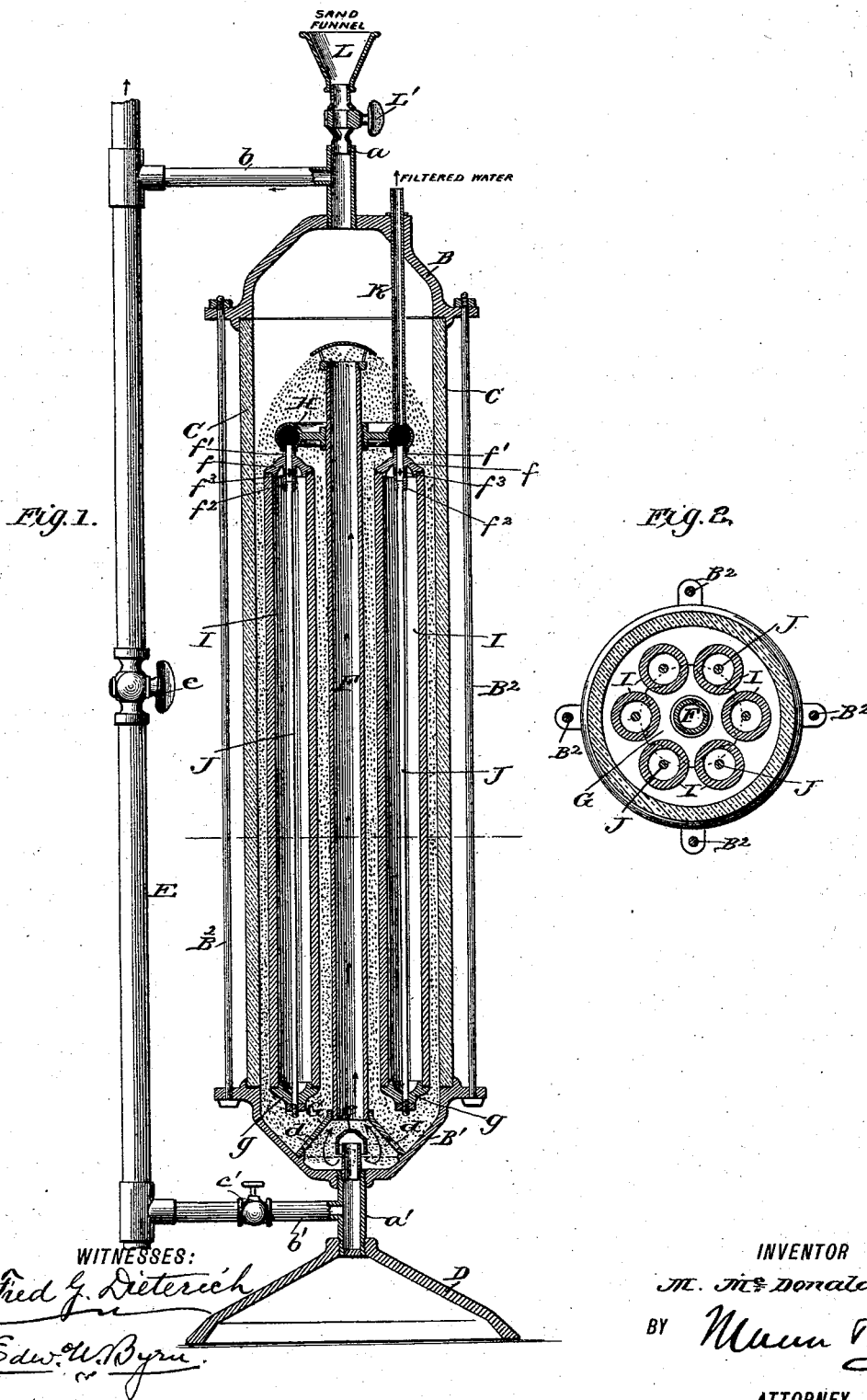


(No Model.)

M. McDONALD.
FILTER.

No. 455,573.

Patented July 7, 1891.



UNITED STATES PATENT OFFICE.

MARSHALL McDONALD, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR
TO THE AUTOMATIC FILTER COMPANY, OF SAME PLACE.

FILTER.

SPECIFICATION forming part of Letters Patent No. 455,573, dated July 7, 1891.

Application filed May 20, 1890. Serial No. 352,573. (No model.)

To all whom it may concern:

Be it known that I, MARSHALL McDONALD, of Washington city, in the District of Columbia, have invented a new and useful Improvement in Filters, of which the following is a specification.

My invention relates to certain improvements in the filter shown and described in my Letters Patent, No. 381,406, dated April 17, 1888. In said filter there is an outward case, a porous filtering medium, certain channels and a body of sand, and means whereby particles of sand are carried upward by a current or currents of water in contact with part of the filtering-surface, and are discharged into other channels and carried downward in a body over other portions of the filtering-surface. It has been found that this method of operation will not maintain the filtering-surface free from the slimy deposits that obstruct the filtering action, and I therefore make use of a practically-solid body of sand, moving downward over the entire filtering-surface, as set forth and claimed in my application for Letters Patent, Serial No. 352,573, in connection with certain improved mechanical features hereinafter described, and illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of a filter embodying my improvement; Fig. 2, a horizontal section on the line A A, Fig. 1.

C is the outer face of the filter, which is preferably made of glass in the form of a cylinder, the transparent case permitting the operations within to be observed. This cylinder is clamped tightly between two metallic heads B B', connected and drawn together by means of tie-rods B², passing through flanges of the edge and provided with nuts. Instead of rods a screw-joint may be used between each head and the cylinder similar to that employed on fruit-jars. In any case the joint is made tight by the use of a suitable packing or gasket.

When the filter is to rest upon a table or other support, it is provided with a base D, and there is an outlet-pipe *a* at the top and an inlet-pipe *a'* at the bottom, the former com-

municating with the pipe *b*, leading to the service-pipe of the house, and the latter with the inlet-pipe *b'*, connecting with the water-main, the two pipes *b b'* being connected by a pipe E, having an intermediate stop-cock *c*, and there is another small stop-cock *c'* in the pipe *b'*. By opening the cock *c* and closing the cock *c'* water may pass through the service-pipe without circulating through the filter. By closing the cock *c* and opening the cock *c'* all of the water may be caused to circulate through the filter, while by partially opening both cocks the water may be divided between the filter and the service-pipe, and thereby the force of water-current for lifting and circulating the sand, as set forth herein-after, may be regulated and adjusted in accordance with the pressure and location. The lower head B' has sides inclining toward an upwardly-projecting nozzle surmounted by a deflecting-cap *e*, whereby the body of sand in the casing is thrown toward the nozzle, while a guard or diaphragm G, which is flaring or in the form of a cone and provided with passages or perforations *d*, serves to limit the flow of the sand toward the nozzle, and also serves as a support for a central tube F, the lower end of which is above the deflecting-cap. Above the tube F is a deflector F', which serves to distribute the up-flowing current radially and uniformly as it passes from the tube F.

Suitably supported within the casing, and as shown by the tube F, is a ring or spider H, from which hangs the filtering medium, as shown in the form of tubes I, which are free at their lower ends and simply suspended from the spider at the upper ends, so that each may be fitted in its place without accommodating it to the dimensions of the other. There may be any suitable number of tubes, six being shown, and each consists of a cylinder of porous earthenware or other material and upper metallic cap or head *f*, a lower cap or head *g*, and the chamber thus inclosed communicates with the outlet-pipe of the filter. Thus each head *f* has an outlet-port communicating with an annular chamber in the spider or ring H, and the latter chamber com-

municates with an outlet-pipe K, extending through the head B of the filter. The heads *f* *g* are suitably connected with the tubes—for instance, the upper head *f* is formed with an exteriorly screw-threaded hollow coupling *f'*, screwing into the bottom of the ring H and inner threaded hollow coupling *f''*, with openings *f'''* communicating with the interior or chamber of the tube. Into the end of the coupling *f''* screws the end of a tie-rod J, which extends through the bottom head *g*, with a head or nut at the lower end, and, if necessary, a gasket to pack the joint.

The pipe K preferably extends to a reservoir, either at a high altitude or with an air-cushion, whereby when the inlet-valve C' is open and the service-pipe is also opened to permit the water to flow through the filter, thereby reducing the pressure therein, there will be a back-pressure from the inside of the filter-tubes, causing the filtered water to flow outward and aid in cleansing said tubes. When the service-pipe is closed and the water can enter only through the pipe *b'*, the pressure within the filter is greater than in the tube and the water flows inward through the latter and is filtered.

L is a funnel or hopper communicating with an opening in the upper cap D, provided with a stop-cock and serving to facilitate the introduction of sand into the casing C, such quantity being introduced as will form a solid body surrounding all of the filtering-tubes nearly to the upper ends of the latter.

It will be noted that the pipe F forms a channel through which the current carrying the particles of sand flows upward without contact with the filtering-surface, so that the body of sand lies in a solid mass around the filtering-tubes.

When the outlet for the filtered water is opened, the pressure within the filtering-tube is reduced, the water flows through the latter and is cleansed; but when the outlet to the service-pipe is opened the sand and water flow upward through the tube F and are then deflected by the deflector F', the particles of sand to be deposited upon the mass below while the water flows through the service-pipe. While the particles of sand carried upward through the tube F move rapidly the body of sand around the filtering-tubes settles gradually with the particles in contact with each other and with the tubes abrading the sides of the latter, grinding off all adhering impurities by a species of glacial action at the time when the back-pressure from the tubes aids in loosening the impurities.

It will be seen that the single channel F serves as a means of elevating the particles of sand that are distributed uniformly and evenly around a large number of tubes, whereby the filtering capacity of the filter is very great and may be increased by the simple addition of other tubes without any other change

in the construction of the other operating parts of the filter.

Without claiming the use of a body of sand carried solidly over the filtering medium and the creating of a back-pressure during this movement of the sand, which is set forth in a separate application, Serial No. 377,089; nor the features set forth and claimed in a separate application No. 352,573, and without limiting myself to the precise construction and operation of parts shown, I claim—

1. The combination, with an outer case having two heads and means for connecting them together, and an inlet-pipe at the lower end, of a central tube or passage-way F, opening at both top and bottom into the outer case, a series of porous filtering-tubes I, and a hollow ring communicating with the interior of the same and having an outlet, substantially as shown and described.

2. The combination, with the cylindrical case C, of an upper head B, a lower head B', inlet-pipe *a'*, conical perforated diaphragm G, a central tube F, supported thereupon, and a hollow ring H, supported upon the top of the tube F and having pendent porous filtering-tubes I, substantially as shown and described.

3. The combination of the porous tube I, the hollow ring H, the head of screw-couplings *f'* and *f''*, holes *f'''*, the lower head *g*, and the central rod *f*, passing from screw-couplings *f''* through the lower head and connecting the two heads to the porous tube, substantially as described.

4. The combination of the case for receiving the water to be filtered, a channel for the upward flow of a water-current, a nozzle below said channel, a filtering medium consisting of a series of filtering-tubes arranged around the channel, and means for suspending the tubes below a support therefor in said case, substantially as set forth.

5. The combination of the case provided with a channel for the upward flow of a current of water and with a body of sand around said channel, and a series of filtering-tubes arranged around said channel, containing chambers communicating with an outlet-pipe for the filtered water, substantially as set forth.

6. The combination, with a case containing a body of sand, of a water-jet, a tube arranged above said water-jet in said case, a series of filtering-tubes supported by the tube F, and a deflector arranged to deflect laterally the current rising through the tube F, substantially as set forth.

7. The combination of the case, central tube F and water-inlet nozzle beneath said tube, a series of filtering-tubes surrounding the tube F, and a body of sand between the case and the tube F and surrounding the filtering-tubes in direct contact therewith, substantially as set forth.

8. The combination of the case for receiving the water to be filtered, a channel for the upward flow of a water-current, a nozzle below said channel, a filtering medium arranged within the casing, a body of sand surrounding the said filtering medium in direct contact with the surface thereof, and a guard

with openings surrounding the nozzle to regulate the flow of sand thereto, substantially as set forth.

MARSHALL McDONALD.

Witnesses:

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SOLON C. KEMON.