(No Model.) 2 Sheets—Sheet 1.

H. C. THACHER & G. H. BREYMANN.

SUBMERGED SECTIONAL FILTER.

No. 372,185. Patented Oct. 25, 1887.

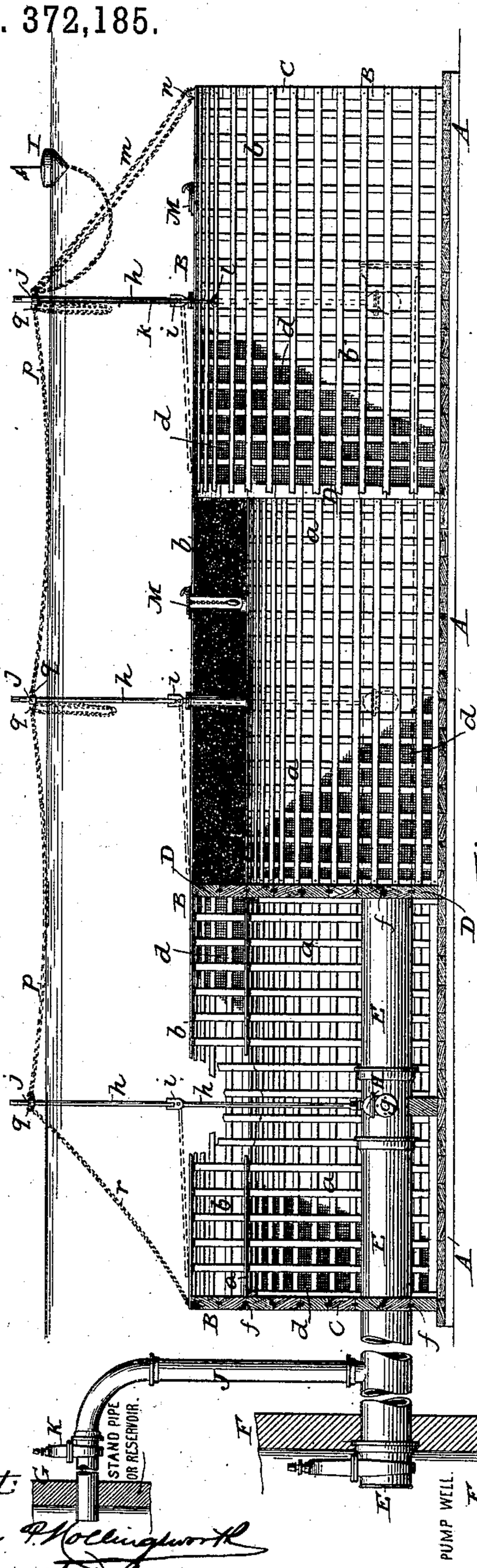

Fig. 1.

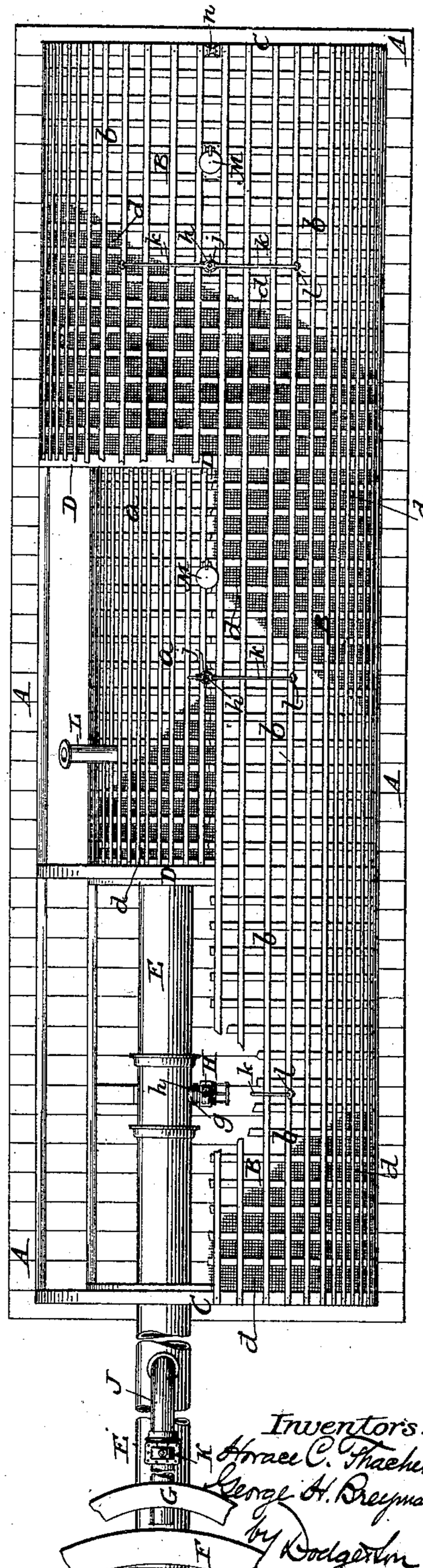

Fig. 2.

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Fig. 3.

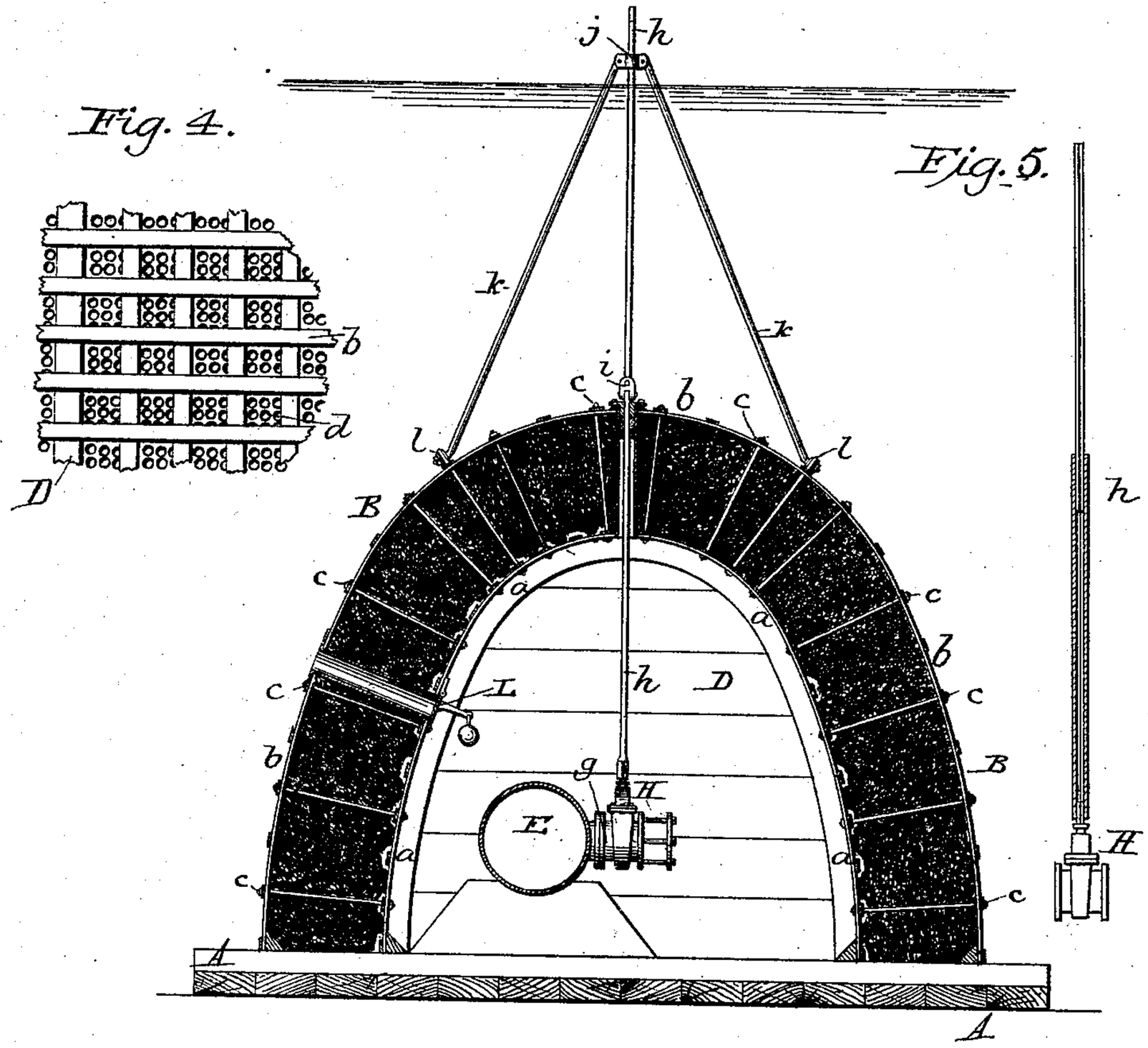

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

HORACE C. THACHER AND GEORGE H. BREYMANN, OF TOLEDO, OHIO.

SUBMERGED SECTIONAL FILTER.

SPECIFICATION forming part of Letters Patent No. 372,185, dated October 25, 1887.

Application filed March 5, 1887. Serial No. 229,749. (No model.)

To all whom it may concern:

Be it known that we, HORACE C. THACHER and GEORGE H. BREYMANN, citizens of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented a new and useful Submerged Sectional Filter for Public Water-Supply, of which the following is a specification.

Our invention relates to filters designed to filter water in large quantities, as required for town or city supply; and it consists in a submerged filter, of tunnel or box form, having filtering-walls of uniform thickness throughout, the structure being divided by partitions into independent sections, from any or all of which water may be drawn to supply the pump-well, and through which water may be forced in the reverse direction, section by section, under the full pressure due to the height of water in the reservoir or stand-pipe into which the filtered water is pumped.

The invention further consists in various features and details of construction, hereinafter set forth, whereby the foregoing and other important results are attained.

In the drawings annexed, Figure 1 is a side elevation of our improved filter, showing three sections or divisions, one complete, another with the outer framing and the filling in section, and the remaining one in vertical section without the filling; Fig. 2, a top plan view, likewise showing one section complete, another partially broken away, and a third with one side entirely removed; Fig. 3, a vertical transverse section taken at the middle of one of the sections; Fig. 4, a view illustrating perforated metal in place of the wire-netting shown in other figures; and Fig. 5 a view showing telescopic valve-rods.

Filters have heretofore been constructed in a great variety of forms; but when designed for filtering water on a large scale, as required for town or city service, they have generally been very expensive, and yet liable to become so clogged in a comparatively short time as to necessitate cleaning, which could only be done by removing and cleansing or renewing the filtering material. This mode of restoring the efficiency of the filter is not only attended with great cost, but also involves much loss of time, during which water must be used in an unfiltered condition or taken from a source independent of the ordinary supply. In order to overcome this difficulty, it has been proposed to reverse the direction of the flow of the water through the filtering material in cases where the filter is placed at an elevation intermediate between that of the source from which the water is taken and that of the point at which the water enters the mains or service-pipes—as, for instance, between the dam and the reservoir of a service supplied from a running stream. When a submerged filter is employed, however, as is generally done when taking water from a lake or from a stream having but little fall, the conditions differ entirely from those met with where the elevation of the source of supply affords the head, and it is impracticable to reverse the direction of the flow of water through the filtering material to the pumps which raise the water to the required height. We therefore provide a pipe or connection extending from the reservoir or stand-pipe to the interior of the filter, through which water under high pressure may be forced outward through the filtering-walls; and we further provide valves, by which the water may be caused to be carried to the sections independently and one at a time. In this manner we are enabled to cleanse the filter-sections thoroughly and rapidly, owing to the force with which the water is caused to pass through the walls, the sediment being dislodged and thrown off at the outside.

The construction and arrangement will be more readily understood upon referring to the drawings, in which A indicates a base formed of heavy timbers suitably tied together and calked or made water-tight, and B a tunnel-shaped structure closed at its ends and erected upon or supported by said base, as best illustrated in Fig. 3.

While it is preferred to adopt the arch form indicated in Fig. 3, because of its strength and ability to resist pressure from without, other forms may be made use of without departing from the substance of our invention.

The body B is composed of an inner shell or wall, *a*, and an outer shell or wall, *b*, both built up of iron of suitable size and shape riveted or bolted together to produce a strong open frame-work for each shell or wall, the

two being connected by stay rods or bolts *c*, which serve to maintain the two walls at a fixed distance apart. Each of these open frames or walls is provided with wire netting or grating *d*, of a mesh proportioned to the size and character of the filling placed in the space between the inner and outer shells, and forming the filtering-body.

In practice we propose to use coke crushed to proper size, and preferably of uniform size throughout, though it may be desirable in some cases to use finer material next the inner wall than is used nearer the outer wall.

As above stated, the ends of the structure B are closed, for which purpose we may use heavy planking, with or without iron stays or bracing, forming heads C, and for the purpose of dividing the filter into separate chambers or compartments we provide a series of partitions or bulk-heads, D, similar in construction to the heads C. To make the heads and partitions tight and prevent the planks or timbers from getting out of proper relation, their opposing faces or edges are grooved, and a strip, *f*, of wood, metal, or other suitable material, is driven into the grooves, as indicated in Fig. 1.

E indicates a pipe, through which water is conveyed from the filter to the pump-well F, whence it is raised by pumps to the reservoir or stand-pipe G, to give it the requisite head for supplying the service-mains. This pipe E extends through the several sections of the filter, the number of which may be varied as desired, and is furnished with a short lateral branch, *g*, within each chamber, each branch being furnished with a controlling-valve, H, as shown in the several figures, so that communication may be established or cut off between the pipe and any or all of the filter-sections at will. One end of pipe E opens into the pump-well, or connects directly with the pump, and the other end, within the last section of the filter, is closed, so that water may pass only through the branches *g*.

The filter being submerged, it is necessary to extend the operating rods or stems *h* of the valves H up to a point above the level of the water in which the filter is placed, as indicated in Figs. 1 and 3; but to prevent these stems from being injured by passing boats or vessels or ice, or from causing injury to the former, we provide each stem with a universal joint, *i*, at a point just above the top of the filter, so that when not required for use the rods may be permitted to drop or fold down thereon.

For the purpose of locating the rods and bringing them readily to position for use, we adopt the arrangement illustrated in Fig. 1, and to some extent shown in Figs. 2 and 3. Each rod or stem *h* passes through a collar, *j*, carried by two brace-rods, *k*, hinged or pivotally attached to ears *l*, secured to the top of the filter at opposite sides of the longitudinal axis of the structure, as shown in Fig. 3, the two braces standing on a line at right angles to said axis. By this arrangement each rod is caused to rise and fall in the direction of the length of the filter, moving through the collar during such rise and fall.

From the collar *j*, nearest one end of the structure—the end farthest from the pump-well in the drawings—a chain, *m*, passes back and downward beneath and around a pulley, *n*, and thence to a float or buoy, I, which serves to locate the filter and the chain. From each collar *j* a chain, *p*, extends to the next collar, as shown in Fig. 1, said chains being of such length as to permit one rod to rise and fall while the next maintains a vertical position. The slack thus allowed is ordinarily taken up by hooking the chains upon hooks *q*, projecting from the collars, as shown in Fig. 1, so that all the rods and their braces may be caused to rise or fall together by simply drawing up or letting out the chain *m*, which goes to the buoy, a stop-chain, *r*, being provided to prevent the rods and braces from moving too far. To hold the rods in an upright position, the chain *m* is engaged with a hook, *q*, of the collar, to which one end of the chain is made fast. If it be desired to lower a particular rod or stem *h*, this may be done by unhooking the chain which holds it up and letting out the slack.

J indicates a pipe leading from the reservoir or stand-pipe and opening into the pipe E at a point between the pump-well and the branch *g* nearest thereto. This pipe J is furnished with a valve, K, and is for the purpose of taking water under full head or pressure from the reservoir or stand-pipe to the interior of the filter, into which it escapes through the branches *g*, only one branch being opened at a time, however, so that the force and action of the water may be confined to and concentrated in a single section. Owing to the force thus secured, and to its concentration within comparatively narrow limits, the water entering the filter-section forces its way rapidly through the filtering material, and passing outward dislodges and carries off the sediment deposited upon the exterior of the section and in the filtering material. In this way the sections may be quickly and effectually cleansed, and hence the filter need not be kept for any considerable length of time out of use. Care will of course be taken to have the reservoir well filled before beginning the cleansing operation, in order that the service may not be cut off, and so, also, that abundant water for cleansing may be at hand.

The capacity of the filter should be such as to afford abundant water for the ordinary service, and should have a considerable margin beyond this, in order that in case of unusual demand the filter may not become an obstruction; but to guard against injury to the filter on the one hand, or insufficiency of supply on the other, each section is furnished with an automatic inwardly-opening valve, L, weighted to hold it closed until a prescribed limit is reached,

whereupon it will open and permit water to enter through the inlet to which the valve is applied. Thus provided, the filter will continue to purify all the water needed to supply the pump or pumps under all ordinary circumstances, and even when the demand exceeds the average; but in the event of a large fire, or other occurrence necessitating a supply of water greatly in excess of the ordinary quantity, there would be danger of drawing off the water in the filter faster than it could be replenished through the filtering-walls, in which case a partial vacuum would be produced therein, and the external pressure would be liable to crush in the walls or force out the filling and destroy the structure, were not the automatic relief-valves provided. So, too, if in cleansing the filter-sections an excessive or unusually great head of water should be turned into the same, the filter might be injured unless provision for relief be made; hence each chamber is furnished with an outwardly-opening valve, M, weighted to offer a certain resistance to the outward pressure of the water used in cleansing, but to yield and afford a free outlet therefor when the prescribed limit is reached.

Practical experience has demonstrated that a certain velocity is necessary to enable water to dislodge and carry off the sediment deposited in the filtering material, and that this velocity must be comparatively high. The ordinary current of a stream will not answer the purpose, nor will the head usually attained in town and city systems do so unless the action is concentrated and confined to comparatively narrow limits; hence the importance of the connection with the reservoir or stand-pipe and the means for confining the action to a single section at a time.

The branches *g* have their mouths at or near the centers of the respective filter-sections, and owing to this arrangement, and to the fact that the filtering-walls are of like thickness and character at all points, the water will pass through all parts alike—a matter especially important in cleaning, because the water would otherwise flow out at the point or points of least resistance and leave other parts uncleaned.

Perforated metal plates may be used instead of the netting *d*, and sliding or telescopic valve-rods may be employed instead of jointed or folding rods, as respectively shown in Figs. 4 and 5.

Having thus described our invention, what we claim is—

1. The combination, substantially as set forth, of a sectional filter, an exhaust-pipe extending through the several sections, provided with an opening into each and connecting with the pump by which the water is drawn off, valves applied to each of said openings, an elevated reservoir or stand-pipe arranged to receive water from the pump, and a valved pipe connecting the reservoir or stand-pipe with the exhaust-pipe, whereby the water of the reservoir may be discharged under full head into any section of the filter at will.

2. The herein-described submerged filter, composed of a base, A, body B, consisting of open frame-work, shells *a b*, foraminous material *d*, and filling *e*, heads C, partitions D, pipe E, having branches *g*, one in each section of the filter, valves H, and relief-valves L and M, respectively adapted to open inward and outward at predetermined pressures.

3. In combination with an elevated reservoir, a submerged filter consisting of a series of separated and independent sections each communicating directly with the source of supply, a suction or exhaust pipe provided with a series of branches, one opening into each of said sections, a valve applied to each branch, a pipe opening from the reservoir into the exhaust-pipe, and a valve applied to the pipe from the reservoir.

4. The combination of a submerged filter, a pump connected therewith and serving to withdraw the water therefrom, and an automatic relief-valve applied to the filter and arranged to open into the filter when the exhaust exceeds a prescribed limit.

5. In combination with a submerged filter and an exhaust-pipe therefor, a valve applied to the exhaust-pipe, and a rod extending from said valve to a point above the filter and provided with a joint, whereby it is adapted to fold down upon the filter when not in use.

6. In combination with a submerged filter and its exhaust-pipe, a valve applied to said pipe, and a rod composed of two parts, one capable of rise and fall independently of the other and connected with the stem of said valve, substantially as described and shown, whereby it is adapted to be raised to the surface of the water and to be dropped below the same, substantially as and for the purpose specified.

7. In combination with a submerged sectional filter, a pipe, E, common to the several sections, a valve, H, in each section for controlling communication of the pipe therewith, valve-rods *h*, provided with joints *i*, collar *j*, hinged braces *k*, chain *m*, pulley *n*, and chains *p* and *r*, all constructed and arranged to operate substantially as explained.

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