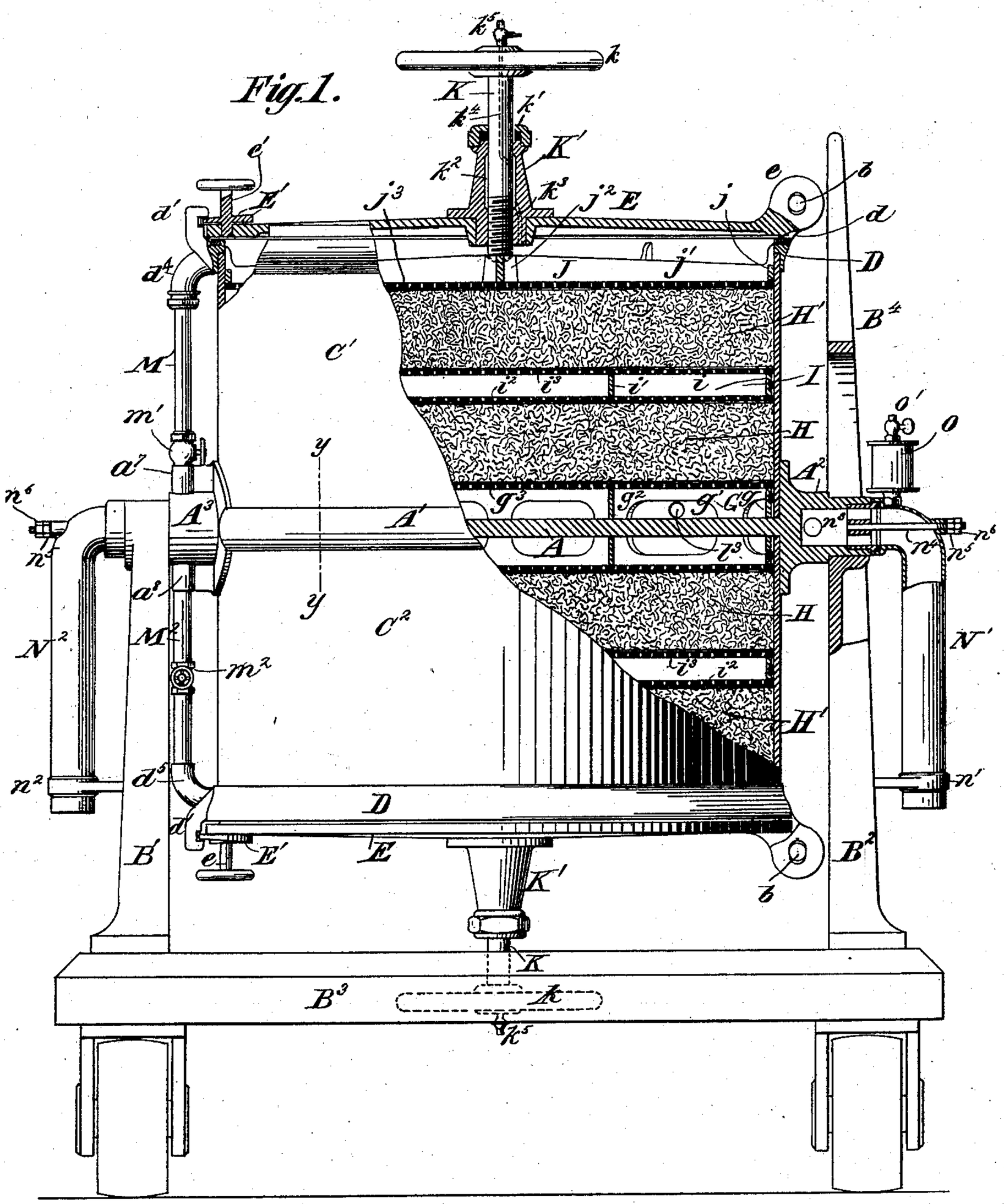
(No Model.) 4 Sheets—Sheet 1.

J. SUTTON.

CONTINUOUS FILTER.

No. 406,603. Patented July 9, 1889.

Fig. 1.



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John Sutton
by attorneys
Brown & Hall

(No Model.) 4 Sheets—Sheet 2.

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CONTINUOUS FILTER.

No. 406,603. Patented July 9, 1889.

Fig. 2.

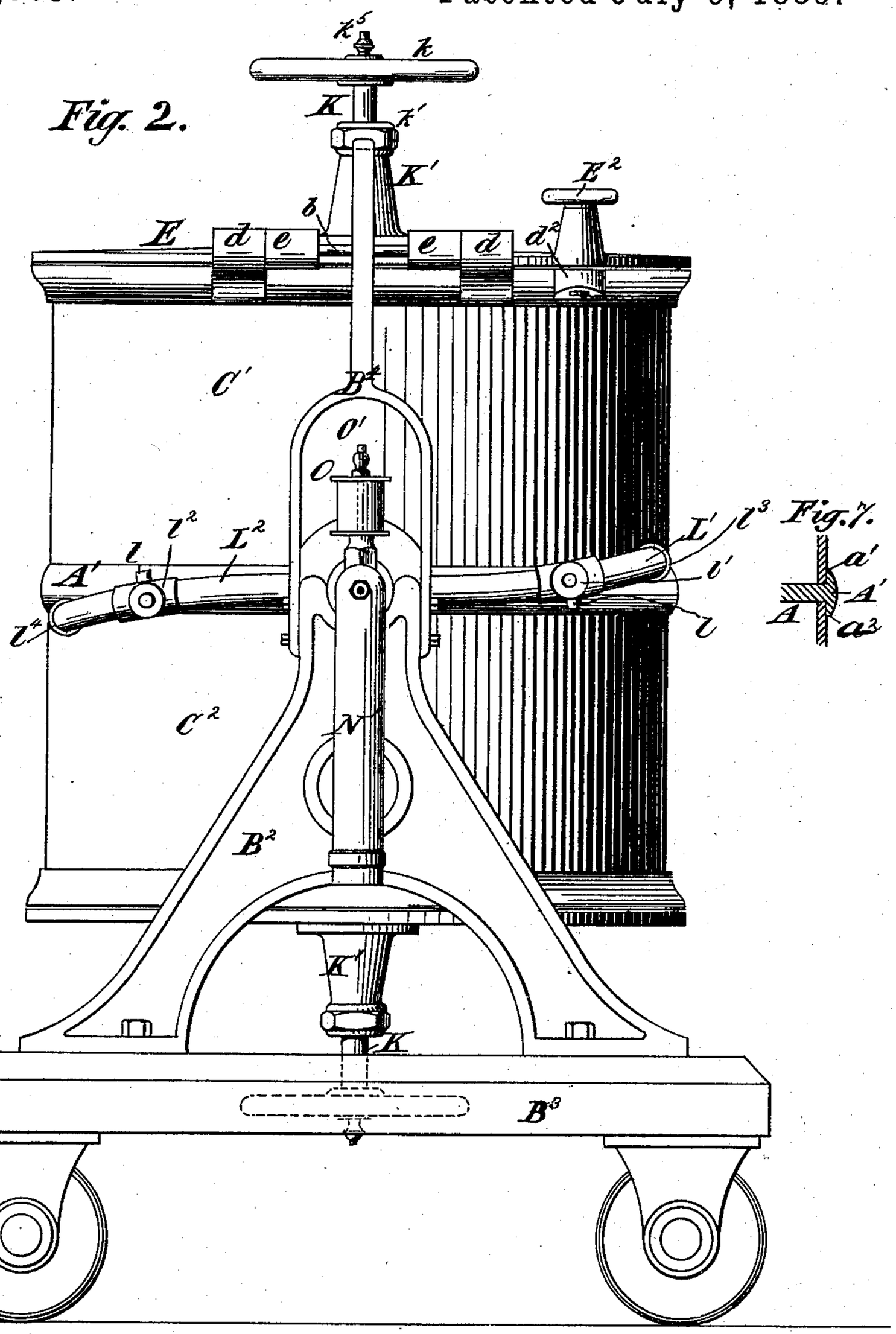
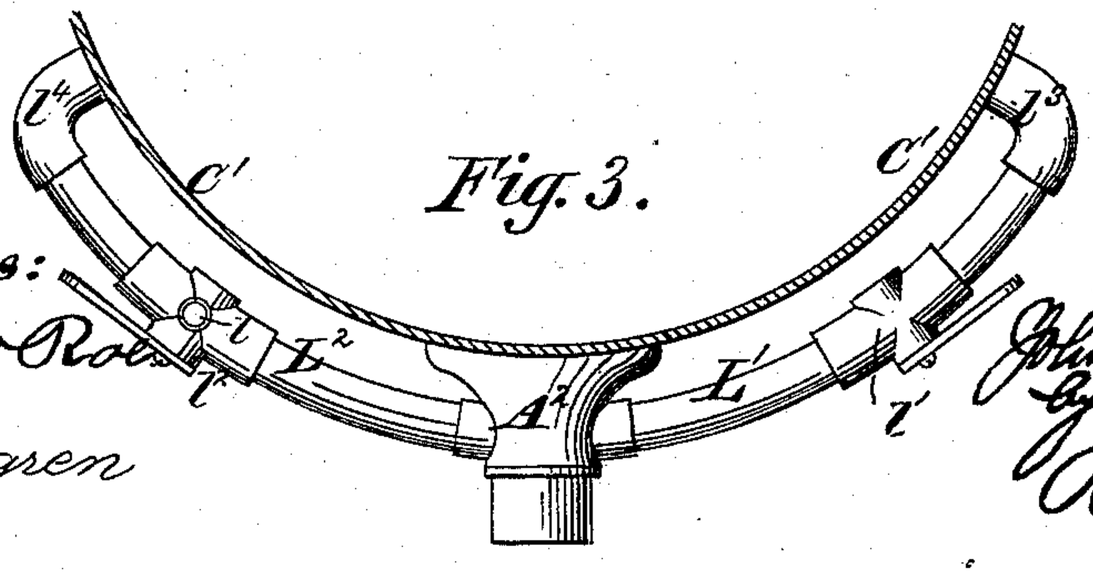


Fig. 7.

Fig. 3.



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(No Model.) 4 Sheets—Sheet 3.

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CONTINUOUS FILTER.

No. 406,603. Patented July 9, 1889.

Fig. 6.

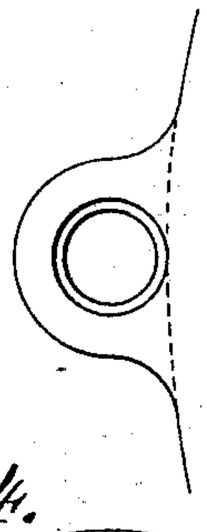

Fig. 4.

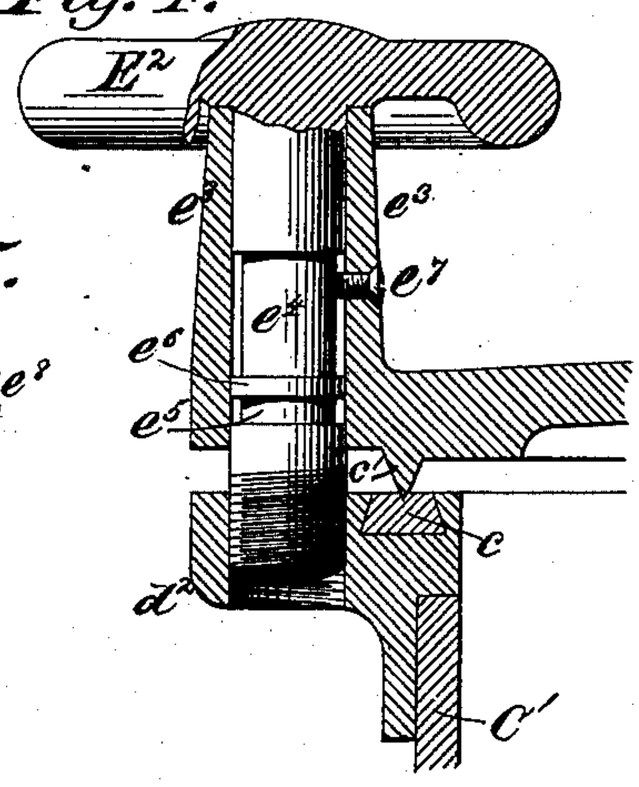

Fig. 5.

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CONTINUOUS FILTER.

No. 406,603. Patented July 9, 1889.

Fig. 10.

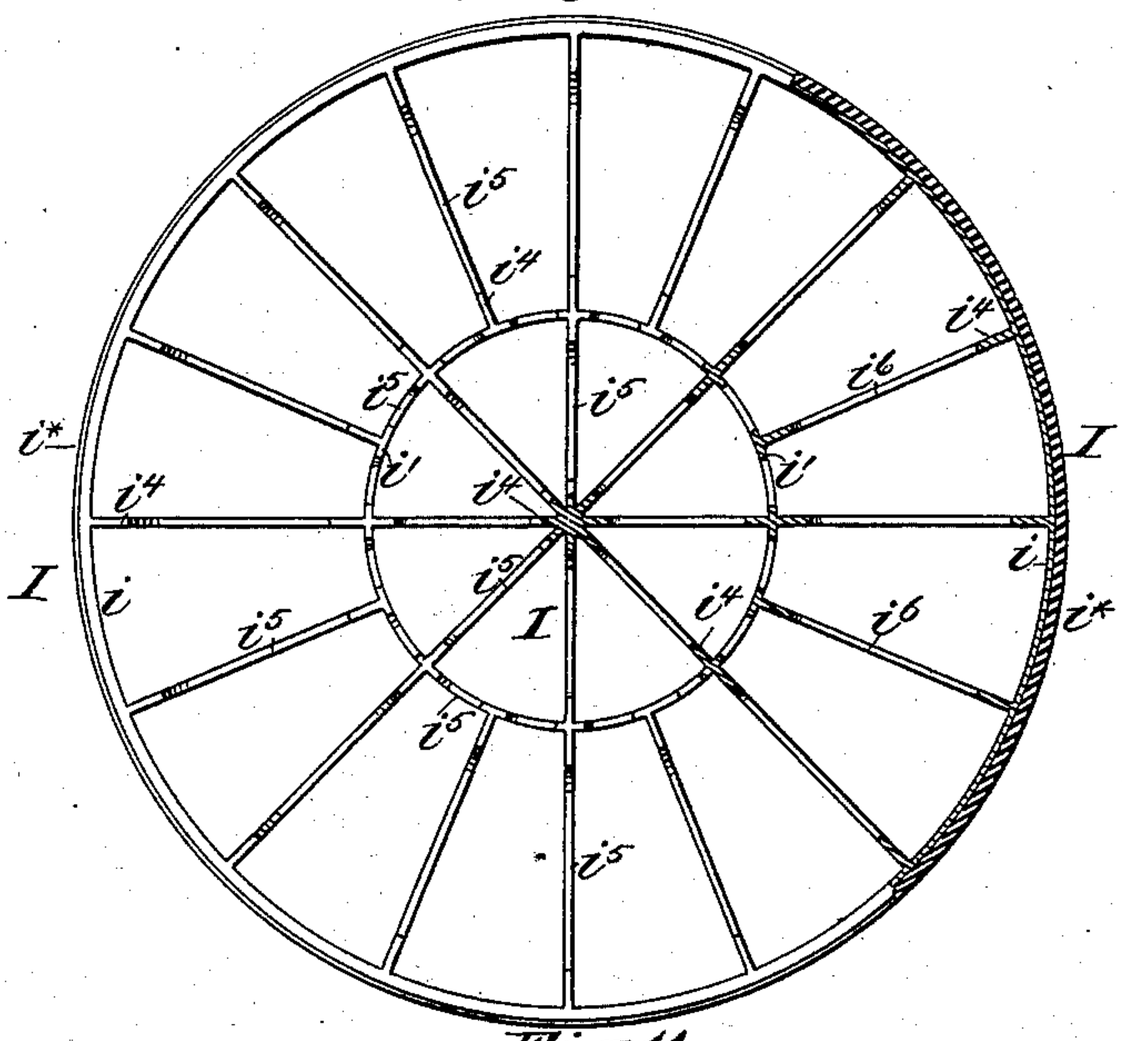


Fig. 11.

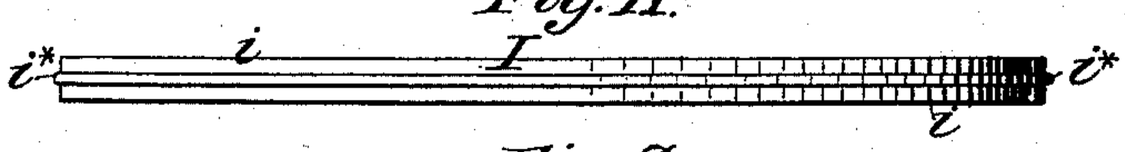


Fig. 8.

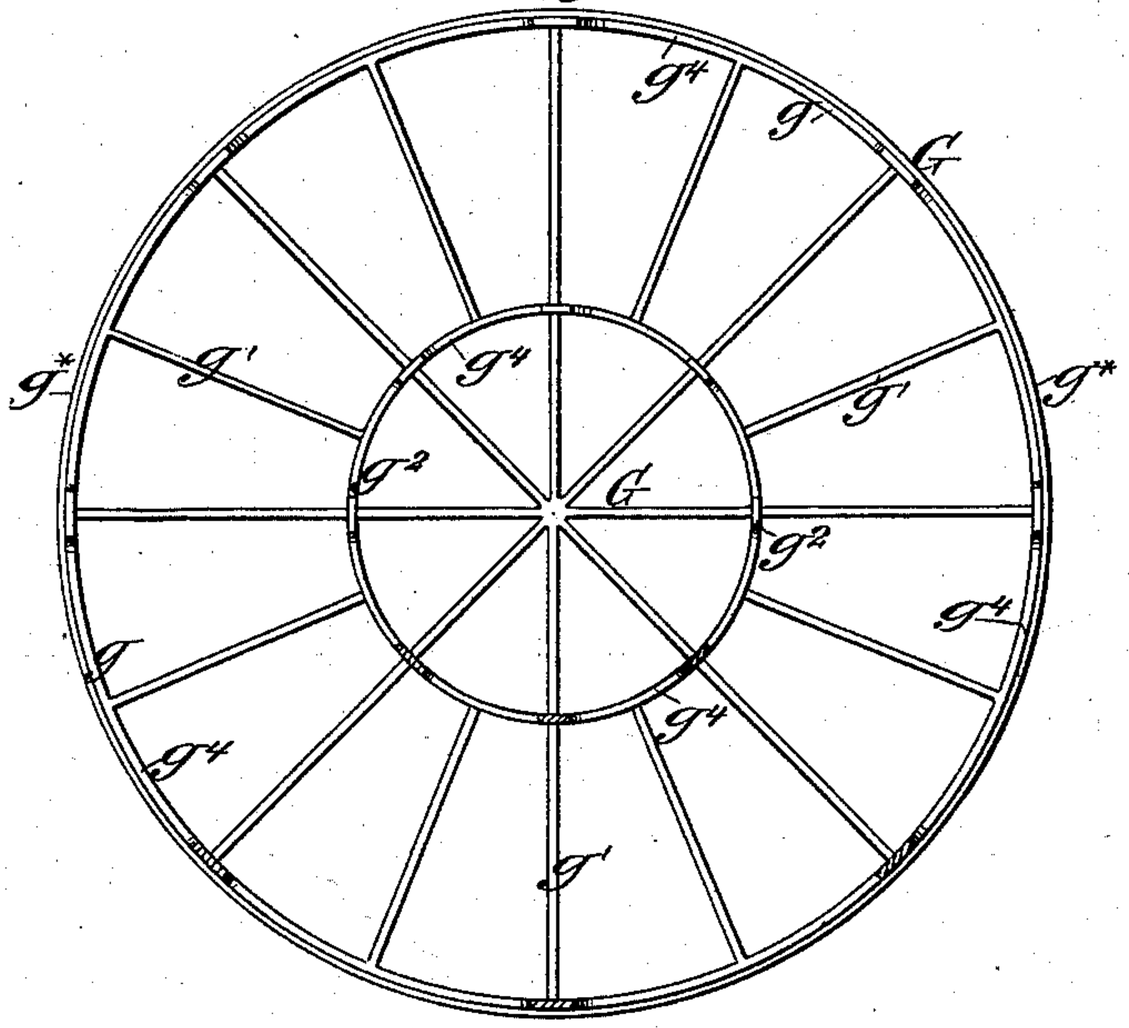
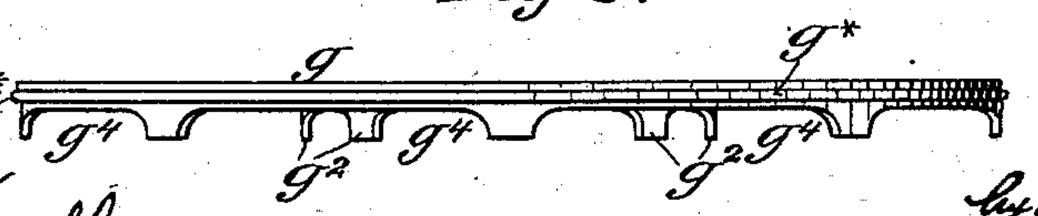


Fig. 9.



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UNITED STATES PATENT OFFICE.

JOHN SUTTON, OF ISLIP, NEW YORK.

CONTINUOUS FILTER.

SPECIFICATION forming part of Letters Patent No. 406,603, dated July 9, 1889.

Application filed May 31, 1888. Serial No. 275,648. (No model.)

To all whom it may concern:

Be it known that I, JOHN SUTTON, of Islip, in the county of Suffolk and State of New York, have invented a certain new and useful Improvement in Filtering or Clarifying Machines or Apparatus, of which the following is a specification.

I will describe in detail the various features of my improvement, and then point them out in claims.

In the accompanying drawings, Figure 1 is an elevation of a machine or apparatus embodying my improvement, certain parts being represented in section. Fig. 2 is an elevation of the machine or apparatus in a plane at right angles to that of Fig. 1. Fig. 3 is a sectional plan of certain parts of the machine or apparatus. Fig. 4 is a sectional elevation illustrating a means whereby a cover employed in the machine or apparatus may be secured when closed. Fig. 5 is a transverse section of a screw, which is represented best in Fig. 4, the section being taken as indicated by the dotted line *x x*, Fig. 4. Fig. 6 is a plan view of a portion of a vessel included in the machine or apparatus. Fig. 7 is a vertical section of certain parts, the section being taken as indicated by the dotted line *y y*, Fig. 1. Fig. 8 is a plan view, partly in section, and Fig. 9 is a side view, of a frame for supporting the filtering material. Fig. 10 is a plan view, partly in section, and Fig. 11 a side view, of a frame which is interposed between the layers of filtering material.

Similar letters of reference designate corresponding parts in all the figures.

My improvement is here shown as embodied in a filtering or clarifying apparatus of the kind in which a filtering or clarifying vessel is provided with trunnions supported in bearings and capable of being reversed, so as to elevate that end which was lowermost and lower that end which was uppermost.

A designates what I term a "floor." In the present example of my improvement it is made in the form of a disk-shaped plate. At the circumference it is provided with flanges a' a^2, extending in reverse directions, one upwardly and the other downwardly, and together forming what I term a "brazing-band" A'. This floor has also affixed to it trunnions A^2 A^3. At the inner ends of the trunnions are circular flanges which join the flanges a' a^2, forming the said brazing-band. It is immaterial how the floor, the brazing-band, and the trunnions are united; but it is obvious that they may be cast integral. In any case there is a permanent liquid-tight connection between the floor and the trunnions, and the floor is of metal and impervious to liquid.

The trunnions are shown as supported in bearings arranged at the upper ends of standards B' B^2. I may here remark that although these standards are shown as erected upon a movable car B^3, they may nevertheless be erected upon any fixed support.

It will be observed that the trunnions A^2 A^3 are hollow. The liquid to be filtered is received in the trunnion A^2 and delivered from the trunnion A^3, or vice versa.

The filtering or clarifying vessel is built upon the floor A, and consists, essentially, of two compartments, one on each side of the said floor; hence the floor not only forms a support for the other parts of the filtering or clarifying vessel, but also a partition separating the two compartments of the vessel.

C' C^2 designate two shells, here shown as of cylindric form and arranged in line with each other. Their adjacent ends bear against opposite sides of the floor A and fit within the flanges a' a^2, forming the brazing-band A', and the flanges surrounding the inner ends of the trunnions.

The shells C' C^2 may be of any suitable material and secured by any desirable means to the brazing-band and trunnion-flanges, and they may be packed, if necessary, in any approved way to secure a tight joint with the floor A.

Each of the shells C' C^2 has secured to its outer end a brazing-band D. Such brazing-band consists of a ring whose inner circumference is coincident with the inner surface of the shell with which it is combined, and is provided with a flange extending over the contiguous edge or end and outside portion of that shell. The flange of the brazing-band D may be secured to the contiguous shell by any suitable means. If desirable, the shells C' C^2 may be cast integral with the floor A and the casting so formed as not to require

the brazing-bands as separate pieces. The trunnions may also be made in the same casting or may be attached to such casting.

E designates covers, which are combined with the outer ends of the shells C′ C² and their brazing-bands D.

It will be readily seen that the floor A, in connection with the shells C′ C² and the covers E, form two compartments arranged in line with each other and at opposite sides of the axis of the trunnions A² A³.

In the outer surfaces of the brazing-bands D are seats for the covers. These seats may advantageously consist of dovetailed grooves fitted with rings *c*, of india-rubber or other suitable material. The inner surfaces of the covers are shown as provided with V-shaped ribs *c′* so located as to offset the rings of rubber, in order that they may, when the covers are in place, form a tight joint in connection with the rings of rubber. Obviously the ribs might be arranged upon the brazing-bands and the rings of india-rubber in the covers with good results.

I have shown the covers as hinged at one point to the brazing-bands and as provided at another point or other points with means for fastening them when closed. The hinges whereby the covers are connected to the brazing-bands D are of somewhat peculiar construction. The covers are provided with bearers or lugs *e* and the brazing-bands with bearers or lugs *d*. There may be any desired number of these bearers or lugs. A pin *b* extends through these bearers or lugs. Either the bearers or lugs *e* of the covers or the bearers or lugs *d* of the brazing-bands D (in the present instance the lugs *e* of the cover) have the hole for the pin or bolt *b* elongated at right angles with the plane of the cover, but so shaped as to snugly fit the pin or bolt in a plane parallel with the cover. The elongation of the holes is such that when the covers are closed they may have a slight movement toward and from the brazing-bands D. Owing to this, they may be clamped securely upon the brazing-bands, so as to form therewith tight joints, and yet they have all the advantages ordinarily appertaining to hinged covers.

The means which I have shown and prefer to use for the purpose of securing the covers are illustrated in Figs. 4, 5, and 6. They consist of screws E², fitted in sockets *e*³, (shown as formed integral with the covers.) These screws are adapted to engage with tapped holes in lugs *d*², extending from the brazing-bands D. The screws E² are provided with handles, here shown as made in the shape of wheels. They have wide circumferential grooves or channels *e*⁴ and narrow circumferential grooves or channels *e*⁵, the grooves *e*⁵ being separated from the grooves *e*⁴ by circumferential ribs *e*⁶. Screws *e*⁷ or analogous devices extend through the sockets *e*³ to the interior thereof and within the grooves with which the screws E² are provided. The ribs *e*⁶ are at one point provided with notches or passages *e*⁸. If the screws *e*² are rotated so as to disengage them from the lugs *d*² and are then turned into such position that the notches *e*⁸ of the ribs *e*⁶ are brought into line with the screws *e*⁷, the screws E² may then be moved longitudinally until their ribs *e*⁶ shall have passed beyond the screws *e*⁷. If then the screws E² are rotated so as to move the notches *e*⁸ of their ribs *e*⁶ out of line with the screws *e*⁷, the screws *e*⁷ will serve to hold the screws E² in such position that their threaded end portions will be flush with the inner sides of the covers.

Whenever the screws E² are to be used to secure the cover, they will first be turned to bring the notches *e*⁸ of their ribs *e*⁶ opposite the screws *e*⁷, whereupon they will be moved longitudinally far enough to insert their screw-threaded end portions in the tapped holes provided in the lugs *d*². Afterward the screws *e*² will be rotated to cause their screw-threaded end portions to work in the tapped holes of the lugs *d*². They may be rotated so as to force the covers firmly upon their seats. It will be observed that the handles or hand-wheels of the screws E² bear upon the outer ends of the sockets *e*³ in forcing the covers to their seats.

I have shown the screws E² and their appurtenances as arranged adjacent to the hinges by which the covers are connected to the brazing-bands D, but may be placed as desired.

Obviously by the means I have described the covers may be very securely and effectively closed, quite as much so as if the covers were not connected by hinges to the filtering or clarifying vessel.

It will be seen that there extends upwardly from the standard B² a prop B⁴ for sustaining the uppermost cover E when opened. It is shown as bolted to said standard. It may be provided with means for holding the vessel firmly, such as a sliding bolt and detent.

Any suitable filtering material or mixture of filtering materials may be used. The filtering material may be arranged in one mass in each compartment of the vessel, or it may be arranged in strata of any desirable number in each compartment.

I have shown the compartments as severally furnished with two strata of filtering material and these strata as separated by intermediate liquid-spaces.

On each side of the floor A, I have arranged a frame G, consisting, as shown in Figs. 8 and 9, each of a circular ring *g*, furnished with certain braces. I have shown braces as consisting of radial webs *g′* and circular parts or rings *g*². The whole frame may be of metal and cast in one piece and of a size to pass easily within the shell C′ or C². The outer surface of the ring *g* of each frame G is provided with a groove, preferably of dovetailed shape, containing india-rubber or other packing material to prevent the passage of liq-

uid through the spaces between the exterior of the ring g and the adjacent shell C′ or C². Openings g^4 (shown in Figs. 8 and 9) are provided in the under parts of the rings g and g^2 for the purpose of enabling the liquid to pass and circulate freely through the frames G and for forming feet. In order that the liquid may circulate freely around the spaces between the rings g and g^2, the radial webs g' are made of a less depth than the ring, so that the liquid may pass freely under them.

Attached to each frame G, on the side farthest from the floor A, is a perforated plate g^3, having a rubber washer secured to that side which is farthest from the floor A.

Each frame G with its appurtenances may be inserted or removed from each compartment of the filtering-vessel at pleasure, it being unfastened therein.

In each of the compartments of the filtering-vessel, beyond the frame G and plate g^3, a stratum of the filtering material H is arranged. Beyond this stratum of the filtering material H a frame I is arranged in each compartment. This frame I consists, as shown in Figs. 10 and 11, of a ring i, another ring i^2, and webs or braces i^4, extending between the said rings. The ring i of each frame I has in its outer surface a circumferential groove, in which is fitted india-rubber or like packing material i^*, to prevent the passage of the liquid between it and the wall or shell C′ C² of the filtering-vessel. The ring i and the braces i^4 have openings in them for the circulation of the liquid through the frames I. These openings may consist of recesses i^5 (see Fig. 10) in the underside of the ring or braces, substantially like the openings or recesses g^4, (shown in Fig. 9,) or by making openings through the middle of the braces, as shown at i^6, in that part of the ring at the right hand of Fig. 10 which is shown in section. Perforated plates i^2 i^3 are secured to each frame I or fitted loosely thereto, as may be desired, one above and one below it.

The frames I and plates i^2 i^3 are fitted to the shells C′ C², to be capable of movement therein and of being taken out and reversed at pleasure. Beyond each frame I is arranged a stratum H′ of filtering material. Beyond the stratum H′ of filtering material a follower J is arranged in each compartment. Each follower consists of a ring j, fitting snugly within the filtering-vessel, and webs or braces j', extending therefrom radially or otherwise and meeting at a common central hub or boss j^2. A perforated plate j^3 may be formed integral with each follower, or may be made separately and secured thereto, or be independent. It will be located on that side of the follower which is next the filtering material. The followers fit snugly within the filtering-vessel, but are not secured thereto; hence may be removed and replaced at pleasure, and may be shifted within the vessel.

K designates screws serving as means for adjusting the followers within the compartments of the filtering-vessel, so as to cause them to compress to a greater or less degree the strata of filtering material within the vessel. These screws K are fitted in hollow standards or sockets K′, that are secured to the covers of the compartments in the filtering-vessel. The inner end portions of the standards or sockets K′ are internally screw-threaded to engage with the screws K. The screws may be provided with any suitable handles—as, for instance, wheels k. The standards or sockets K′ at the outer ends are provided with stuffing-boxes k', through which the screws pass. Between the stuffing-boxes and the screw-threaded inner end portions the standards or sockets are enlarged internally to form air-chambers k^2. From the air-chambers k^2 passages k^3 extend to the interior of the compartments of the filtering-vessel. That portion of the screws K which is opposite the air-chambers k^2 of the standards or sockets K is provided with passages k^4, extending from its circumference inwardly to the center of the screws, and thence upwardly to the outer extremity of the screws. At the extremities of the screws are air-escape cocks k^5. The air-cocks k^5 may be opened to admit air or to permit the escape of air whenever desired.

I will now explain the means by which liquid may be conducted to the compartments of the filtering-vessel and withdrawn therefrom. It will be remembered that the trunnions are hollow, that the trunnion A² is the receiving-trunnion, and that the trunnion A³ is the delivery-trunnion. From the trunnion A² conducting-pipes L′ L² extend. These pipes are provided with cocks l' l^2, whereby the passage of liquid through them may be controlled. These pipes l' l^2 extend to elbows l^3 l^4, which may be cast integral with the brazing-band A′. The pipes may be coupled to the trunnions, the cocks, and the elbows in any approved manner. It will be observed that the pipe L′ communicates with one of the compartments of the filtering-vessel within the shell C′, and that the pipe L² communicates with the other compartment. Both communicate with their compartments close to the floor A.

Liquid to be clarified or filtered may be passed under any desired pressure to both compartments of the filtering-vessel or to either of the compartments only by properly manipulating the cocks l' l^2.

The brazing-bands D are provided with elbows d^4 d^5. These elbows may be cast integral with the said brazing-bands. Opposite the elbows d^4 d^5 the delivery-trunnion A³ is provided with elbows or conduits a^7 a^8. Pipes M′ M² extend between the elbows d^4 d^5 and the opposite conduits a^7 a^8 of the trunnion A³. These pipes may be of glass, so as to afford opportunity for examining the liquid escaping from the compartments of the vessel, or they may be made of metal. They preferably will have combined with them stop-cocks,

whereby the passage of liquid through them may be controlled. I have represented the pipe M′ as if it were made of a single piece of glass and as having a cock m' combined with it. The pipe M^2, I have shown as made in two sections, having a cock m^2 arranged between them. It will be understood that the pipes M′ M^2 and their appurtenant connections, which I have just described, serve to conduct liquid from the outer portions of the compartments of the filtering-vessel and from beyond the filtering material. The liquid may be supplied to the receiving-trunnion A^2 by flexible hose capable of being turned or twisted and taken off from the delivery-trunnion by similar hose. I have, however, represented pipes N′ N^2 as communicating with the trunnions. These pipes may have hose or other pipes connected to them. They do not rotate with the trunnions, but are held stationary by brackets n' n^2, which are secured to the standards B′ B^2. It will be seen that these pipes N′ N^2 extend upwardly from the lower ends and the upper ends are turned inwardly, so as to communicate with the ends of the trunnions. They may be fitted to the trunnions by means of ground joints or packed with washers to prevent leakage. The connection of the pipe N^2 with the trunnion A^3 may be similar to the connection of the pipe N′ with the trunnion A^2. The latter connection is illustrated, owing to the parts forming it being shown in section. It will be seen that a socket n^3 is fitted in the trunnions. It may be secured there by means of screw-threads or otherwise. It is provided with cross braces or webs extending to a central hub in which a bolt n^4 is secured. This bolt extends outwardly through the open portion of the pipe N′, and at the outer end has fitted to it jam-nuts n^5 n^6, a washer or washers being used to prevent leakage. The upper end of the pipe is enlarged, so that it may slide over the outer part of the socket n^3. A washer is shown as arranged between the socket and the opposite portion of the pipe to prevent leakage. It will be readily understood that this connection of the pipes N′ N^2 with the trunnions permits of the rotation or reversal of the filtering-vessel without entailing the disconnection of any parts.

I have shown a testing-vessel O as arranged upon the upper portion of the pipe M′. Its body will preferably be made of glass, so that the liquid entering it may be examined as to its appearance. This vessel has at its top an air-cock Q′. By opening this air-cock air may be allowed to escape to permit the flow of liquid into the vessel, and some of the liquid may, if desired, be allowed to flow out.

I will now describe the operation of my machine or apparatus. Assuming that the upper compartment of the filtering-vessel has been packed properly, its cover will be closed and secured. Then the air-cock k^5 of the screw K belonging to the upper compartment will be opened to permit the escape of air. The cock O′ of the testing-vessel O will also be kept partially open for the purpose of permitting the escape of air from the inlet-pipe N′, the lower compartment of the filter, and the testing-vessel. The cock l', controlling the passage of liquid through the pipe L′, will then be opened. Then liquid will be able to flow, under pressure, from the receiving-trunnion through the pipe L′ to the upper compartment of the filtering-vessel. It will enter this compartment just above the floor A and in the space of the compartment which is formed by the frame G. After filling this space it will be free to rise through the filtering material into the upper part of the compartment, and ultimately out through the elbow d^4 down through the pipe M′, thence, under control of the cock m', into the delivery-trunnion A^3 and out from the pipe N^2. The cock m' will at first be opened but slightly, so that it will detain some of the liquid within the glass pipe M′, so that its condition may be ascertained. Then the screw K of the upper compartment will be manipulated to vary the compression of the filtering material until the condition of the filtering material becomes such that liquid of the desired quality and quantity may pass through it. Then the cock m' may be opened farther or wholly; but preferably it will always be opened only to such degree as will cause it to detain some of the liquid in the glass pipe M′, in order that the character of the escaping liquid may always be seen. When the conditions have been thus adjusted, the air-cock k^5 will be closed. The air-cock O′ of the vessel O is then kept partially closed. Now the filtering-vessel will be rotated or oscillated by means of its trunnions, so as to reverse it and bring the compartment which was uppermost downward and the other upward. While the compartment, packed and adjusted as described, occupies the lower position it is in operation, liquid being passed through it from the receiving-trunnion and delivered at the delivery-trunnion. The compartment of the vessel now uppermost is packed, its cover is closed, and its parts are operated in exactly the manner previously described with reference to the inverted compartment. Both compartments are now operating. The appearance of the liquid passing from the compartments will be watched. Whenever it appears possible to do so, the screws K may be rotated so as to relax the pressure upon the filtering material. The latter will then expand. It may be advantageous from time to time to thus relax the pressure upon the filtering material, so that the desired clarification or filtration of the liquid may be attained with the most rapid flow possible. As soon as the liquid appears to run off in a foul condition it is time to cleanse and repack the compartment from which it escapes in such condition. When this is necessary, the filtering-vessel may be reversed without

disconnecting any parts or interfering with the operation of that compartment which does not at the time require cleansing and repacking. The compartment to be cleansed and repacked is thus brought uppermost. When in that position, the cock l', controlling the inflow of liquid into such compartment, is closed. Afterward the cock m', controlling the escape of liquid from the compartment, is closed. This compartment is then out of operation. The air-cock k^5 is now opened. The cock l', controlling the pipe M', will then be opened, so as to open an outlet-nozzle l, with which the cock l' is provided, while still preventing the liquid from flowing from the receiving-trunnion A^2 through the pipe L'. The air-cock k^5 must now be opened and the liquid from the upper compartment will escape through the nozzle l, and may be caught in any vessels suitable for that purpose or carried off by a pipe attached to the nozzle. Then the cover of the upper compartment will be unfastened and opened. Now the compartment will be emptied and cleansed. Afterward it will be repacked in the same manner in which it was originally packed. The cover of the cleansed and repacked compartment will then be closed and this compartment operated as heretofore described. Both compartments are now operating again.

If the nature of the filtering material employed in the vessel will permit of it, either compartment of the vessel on becoming foul may be cleansed by circulating water through it under pressure. If such course is to be pursued, it will be advantageous to manipulate the screw K of that compartment so as to relax the pressure upon the filtering material. Then a pipe leading from a supply of water will be connected to one of the stop-cocks controlling the passage through the compartment, and water may thus be circulated through the compartment. If the stop-cocks m' m^2 be suitably constructed, water may be passed through them by connecting pipes to nozzles extending from them, and then the water could be made to flow through the compartment in a direction the reverse of that taken by the liquid which is to be clarified or filtered.

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

1. In a filtering apparatus, the combination of a vessel composed of a floor, a band or flanges at the circumference of the same, hollow trunnions secured to said band or flanges and serving one to receive and one to deliver liquid, shells fitted to the flanges or bands, covers at the outer ends, pipes or conduits between the receiving-trunnion and the compartments formed by the floor, shells, and covers, and pipes or conduits extending from the compartments to the delivery-trunnion, substantially as specified.

2. In a filtering apparatus, the combination of a vessel, a cover for the vessel, a screw fitted in a socket with which the cover is provided and having two circumferential grooves separated by a rib notched in the direction of the length of the screw, a projection extending transversely from the socket into the grooved portion of the screw, and a lug attached to the vessel opposite the screw and provided with a tapped hole for engaging with the screw, substantially as specified.

3. In a filtering apparatus, the combination of a vessel, a cover for such vessel, a screw extending through the cover, an air-passage extending through the cover to an air-chamber surrounding the screw, a passage from the air-chamber through the outer portion of the screw, and an air-cock at the outer end of the screw, substantially as specified.

4. In a filtering apparatus, the combination of a vessel and a frame for sustaining filtering material therein and consisting of a ring and braces, the ring fitting snugly within the vessel and provided externally with a groove filled with packing material, substantially as specified.

5. In a filtering apparatus, the combination, with a vessel, of a support for filtering material arranged therein and consisting of a ring and braces, both the said ring and braces having transverse openings or recesses, through which liquid may flow to circulate within the whole of the space within said support.

6. In a filtering apparatus, the combination of a vessel having two compartments, a floor or diaphragm separating the two compartments, hollow trunnions, and stationary pipes fitted to the ends of the trunnions and secured to the trunnions by bolts affixed at their inner ends to the trunnions, extending through the pipes, and fitted with nuts at the ends outside the pipes, substantially as specified.

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