No. 634,512. Patented Oct. 10, 1899.

# W. G. TOUSEY.

## WATER FILTER.

(Application filed Apr. 25, 1899.)

(No Model.)

Fig. 1.

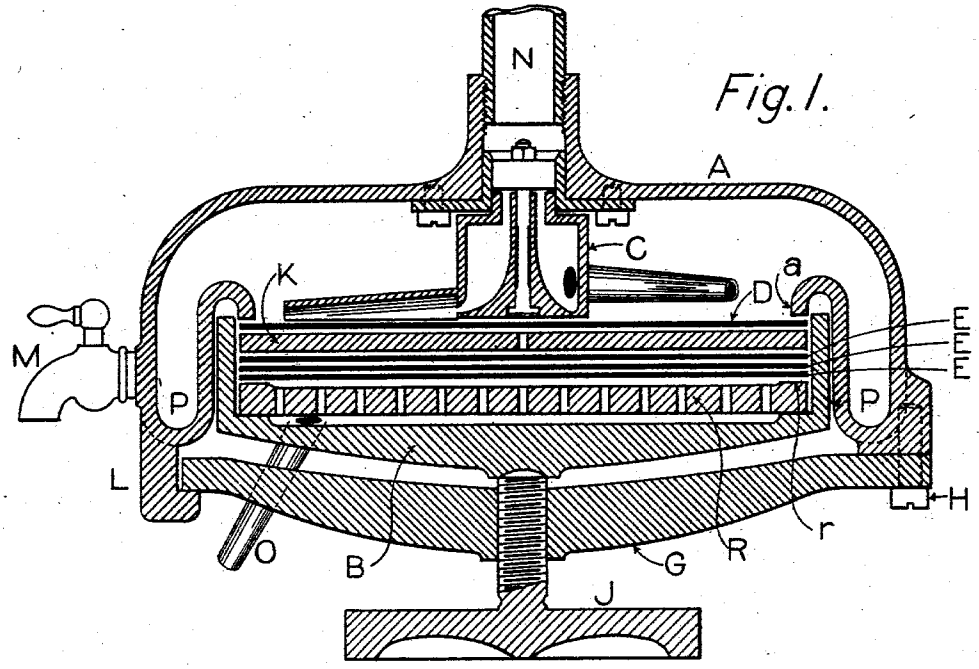
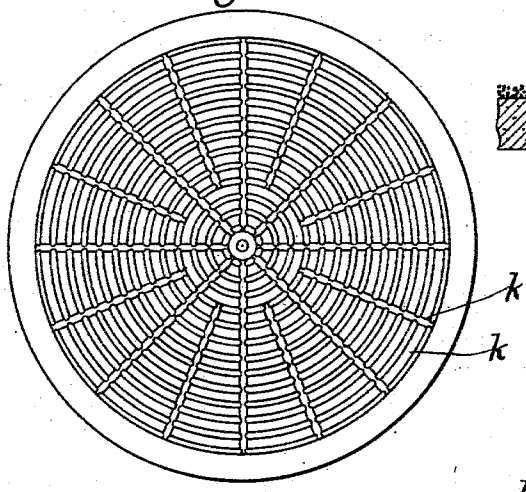



Fig. 2.



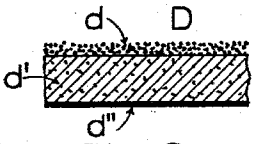




Fig. 3.

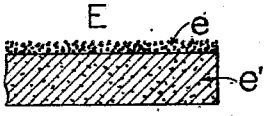



Fig. 4.

Witnesses,

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# UNITED STATES PATENT OFFICE.

WILLIAM G. TOUSEY, OF SOMERVILLE, MASSACHUSETTS.

## WATER-FILTER.

SPECIFICATION forming part of Letters Patent No. 634,512, dated October 10, 1899.

Application filed April 25, 1899. Serial No. 714,436. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM G. TOUSEY, a citizen of the United States, residing at Somerville, in the county of Middlesex and State of Massachusetts, have invented new and useful Improvements in Water-Filters, of which the following is a full, clear, and exact description.

My invention relates to improvements in water-filters, and has for its object the clarification and purification of water or other liquids.

Figure 1 is a vertical section of the entire machine. Fig. 2 is a view showing how both surfaces of the diaphragm K and the upper surface of the supporting-plate R are grooved. Fig. 3 is a vertical section of the filtering-tablet D. Fig. 4 is a vertical section of the filtering-tablet E.

Broadly described, the machine is a mechanicochemical filter in which a composite filtering medium is compacted to any desirable degree by pressure provided for in the construction of the mechanism. This composite medium is adapted to be used alone or in conjunction with other filtering materials. It consists, primarily, of a fibrous sheet or tablet composed by preference, though not necessarily, of cotton or linen fiber treated much as in the manufacture of filter or blotting paper. I do not, however, limit myself to these fibers or to this specific mode of treatment. This fibrous sheet after being dipped in an antiseptic solution and while yet moist has one surface coated with a layer of gelatinous hydroxid of aluminium or analogous substance, (shown in Fig. 3 at *d* and in Fig. 4 at *e*.) In addition to this coat of hydroxid of aluminium I usually commingle the same substance with the fibers of the filtering-sheet, (shown in Fig. 3 at *d'* and in Fig. 4 at *e'*.) This is best done by mixing freshly-precipitated aluminium hydroxid with the fibrous pulp before it is run into sheets. A good way to effect this is to treat the pulp with a solution of aluminium sulfate and then precipitate the aluminium hydroxid with an alkaline solution—*e. g.*, ammonium hydroxid, calcium hydroxid, or sodium carbonate—or I can secure this result in fair degree by dipping the sheet when dry in a solution of aluminium sulfate, thus impregnating the fiber, and then treating it to an alkaline bath to precipitate the aluminium hydroxid. Still further, when this filtering sheet or tablet is to be directly exposed to a scouring process—such, for instance, as that described by me in my application, Serial No. 668,376, filed January 29, 1898, and patented May 9, 1899, No. 624,580—I treat the side of the tablet opposed to that which carries the layer of aluminium hydroxid with an insoluble cohesive "size" *d''*, Fig. 3, which serves to give superior tenacity to a thin stratum of the fabric and prevents the entire cutting away of the filtering-tablet when subjected to prolonged scouring. This particular treatment can be effected in different ways. The following method, though I do not confine myself to it, is successful: A mixture of equal parts of melted wax (Japan wax is good) and refined rosin is applied in a thin coat to a hot metal surface. The filtering-tablet is then pressed for an instant against this surface and quickly removed. The result is a very thin layer of evenly-waxed fiber. Thus treated the size is limited to a superficial stratum of the tablet, and the interstices are not filled to the embarrassment of the flow of water. For expeditious work the tablets may be run between cylinders, one of which is heated and supplied with a film of the wax preparation.

The method which by preference I employ to apply pressure for the compacting of the filtering-tablets can be seen by reference to Fig. 1.

R is a diaphragm or seat perforated and grooved, as at *k*, Fig. 2, on its upper surface, which supports the filtering-tablets E E E.

K is a free diaphragm suitably grooved, as at *k*, Fig. 2, and perforated and made to support the filtering-tablet D.

G is a swinging bar or yoke hinged at H and engaging when in position with the lug L, as shown.

J is a screw by the action of which the parts B R E K D are forced up against the flange *a*, a water-tight jointure secured, and the filtering-tablets E E E compressed and so compacted as greatly to improve their character as a filtering medium. This pressure is suitably graduated by the height given to the rib *r*. Usually the height of this rib scarcely ex-

ceeds one-eightieth of an inch. The effect of this construction is that the pressure applied to approximate the diaphragms K and R, while sufficiently concentrated upon the peripheral portions of the tablets E E E, coincident with the rib *r*, to prevent lateral percolation, is nevertheless distributed in considerable degree—a degree inversely proportionate to the height of the rib—over the more central portions of the tablets, thus compressing and compacting the somewhat spongy mass, giving to it a greater density and improving its character as a filtering medium.

In some cases I find it advantageous to perforate the diaphragm K with but one or a few holes, the capacity of which shall be relatively small as compared with the capacity of the underlying tablets to transmit liquids. The result of this construction is that a large part of the pressure of the water system to which the filter is attached is made to rest upon the diaphragm, and this pressure coöperating with that produced by the screw J has the effect of compacting in a higher degree the underlying filtering material. When the pressure of the water system is great, I sometimes make this diaphragm quite thin and flexible, and thus rely exclusively on this pressure of the water system for compacting the filtering material. It should be noted that pressure secured by this device will be automatically graduated. As the filtering-tablets E E E become more highly compacted or clogged by the deposition of suspended matter in the liquid and as the ratio of the capacity of the filtering-tablets to the capacity of the orifices of the diaphragm is thus lessened, the pressure on the diaphragm will be proportionately lessened and may even be reduced to nothing. The automatically-graduated pressure upon the filtering-tablets and the automatically-regulated flow thus secured are found to be important factors of the superior results obtained by this filter.

I am led to describe this filter as a mechanicochemical filter, because there is both a mechanical straining of the liquid and also a chemical purification. The minute fiber and close texture of the filtering-tablets, particularly when swollen with moisture and compacted by pressure, insure a highly-perfect mechanical filtration; but in addition to this the gelatinous layer of aluminium hydroxid, while operating mechanically to detain suspended matter and to entangle microorganisms of whatever sort, also by virtue of its well-known chemical affinities and great avidity for organic substances, operates effectively to purify the liquid. Moreover, the particles of aluminium hydroxid distributed throughout the texture of the filtering-tablets not only serve to fill the interstices of the fibers, and thus afford a denser texture and closer filtering medium, but they contribute their part to the chemical refinement of the filtrate.

To indicate the course pursued by the liquid undergoing filtration and the processes to which it is subjected, let me point out that entering by the inlet-pipe N it passes through the member C into the chamber of which P is an extension, or in the absence of such a member it passes directly into the said chamber. Thence it is forced through the composite tablet D, which arrests suspended matter and effects some degree of chemical purification. Thence it passes through the perforations of the diaphragm K and is forced through the series of tablets E E E, which by virtue of their composition and the compacting pressure applied to them still further perfects the process begun by the protective tablet D. Finally, passing through the perforations of the plate R it issues from the outlet-pipe O as a filtrate free from dangerous organisms, colorless, and sweet.

To cleanse the filter, the waste-cock M is opened. The outrushing current then carries away the impurities arrested by the tablet D. This cleansing will be much more effective when the cleaning device C, heretofore referred to, or its equivalent is employed.

I would not be understood as laying claim in this instance to a particular form of filter-case, or a particular kind of cleaning device, or broadly to the employment of a fibrous tablet as a filtering medium.

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

1. In a filter the combination of a filter-case, a fibrous filter-tablet, and aluminium hydroxid, or similar salt; substantially as, and for the purpose, set forth.

2. In a filter the combination of a filter-case, and a fibrous filter-tablet having a layer of aluminium hydroxid, or similar salt, applied to its surface, whereby a composite filter medium is obtained; substantially as set forth.

3. In a filter the combination of a filter-case, and a fibrous filter-tablet having aluminium hydroxid, or similar salt, intermixed with the fibers of the said tablet, whereby a composite filter medium is obtained; substantially as set forth.

4. In a filter the combination of a filter-case, and a fibrous filter-tablet having on one side a thin stratum impregnated with an insoluble adhesive "size" whereby a greater tenacity is given to said stratum which prevents the filter-tablet from being entirely scoured away in the cleansing process; substantially as set forth.

5. In a filter the combination of a filter-case, and a fibrous filter-tablet charged with aluminium hydroxid, or similar salt, and having on one side a thin stratum impregnated with an insoluble adhesive "size;" substantially as, and for the purpose, set forth.

6. In a filter the combination of a filter-case, fibrous filtering-tablets, a supporting-plate of said tablets, a covering-diaphragm, with a perforation of the said diaphragm relatively small in comparison with the capacity of the underlying filtering-tablets to transmit the

liquid undergoing filtration, whereby the flow is regulated, and the pressure of the water system to which the filter is attached is made to rest in self-graduated measure upon the said diaphragm, and so to compress and compact the underlying filtering-tablets as occasion requires; substantially as set forth.

7. In a filter the combination of the top A, the diaphragm K, the filtering-tablets E E E, the supporting-plate R, the bottom B, the swinging bar G, with the screw J, whereby the filter-case is closed, the parts K and R are forcibly approximated, and the interposed filtering-tablets E E E are compressed and compacted; substantially as set forth.

8. In a filter the combination of a filter-case, fibrous filtering-tablets charged with aluminium hydroxid, or similar salt, a supporting-plate for said tablets, a diaphragm covering said tablets, with means for forcibly approximating said supporting-plate and covering-diaphragm, and thus compressing and compacting the interposed filtering-tablets; substantially as set forth.

9. In a filter the combination of a filter-case, fibrous filtering-tablets charged with aluminium hydroxid, or similar salt, a supporting-plate for said tablets, and a covering-diaphragm having perforations relatively small in comparison with the capacity of the underlying tablets to transmit the liquid undergoing filtration, substantially as set forth.

10. In a filter the combination of a filter-case, fibrous filtering-tablets, a supporting-plate for said tablets, a covering-diaphragm having a perforation relatively small in comparison with the capacity of the underlying filtering-tablets to transmit the liquid undergoing filtration, with means for forcibly approximating said supporting-plate and covering-diaphragm, substantially as set forth.

11. In a filter the combination of a filter-case, fibrous filtering-tablets charged with almuinium hydroxid or similar salt, a supporting-plate for said tablets, a covering-diaphragm having a perforation relatively small in comparison with the capacity of the underlying filtering-tablets to transmit the liquid undergoing filtration, with means for forcibly approximating said diaphragm and plate and thus compressing the interposed filtering-tablets, substantially as set forth.

In testimony that I claim the foregoing invention I have hereunto set my hand this 24th day of April, 1899.

WILLIAM G. TOUSEY.

Witnesses:
A. B. UPHAM,
GUY H. HOLLIDAY.