportion of the parts being such that when the float is in its

lowermost position, resting on the bottom of the casing B, the guide-rod extends into the outlet $b^3$, thereby preventing the float-valve from being displaced and from failing to seat when normal conditions are restored and the float is free to rise.

In order that there may be electrolysis at all, it is necessary that a direct current be used; but to enable the electrolysis to continue in the most efficient manner without one set of plates deteriorating more rapidly than the other and without deposits forming on the plates it is necessary that the direct current should be reversed periodically. To accomplish this result automatically, I have provided the following means:

C is a direct-current generator. Connected thereto are the conductors $c$ $c'$. The former is connected to the switch D, thence to the pivot $e$ of a knife-blade switch on the switch apparatus E. The conductor $c'$ is connected to the pivot $e'$ of another knife-blade switch of said switch apparatus. The switch apparatus E consists, as shown, of two sets of solenoids $e^2$ $e^3$. Depending within the solenoids is a pair of cores $e^4$ $e^5$, connected by plates, which in turn are connected with but insulated from the knife-blades $e^7$ $e^8$.

F is a commutator carried by a suitable shaft $f$, which is driven by suitable mechanism G. This mechanism is preferably clock-work mechanism. The commutator is provided on each side thereof with conducting-disks $f'$ $f^2$. On the periphery of the commutator are two series of conducting-plates $f^3$ $f^4$, separated from each other and from the conducting-disks $f'$ $f^2$ by suitable insulating material and connected, respectively, to said disks.

Bearing on the surfaces of the conducting-disks are the contact-fingers $f^5$ $f^6$, and leading from these are wires $f^7$ $f^8$, which wires connect with the winding $e^6$ for the solenoids $e^2$ $e^3$. A conductor $f^{10}$ is connected with contact-fingers $f^9$, adapted to bear upon the periphery of the commutator.

In operation (assuming the parts to be in the position shown in Fig. 1, but with the switch D closed) the current from the conductor $f^{10}$ will flow through the commutator-disk $f'$, the finger $f^5$, and the wire $f^7$ to the winding $e^6$ of the solenoid $e^2$, thence back to the generator through the conductor $f^{11}$. The current flowing through the winding of this set of solenoids will attract the corresponding cores; but at this time the other set will have no current in it and will be out of action. Assuming that the current is flowing through $f^7$, it will cause the solenoids $e^2$ to attract the cores $e^4$, the switch-knives $e^7$ will be drawn into contact with their coöperating members $e^9$, and the current flowing from the generator C through the conductor $c$, the switch D, pivot $e$, blade $e^7$ will enter the purifying apparatus at $a^6$ and will leave the same through the connection $a^7$, thence to the opposite switch-knife $e^7$, pivot $e'$, and back to the generator through the wire $c'$. When the commutator has been revolved so that one of the contact-fingers $f^9$ is in contact with one of the plates $f^4$, it will be evident that the current will flow through the winding of the other set of solenoids, causing the switch-blades $e^8$ to be drawn down into contact with their coöperating members, and the current through the purifier will be reversed. The length of the interval of time between the reversals of the current through the purifier may be regulated easily by the speed of rotation of the commutator F and the distance between the plates thereon.

In order to prevent any water from flowing through the reservoir A without being purified, I have connected the valve $d^3$, controlling the flow of water to the reservoir, with the operating-handle $d$ of the main switch D. For this purpose I have provided the valve $d^3$ with a lever $d^2$, having attached thereto a weight $d'$. The end of the lever $d^2$ is connected, as by a cord or other flexible connection $d^4$, with the handle $d$. With the parts in the position shown in Fig. 1 the valve is closed and the switch open. By operating the handle to close the switch the valve will be opened, and by operating the handle to open the switch the valve will be closed. When the knife-blade $d^5$ of the switch is withdrawn from its coöperating members $d^6$, the weight $d'$ will close the inlet-valve $d^3$.

While I have described this apparatus as employed for the purification of water, it will be evident that it may be used for purifying other liquids.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In combination with an apparatus for purifying liquid by electrolysis, a reversing-switch for changing the direction of the electric current through the electrodes at periodic intervals, said switch being automatically operated independently of the shutting off or turning on of the liquid supplied to the apparatus, substantially as described.

2. In combination with an apparatus for purifying liquid by electrolysis, a reversing-switch for changing the direction of the electric current through said liquid, said switch being automatically operated by means independently of the flow of the liquid, substantially as described.

3. In an apparatus for purifying liquid by electrolysis, the combination of a reservoir, electrodes in said reservoir, an electric generator, a reversing-switch interposed between said generator and said electrodes, connections between the generator and said switch and between said switch and the electrodes, and means for automatically operating said reversing-switch at definite predetermined time intervals, substantially as described.

4. In an apparatus for purifying liquid by electrolysis, the combination of a reservoir, electrodes in said reservoir, an electric generator, a reversing-switch interposed between said generator and said electrodes, connections between the generator and said switch and between said switch and the electrodes, and means actuated independently of the flow of the liquid for operating said reversing-switch at definite predetermined time intervals, substantially as described.

5. In an apparatus for electrolytically purifying liquid, the combination of a reservoir for said liquid, a casing outside said reservoir having its bottom below the normal level of the liquid in said reservoir, and having its top formed with a valve-seat and an upwardly-extending discharge-outlet thereabove, pipes connecting the upper and lower portions of said casing with the upper portion of the reservoir, an upwardly-seating float-valve in said casing having a guide-rod extending above said valve adapted to fit in the discharge-outlet, the height of the casing and of the float-valve being so proportioned that, when the float-valve occupies its lowest position in said casing, the guide-rod extends into the discharge-outlet thereby retaining the valve in alinement with its seat, substantially as described.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

PIERRE J. BOUCHER.

Witnesses:

ALBERT H. BATES,

B. W. BROCKETT.