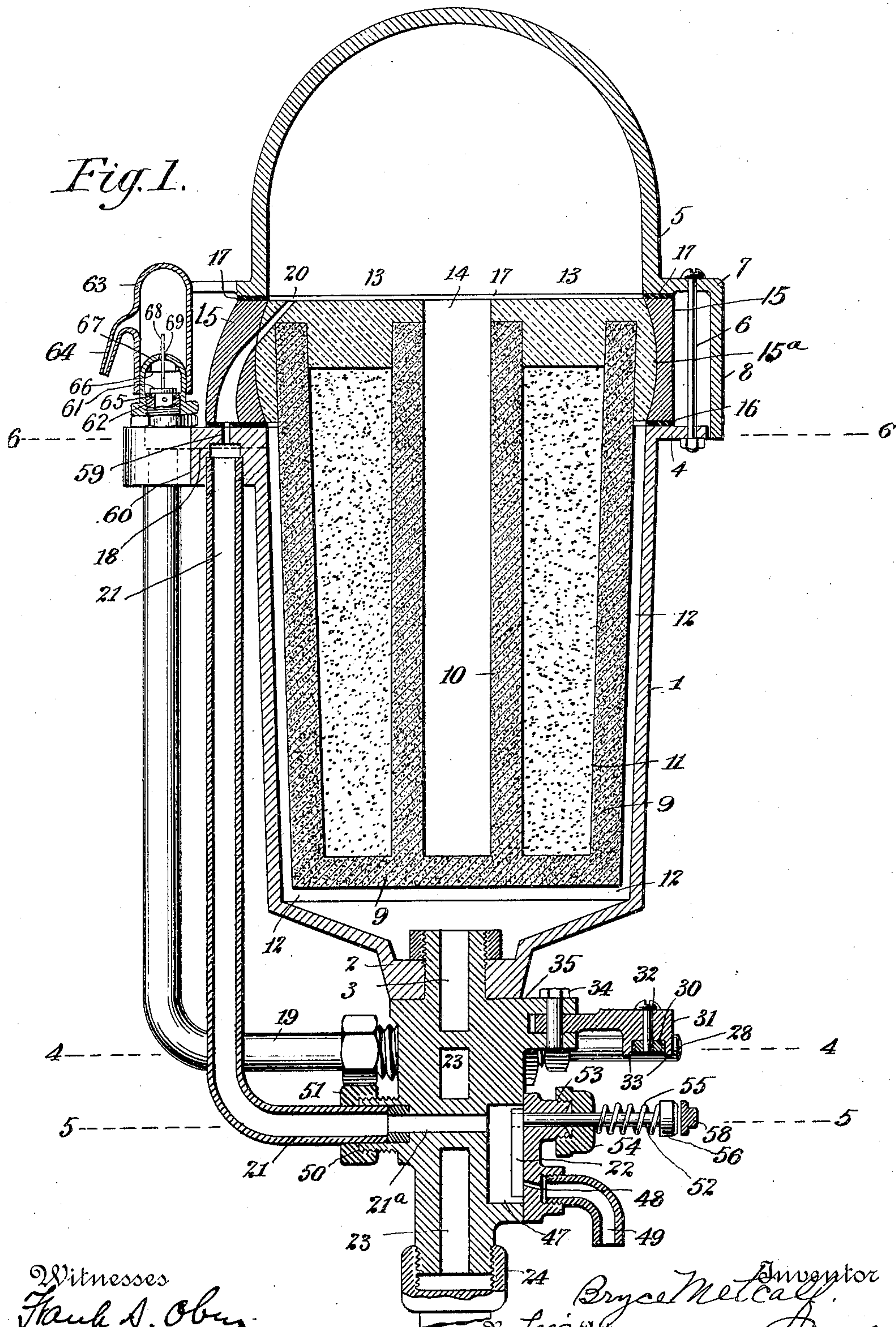


No. 789,751.

PATENTED MAY 16, 1905.

B. METCALF.
SELF CLEANING FILTER.
APPLICATION FILED DEC. 18, 1903.

3 SHEETS—SHEET 1.



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3 SHEETS—SHEET 2.

Fig. 2.

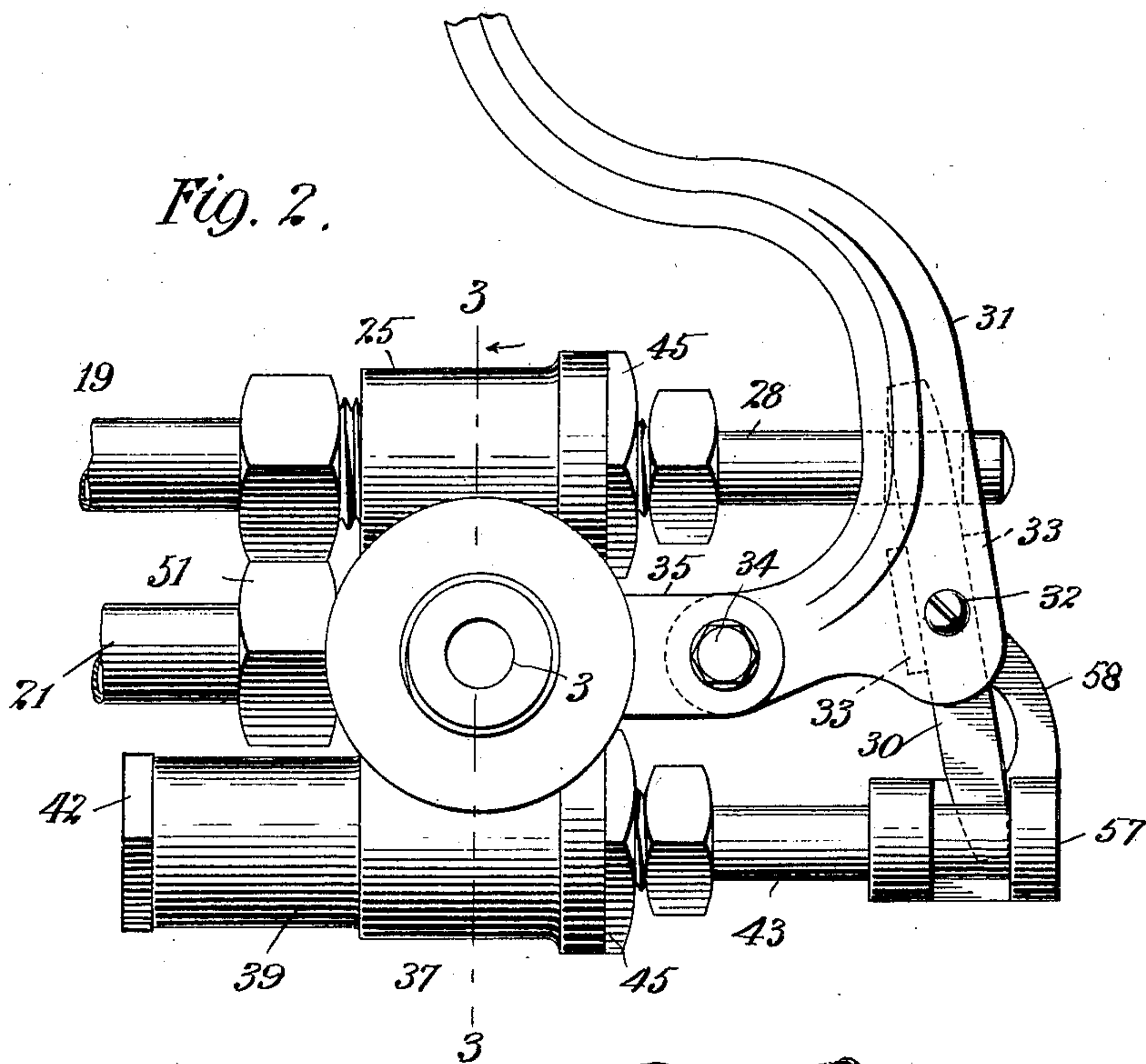
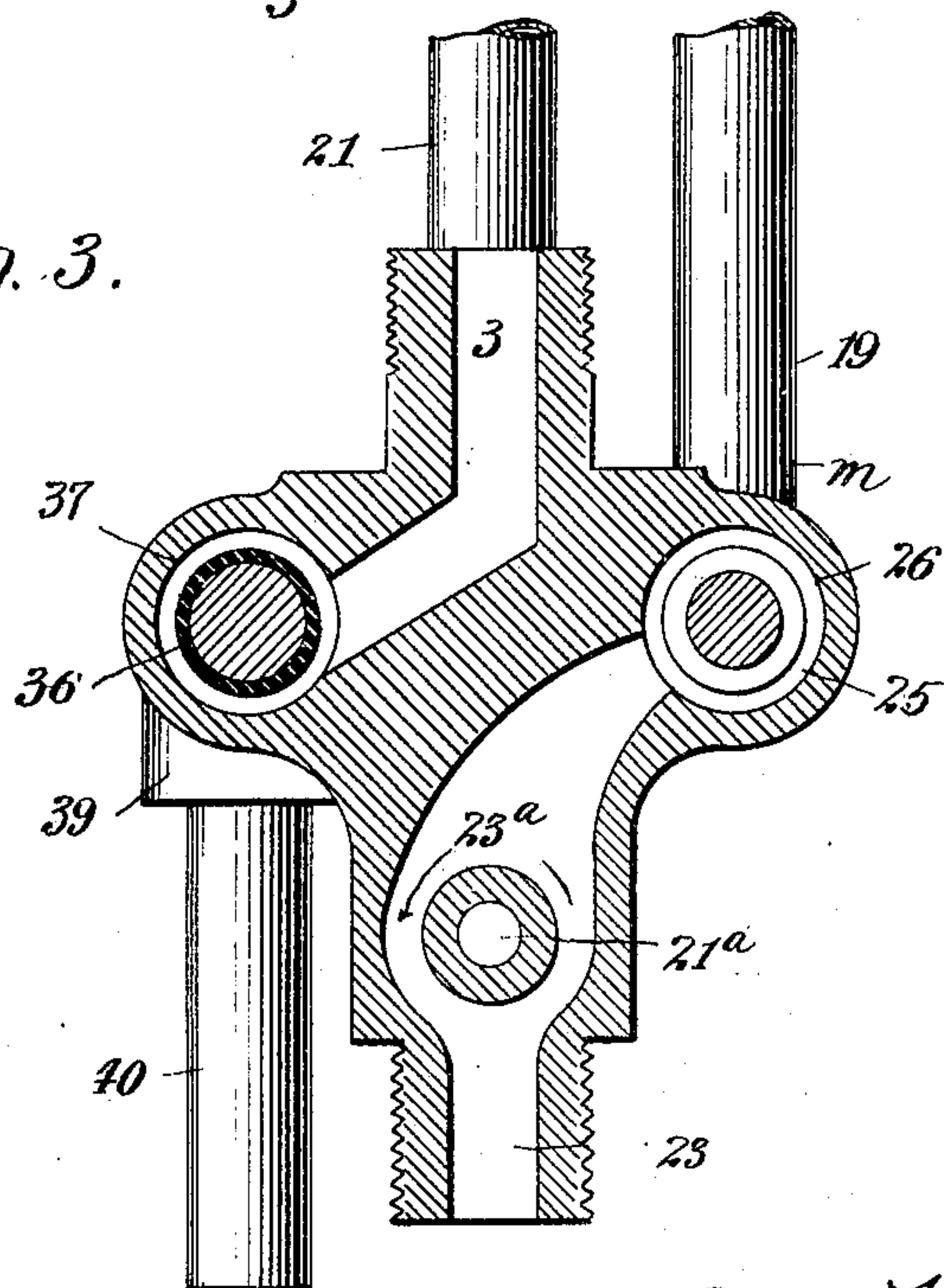


Fig. 3.



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3 SHEETS—SHEET 3.

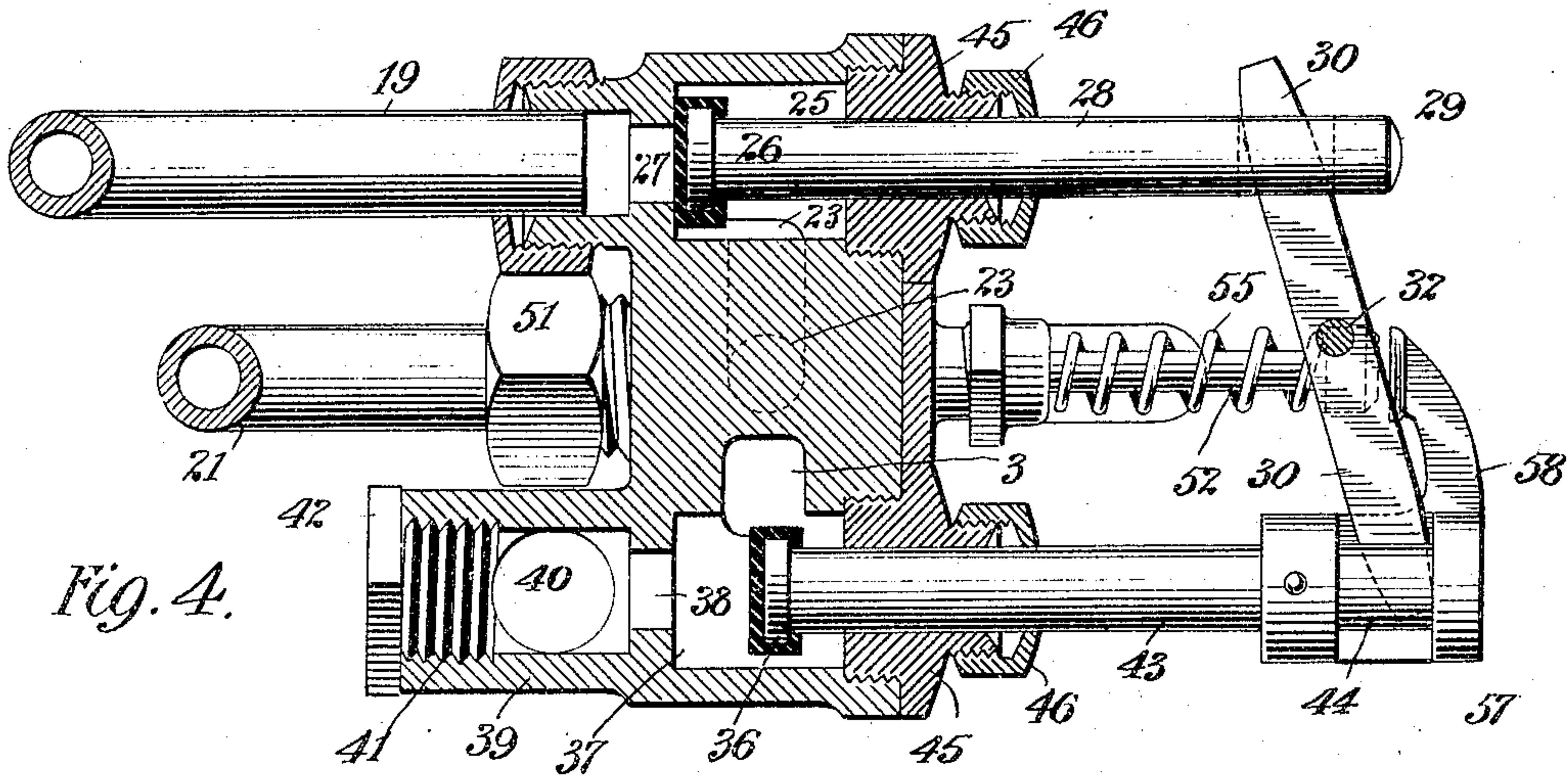


Fig. 4.

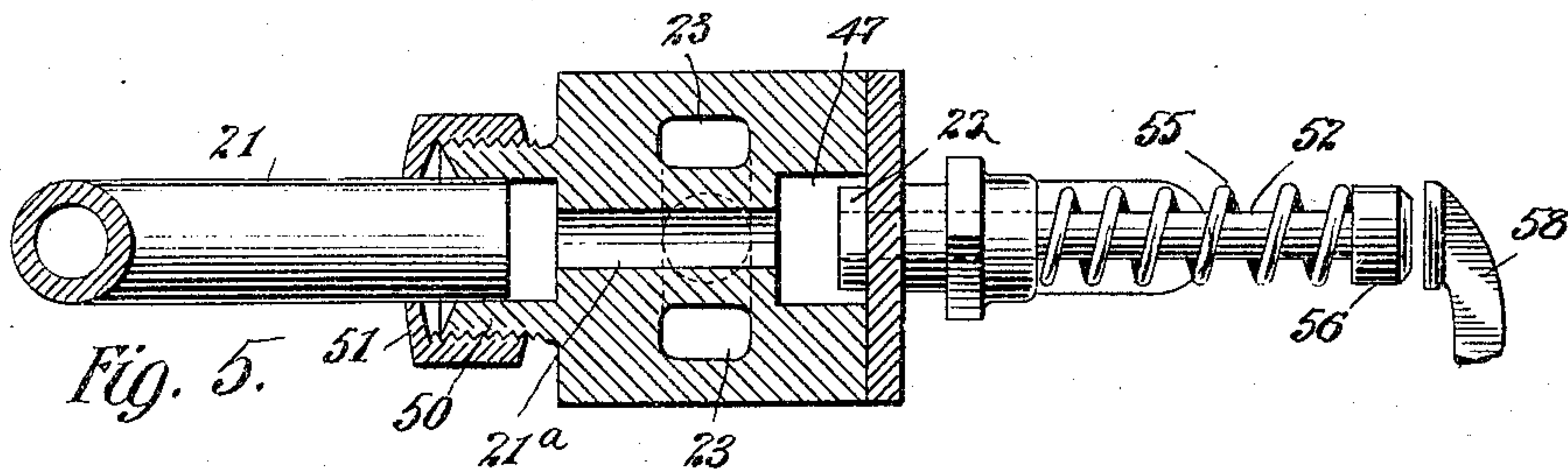


Fig. 5.

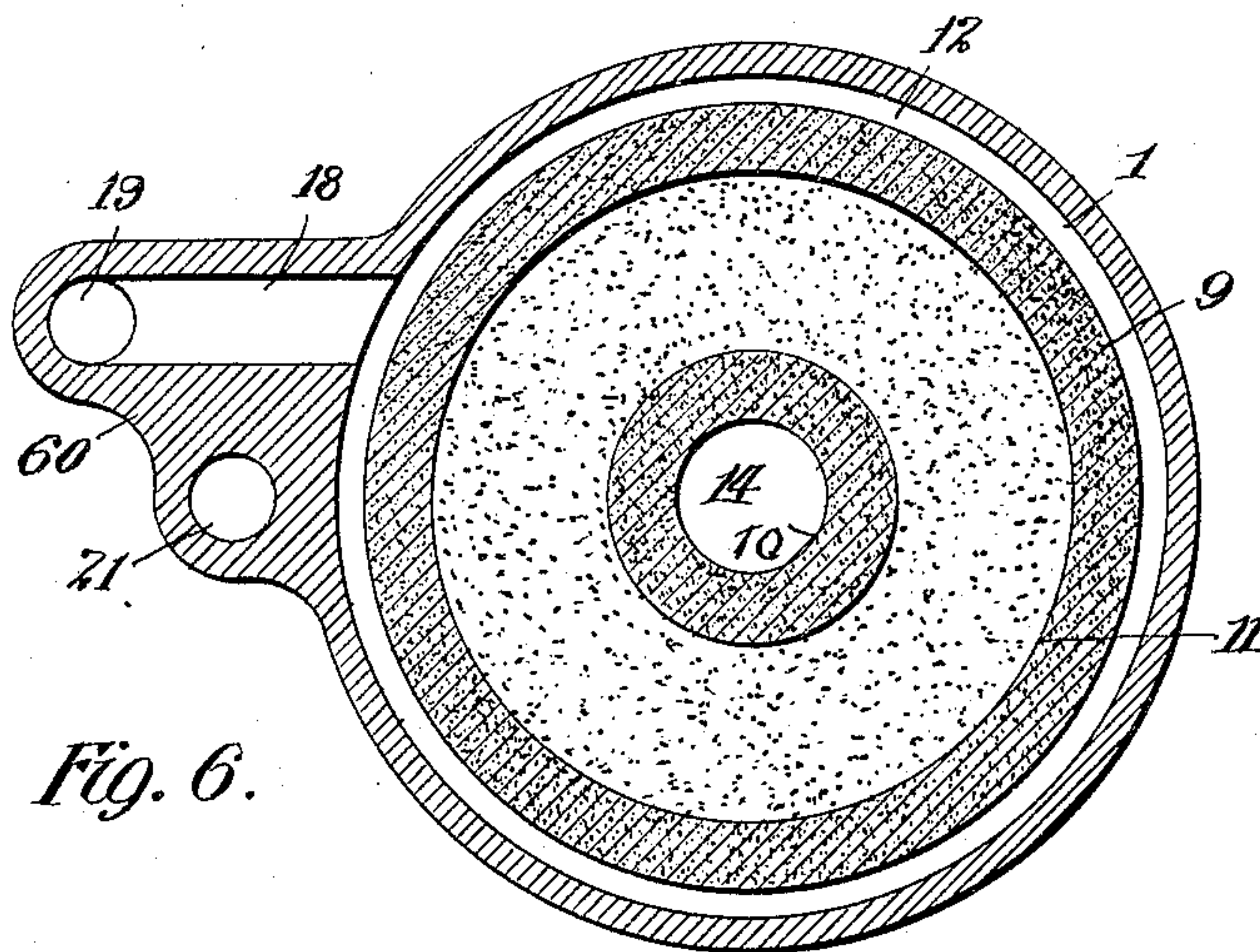


Fig. 6.

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UNITED STATES PATENT OFFICE.

BRYCE METCALF, OF NEW YORK, N. Y.

SELF-CLEANING FILTER.

SPECIFICATION forming part of Letters Patent No. 789,751, dated May 16, 1905.

Application filed December 18, 1903. Serial No. 185,711.

To all whom it may concern:

Be it known that I, BRYCE METCALF, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Self-Cleansing Filters, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to filters for purifying water taken from a water-main; and it is particularly adapted for a type of household filter in which the water is both aerated and filtered and in which the filter body or medium is automatically cleansed by filtered water each time the drawing off of filtered water is stopped. A type of this class of filter is shown in United States Patent No. 516,140, granted March 6, 1894, to William Weir.

My present invention has reference to the improvement of certain features, some of which are particularly adapted to this class of filter, as hereinafter fully set forth and then pointed out in the claims.

I have illustrated a type of my invention in the accompanying drawings, wherein—

Figure 1 is a sectional view of the complete apparatus, the plane of the section being vertical and central through the same and shows the several parts thereof as in normal closed positions. Fig. 2 is an enlarged plan view of the lower part of the apparatus comprising the main fitting and valve casings and stems together with the hand-lever, the filter-casing connected pipes being omitted. Fig. 3 is a central vertical section of the parts shown in Fig. 2, the plane of the section being indicated by the line 3 3, Fig. 2, and the view being taken in the direction of the arrow adjacent to said line. Fig. 4 is a horizontal sectional view taken on a plane indicated by the line 4 4, Fig. 1, with the parts shown in their relative positions when closed. Fig. 5 is a horizontal sectional view taken on the plane indicated by the line 5 5, Fig. 1. Fig. 6 is a horizontal sectional view taken on a plane indicated by the line 6 6, Fig. 1.

Referring to the drawings, in which like numbers of reference designate like parts throughout, 1 designates a circular cup-shaped casing, made preferably of metal, and having the bottom thereof tapering somewhat downwardly toward the center, where it is provided with a suitable outlet or opening 2, which receives an attaching threaded part 3 of the waste-water pipe or outlet. The upper part of the main casing 1 is provided with an outwardly-projecting flange 4, to which is clamped the upper dome-shaped casing 5 by means of a set of bolts 6, passing through a flange 7 on the casing 5 and the flange 4 of the casing 1. This flange 7 has a downward extension 8, which overlaps the outer edge of the flange 4 and forms an annular band which covers the attaching-bolts 6 and the parts lying within, as hereinafter described.

Within the interior of the casings is mounted the filter-body 9, which is made of ordinary unglazed earthenware, and the main portion thereof is cup-shaped, with a central tubular portion 10 extending up from the bottom of the interior, so as to provide an annular-shaped space 11, which is packed with a suitable filtering material, such as animal or bone charcoal. The filter body or part 9 is somewhat smaller than the interior of the casing, so as to provide between the two said parts a suitable chamber 12, which constitutes the unfiltered-water chamber.

The upper end of the filter-body 9 is sealed by an annular cap 13, which covers the annular interior space 11 of the filtering-body and leaves open the upper end of the space 14 of the tubular part 10 thereof. This cap 13 is preferably made of a suitable cement, which is made non-filtering and impervious, and it extends over upon the sides of the upper end of the body 9, at which point it is covered by a suitable band 15 of rigid material, such as metal, and this band, together with the material itself of the cap 13, affords a lateral projection extending around the head of the filter-body and by which it may be suspended from the upper part of the casing 1, where it rests upon the flange 4, it being interposed between such flange and the flange 7 of the upper portion 5 of the casing, the joints at these

two points being provided with washers 16 and 17, respectively, so that when the parts are thus put together and the bolts 6 are secured tightly in position the filter-body, with its cap 13 clamped securely in place, the parts are sealed by the washers 16 and 17, so as to prevent the passage of either water or air through the same. The metallic ring 15 has its interior formed concave, as indicated at 15^a, and when the band is put in position the cement is poured into place, so as to form the sealing-cap 13, the cement filling the concavity of the ring, and thereby securely keeping the ring or band 15 in place. In this connection it will be noted that this arrangement of clamping the head of the filter-body between the flanges of the upper and lower casings 5 and 1, respectively, affords a very securely-sealed joint, at the same time requiring no great nicety of adjustment.

The water entering the unfiltered - water chamber 12 through the opening 18, (see Figs. 1 and 6,) to which it is supplied by the supply-pipe 19 under the pressure of the water-main, fills such chamber and is then forced through the filtering-body 9, thence through the packed charcoal contained in the annular space 11, thence through the walls of the tubular center part 10 into the interior space 14 thereof, which it gradually fills, and from this it ascends into the interior of the dome 5, whence it flows through the passage 20, extending through the head 13 of the filter-body to the drawing-off pipe 21, which extends to the main-fitting, hereinafter described, where its outlet is controlled by the drawing-off valve 22, which is normally closed, but opens during the filtering. The filtered water thus backs up in the dome 5, where it pockets the contained air and compresses the same to quite an appreciable degree, which depends upon the head or pressure in the main.

The main-fitting upon which the filter-casing 1 is mounted by its opening 2 is preferably a cast-body containing the various chambers and passages hereinafter described. The lower part of the fitting is provided with the tubular inlet 23, having an external screw-thread, by which it is screwed to the water main or pipe 24. This supply-passage 23 extends upwardly through the main-fitting and divides at 23^a, so as to pass around the drawing-off pipe 21, and extends thence off to one side, (see particularly Figs. 3 and 4,) where it opens into the valve-chamber 25, containing the valve 26, which controls a port 27 in one end of the valve-chamber 25. This port 27 supplies pipe 19, which connects, through the passage 18, with the interior of the upper end of the unfiltered-water chamber 12. This inlet-valve 26 has a valve-stem 28 extending through the opposite end of the valve-chamber from the port 27, where it has a suitable bearing and packing, and its outer end is formed with a hole 29, through which loosely

extends one end of an operating-bar 30, which is practically a rigid part of the operating-handle 31, to which it is secured by a pin 32, it being held in fixed relation to the handle 31 by means of this fixed pin and a pair of fixed projections 33 on the under side of the handle, (see Figs. 1, 2,) between which the bar extends. The operating-handle is pivoted at 34 to a fixed piece 35 on the main-fitting. The inlet-valve 26 is shown in the figures in closed position, and the throw of the handle 31 is sufficient, through means of the bar or piece 30, operating on the valve-stem 28, to move the same, so as to open the valve and permit the water to flow from the valve-chamber 25, through the port 27, into the supply-pipe 19.

The waste-water or cleansing valve 36 operates in a valve-chamber 37, formed upon the opposite side of the main-fitting from the valve-chamber 25 and corresponding substantially thereto, and the waste-valve controls an outlet-port 38, connecting with the waste-pipe 39, which may discharge downwardly through the pipe 40, or when this is not present may discharge through the extension 41, which is shown in the present instance as closed by a screw-plug 42. The waste-water pipe 3 connects directly with the waste-valve chamber 37, and normally the waste-valve 36 is open. (See Figs. 3 and 4.) The waste-valve 36 is operated by its valve-stem 43, which operates through a suitable packed bearing in the end of the valve-chamber 36 and extends outwardly, and its free end is provided with a hole or slot 44, in which loosely works the end of the piece or bar 30, which is operated by the handle 31, as previously described. When the operating-handle 31 is swung on its pivot 34, in addition to operating the inlet-valve 36 to open it it also, through means of the bar or piece 30, which then moves inwardly, forces in the valve-stem 43, and thereby closes the waste-valve 36 on the port 38, so that when the unfiltered water flows into the unfiltered-water chamber 12 by way of the valve 26 and the described passages the exit of such water is cut off by the waste-valve 36, so that the water let into the filter first fills up the passages, then the filtered-water chamber, and so on, as previously described. The valve-stems 28 and 43 of the inlet-valve 26 and waste-water valve 36, respectively, are mounted in similar packed bearings comprising a screw-plug 45, fitted in the end of its respective valve-chamber and provided with a packing-cap 46, as indicated in Fig. 4. These respective valve-chambers 25 and 37 are arranged in the same horizontal plane and upon opposite sides of the main-fitting, so as to give the same a symmetrical appearance, as shown particularly in Fig. 2, and to still further preserve the symmetry of the fitting the inlet or supply pipe fitting thereof at 23 (see Figs. 1 and 3) is arranged

centrally of the fitting, at the lower part thereof, while at the central upper portion thereof the waste-pipe nozzle 3 is formed.

The drawing-off valve 22, which controls the exit from the pipe 21, through which the filtered water may be drawn off whenever desired, is arranged in the valve-chamber 47 and controls a small outlet 48, which discharges into the curved nozzle 49, which is like the end of an ordinary faucet. The filtered-water pipe 21 connects with the main-fitting by means of a tubular projection 50 thereon, over which a nut 51 is placed, and this pipe 21 communicates with the valve-chamber 47 by a passage 21^a, extending through the fitting, as indicated in Figs. 1, 3, and 5. The drawing-off valve 22 is operated by a valve-rod 52, which works through a suitable bearing 53 on the side of the fitting, having suitable packing-cap 54, and the outer end of the valve-rod 52 is provided with a strong spring 55, which passes around the valve-stem and has its inner end bearing against the fixed cap 54, while its outer end takes against the fixed piece 56 on the end of the valve-rod. Normally the spring 55 holds the valve-rod outwardly, so as to keep the drawing-off valve closed on the port 48. The valve-rod 52 is pushed inwardly whenever the operating-handle 31 is turned through means of a fixed bracket 57, secured upon the end of the waste-valve stem 43 and having a fixed projection 58, extending over in line with the end of the valve-rod 52, which latter does not quite reach the piece 58 when the valve is closed. When the waste-valve rod 43 is thrust inwardly, this carries the fixed piece 58 along with it until it collides with the end of the valve-rod 52, and its continued movement forces such rod inwardly and forces the drawing-off valve 22 inwardly, so that the filtered water now finds its exit from the apparatus through the spout 49. It will be noted that the drawing-off passage-way 21^a, through which the filtered water is conveyed through the fitting, extends through the supply-passage 23 in the fitting and at a central point therein, as indicated particularly in Figs. 1, 3, and 5, and in this respect the symmetry of the fitting is also carried out.

From the foregoing description the operation of the filter will be readily understood. The drawings show the several parts in their normal relative positions and in which the supply-valve 26 is closed, likewise the drawing-off valve 22, while the waste-valve 36 is open. By swinging outwardly the end of the operating-handle 31 the valve-stem 28 of the inlet or supply valve 26 is drawn outwardly and this valve is opened, while the valve-stem 43 of the waste-valve is forced inwardly and the waste-valve closed on the port 38. This admits the water from the main 24, (see Fig. 1,) through the supply-passage 23 by way of valve-port 27, pipe 19, opening 18, to the un-

filtered-water chamber 12, the water from which first fills up the waste-water passages down to the closed waste-valve, and then the chamber 12 being filled the pressure of the water which is still supplied thereto forces the water through the filter-body and fills the interior space 14 thereof. The space 14 then becomes filled with the filtered water, whence it rises in the dome 5 and fills the connected passage 20 and the drawing-off pipe 21, passage 21^a, and the drawing-off-valve chamber 47, where the valve 22 is open, by reason of the inward movement of the waste-valve stem 43 having carried the valve-stem 52 inwardly. The exit or drawing-off passage 20, leading from the filtered-water dome 5, is small when compared with the size of the inlet-pipe 19, so that the water flows into the filtered-water compartment more rapidly than it flows out, and it therefore rises in the dome 5 and puts the air therein confined under considerable pressure. The outlet for the filtered water through the passage 20 is also reduced at the point 59, (see Fig. 1,) which is formed in a thickened part 60 of the flange 4 at the upper end of the casing 1, (see Figs. 1 and 6,) in which both the supply-pipe 19 and the drawing-off pipe 21 are formed and through which they practically extend. The outflow of filtered water from the drawing-off-valve chamber 47 is also impeded at that point by the reduced size of the outlet part 48. (See Fig. 1.) This differential flow of the water in its inflow and outflow, which permits the air to accumulate under pressure of the water in the dome 5, serves also to aerate the water in the dome, and the water drawn off from the dome is both filtered and aerated and in condition for the desired use. This operation continues as long as the supply-valve 26 is kept open, which condition continues as long as the hand of the operator keeps the end of the operating-lever 31 pressed outwardly—that is, toward the right hand in Figs. 2 and 4. Upon the operator moving the handle 31 from its outwardly-drawn position to its inward position, the spring 55 of the drawing-off-valve stem 52, which has been under compression during the condition just described, exerts its force and pushes the valve-stem 52 outwardly, thereby closing the drawing-off valve 22 of the port 48 and cutting off the outflow of the filtered water at such point. This inward movement of the handle acts on the waste-valve stem 43 to move it outwardly, thereby opening the waste-valve 36, and at the same time, through the intermediate action of the bar or piece 30 of the operating-lever 31, forces inwardly the valve-stem 28 and closes the supply-valve 26, which then cuts off the inflow of water from the main 24. These relative positions of the several described parts are shown in the several figures of the drawings, and since at this time the central chamber 14 of the filter-body 9 is filled with water likewise a considerable

portion of the dome 5, while the air above such filtered water being under considerable pressure the sudden opening of the waste-valve 26 will cause the pressure of the compressed air in the dome to force the filtered water therein and also in the recess 14 back through the filter-body 9 in the reverse direction from which it previously passed through the same, and thence into the unfiltered-water compartment 12, lying to the exterior of the filter-body. This reverse flow of the filtered water through the filter-body caused by the expansion of the air above the water to its natural volume acts to wash from the filter-body the foreign matter which has been strained or filtered from the water in its first passage through the filter-body and to throw off the matter from the exterior of the filter-body and thence into the unfiltered-water chamber 12, into which it is washed with considerable force, and from whence it passes out from the waste-outlet 3 to the exterior of the apparatus through the discharge-nozzle 40 or from any other suitable point in the apparatus, the object being to discharge this waste completely from the apparatus without any liability of its reëntering any part of it. It is found from considerable experience in this apparatus that this backwash automatically occurring after the drawing off of a portion of filtered water from the apparatus serves practically to wash off from the filter-body and the unfiltered-water chamber 12 all of the impurities or foreign matter, and thus to keep the filter-body clean and sweet, compared with other methods of filtering, so that the filter-body may be used a great length of time, and, in fact, it is found that the only limit to its duration is that in some of the waters the lime deposits therein eventually clog the filter-body, so as to permanently fill the pores thereof, and when this occurs to any great extent the filter-body must of course be renewed. It should also be noted that in this backwash under pressure the water which is used to wash out and cleanse the filter-body is filtered water, so that there is no foreign matter deposited by such backwash.

It has already been pointed out how the comparatively small drawing-off passage impedes the outflow of filtered water from the dome 5, so as to permit the air to accumulate in the dome above the water under pressure, and the water from the supply continues to flow in faster than the filtered water flows out until the air above the water is compressed to a point which checks the inflow or supply, so that at this time the outflow of filtered water is substantially equal to the supply of unfiltered water. When the backwash occurs after shutting off the supply-valve 26 to cleanse the filter, the air which is now relieved from compression above the water escapes to a certain extent with the waste water, and I therefore employ an air-valve 61, located in a suitable up-

ward extension 62 of the supply-pipe 19 and arranged to close upwardly to cut off the air-inlet by the pressure of the water in the supply-pipe. The part 62 is a tubular piece, the interior of which is in communication with the supply-pipe 19 through the opening 18, which extends laterally through the member 60 (see Fig. 6) and connects such supply-pipe with the annular chamber 12, surrounding the filter-body. A thimble-shaped casing 67, having the interior of its open end screw-threaded to receive a thread upon the part 62, is screwed upon the part 62 by the screw-thread, and the interior of the casing 67 is constantly in communication with the interior of the tubular part 62 by means of diagonal passages 65, extending from the interior of such part 62 upwardly to the upper edge thereof and at a point where they cannot be covered by the valve 61, as indicated in Fig. 1. The stem 68 of the valve 61 extends loosely through an opening 69 in the upper end of the casing 67, and the valve seats itself at 66 in the upper part of said casing and closes communication between the interior of the casing and the outer air afforded by the opening 69. This valve-casing 67 is covered by a removable hood 63, placed over the valve-casing and having a small drain-spout 64 extending from the side thereof, the purpose of the hood being to catch any water that may be sprayed or forced out from the valve-casing through the opening 69 around the valve-stem 68 before the valve can close on its seat, and the water thus escaping may drain from the hood by the spout 64. This valve is closed during the inflow of water through the pipe 19, but is automatically opened as soon as the supply-valve 26 is closed and the water begins to fall in the unfiltered-water chamber 12. This action serves to open the air-valve and admit air to the chamber 12 as well as to the interior of the filter-body and the filtered-water chamber, so that when the next supply of water is admitted through the valve 26 and pipe 19 the air-valve 61 automatically closes and the fresh supply of air which has just been admitted by the air-valve is forced ahead of the incoming water through the chamber 12 and the filter-body and into the filtered-water chamber and is therein compressed in the dome, as previously described. It will be observed that in its normal position the supply-valve 26 is so located as to be held on its seat in closed position by the pressure of the water present in the valve-chamber 25 and which has the same pressure as that in the main 24. In moving the handle 31 the first motion thereof is imparted, through the fixed piece 30, to the valve-stem 28, a very slight motion of which lifts the valve 26 from its seat and permits the supply-water to pass the valve, and when so opened the pressure of the water on the face of the valve will tend to force it still farther away from its seat.

This pressure exerted on the valve 26, when partially open, is not sufficient, however, to throw the operating-handle itself outwardly, and thereby open the drawing-off valve and close the waste-valve, though it has a tendency to do this. By virtue of this construction of the handle 31 and the intermediate piece 30, connecting the two valve-stems 28 and 43 and having a certain play relative to each and controlling the inward movement of the drawing-off-valve stem 52 by complete inward movement of the valve-stem 43, but having a slight lost motion between the operative connection of the valve-stem 43 and that of the valve-stem 52, the operator may readily set the handle into partially-open position, so as to open the supply-valve 26 quite fully without, however, closing the waste-valve 36 or opening the drawing-off-valve 22. This capability of the arrangement may be seen particularly from Figs. 1, 2, 4, and 5, wherein it is noted that normally there is quite a gap or play between the drawing-off-valve stem 52 and the piece 58 which forces it in. Under this condition of the supply-valve being somewhat opened and the waste-valve not closed and the drawing-off valve still in its normal closed position the water may be allowed to pass from the main 24 through the supply-passage 23, thence the supply-pipe 19, opening 18 into the unfiltered-water chamber 12 and directly out of the same through the waste-opening 3, and thence discharged from the waste nozzle or pipe 40 in the same condition in which it has entered the apparatus from the main pipe 24. In this way the filter need not be used as a filtering device when the water to be taken from the apparatus is for uses other than drinking purposes, and to this extent the life of the filtering medium may be prolonged by its not necessarily being called upon to perform its filtering function, as is the case in many constructions wherein it is not possible to draw water from the apparatus other than filtered water, and this in some cases necessitates the use of an extra faucet for drawing direct from the main. By setting the operative handle 31 at this intermediate position between the full-closed and full-opened points the water may be made to flow with the full force derived from the main and with considerable agitation through the unfiltered-water chamber 12 and over all of the exposed surface of the filter-surface of the filter-body 9 within the chamber 12, so that such exterior surface of the filter-body may be in this way washed off and any foreign matter deposited thereon may be carried out through the waste-pipe. If desired, an ordinary scale showing the full-open and full-closed positions as well as the intermediate position of the operating-handle may be used in conjunction therewith.

The particular form of filter-body which I herewith show—namely, that having a central

chamber 14, provided by central tubular portion 10—affords an extensive capacity for accommodating filtered water, at the same time increasing the filtering-surface, the water being filtered into it through the bottom portion of the filter-body directly into such space as well as through the walls 10 of the tubular part indirectly through the mass of charcoal packed in the annular space 11 of the filter-body 9. The complete filter-body 9, with its central tubular portion 10, molded from unglazed porous earthenware, is herewith shown as being formed in one piece, though in practice I often make the central portion 10 separate and cement it to the bottom of the main portion in the position shown in Figs. 1 and 6. The construction of this filter-body 9 with the cement cap 13 and its protecting-band 15, which band being made of metal serves as a rigid piece for being interposed between the clamping members comprising the lower part 1 of the casing and the upper part 5 of the casing, is another important feature, as it will be seen that in addition to this metallic band 15 protecting the fragile cement it affords all the necessary resistance to the clamping force referred to without having to use a separate and distinct piece for protecting the part of the filter-body that is gripped by the clamping members to suspend such body. This cement cap 13, which is put on in plastic condition and molded with its band 15 in position, also seals the head of the filter-body with its contained charcoal in the annular space 11, so as to prevent any one from tampering with the interior structure of the filter-body. By this particular construction of having the metallic ring 15 form part of the suspending-head of the filter-body and utilizing it as a rigid abutment or part against which the clamping together of the sections may be directed to both suspend the body in operative position and to form at such point an air and water tight joint the structure is much simplified and at the same time rendered more efficient. With the described construction there is really but one place where there is any liability of the unfiltered water leaking into the filtered-water chamber and that is through the joint formed between the interior concavity 15^a of the metallic ring 15 and the cement head 13; but as this joint can be made absolutely waterproof there is little liability of this occurring, and this is, in fact, the only way through which the accident of mingling the unfiltered water with the filtered water can take place. In this respect this construction of filter has the advantage over many constructions in use wherein the leakage of unfiltered water into the filtered water may accidentally take place at several points.

It is also important to have the pipe connections, either the supply-pipe or the drawing-off pipe, or both, arranged so as the same do not pass through the water contained in any

part of the filtering apparatus, and this improved construction provides a way of obviating this, since it will be noted that both the supply-pipe 19 and the drawing-off pipe 21 lie wholly to the exterior of the apparatus and practically no part of these pipe connections pass through a body of water in the filtering apparatus, as is the case in some constructions of filters, and I thereby avoid the defect of the presence of corrosive material in such water. Moreover, any leakage from these parts may be more easily detected than if the same were concealed within the filter apparatus, and in case there should be leakage from any of the pipe connections or their joints, the same being practically to the exterior of the apparatus, the unfiltered water cannot in this accidental way become mixed with the filtered water, as might otherwise be the case. These pipe connections 19 and 21 are made of block-tin, while the main fitting at the base of the apparatus in which the various passages and valve-chambers are formed is of a suitable metal casting, such as brass, so it will be seen that the filtered water in its pure state only comes in contact with such metal and the earthenware and cement, thereby being uncontaminated and maintained in its pure state until delivered from the spout 49 of the apparatus.

The main fitting at the base of the apparatus is a suitably-shaped metal body cast in one piece with the two horizontal valve-chambers 25 and 37 of the supply and waste valves, respectively, formed at the opposite sides of the body on the same level, as indicated in Figs. 2, 3, and 4, and have the exteriors thereof rounded, as indicated in the drawings, so as to appear alike, while from the center thereof between the two casings 25 and 37 projects upwardly the waste-pipe connection 3, and directly below the same at the lowest point extends downwardly the supply-pipe connection 23 for communicating with the main 24, the drawing-off-valve chamber and spout 40 being located on the center line to one side of the fitting with the valve-stem mounting directly above it, the drawing-off pipe 21 communicating with the passage 21^a of the fitting being also on the center line thereof upon the opposite side and extending bodily through the supply-passage 23, as indicated in Figs. 1, 3, and 5, the waste-pipe outlet 39 40 being arranged at one end of the waste-valve casing 37, and, finally, the operating-handle 31 being pivoted at 34 to a fixed boss or projection 35, extending centrally from one side of the upper portion of the casing, as indicated in Figs. 1 and 2. This main fitting with these described parts constituting the different bearings to the moving parts, coupling-joints, passage-ways, and ports is preferably cast in one piece and constitutes a strong and durable part for both the mounting of the moving parts therein, as referred to, as well as prac-

tically sustaining the filter-casing with its contained filter-body and the body of water therein. The operating-handle 31 may of course be mounted at any point on the fitting than on the boss 35, so long as it can be made to act upon the valve-stem 28 and 43 and in turn control the valve-stem 52. The part 30, which connects the handle with both the valve-stems 28 and 43, is practically a part of the handle, though it is shown as separate therefrom; but it has no function in being a separate piece from such handle, as it responds to the swinging movement thereof. It will also be noted that the supply-valve 26, waste-valve 36, and the drawing-off valve 22 are simple forms of valves, the two former being ordinary disk valves covered with a soft material, as indicated in heavy dark lines in Figs. 4 and 5, the valve 22 being an ordinary flat valve closing over its port 28 without any special fitting to the seat thereof. This has an advantage over a ground-metal valve that is required to fit with great nicety in its seat, as the latter type of valve becomes quickly worn and soon leaks, and in some constructions of filters the leakage is such that the unfiltered water is diverted in great quantities directly into the filtered water, thereby defeating the perfect operation of the apparatus. In my construction these simple forms of valves do not wear so rapidly as to leak, and in case they do the user of the filter can easily replace the soft material of the valve by removing the screw-plug 45 and taking out the valve-stem with its valve.

This construction of filter, in which filtration takes place through unglazed earthenware and the oxidation is effected through animal charcoal and the water at the same time aerated, provides a very efficient apparatus, particularly in respect to the self-cleansing feature thereof, as it will be noted that the foreign matter filtered from the water never gets beyond the exterior surface of the filtering-body in the unfiltered-water chamber 12. This permits the ready washing off of such matter by the return flow of the filtered water, and when once this foreign matter is dislodged from the surface from where it is deposited it is carried out by the waste water without the possibility of being in any way returned to the apparatus. By this means of self-cleansing the filter-body is not subjected to any wear, as is the case in some forms of filter in which knives are used to scrape the filter-body, the action of the knives resulting in the constant wearing away of the filter-body until finally it is destroyed. Again, in the construction herewith shown there are no loose or working joints in the filter itself, thereby avoiding any accidental leaking and causing the filter to operate without really any possibility of the unfiltered water being mixed with the filtered water.

I wish to be understood as not limiting my

invention to the exact form of structure herewith shown, as it is evident that various changes may be made in the different parts thereof without, however, departing from the spirit of the invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A self-cleansing filter comprising an unfiltered-water chamber, a closed filtered-water and air chamber, a filtering medium between and separating the two said chambers, a pipe extending from the filtered-water chamber and provided with a valve for drawing off the filtered water, the said pipe lying to the outside of both of said chambers, a supply-pipe connected with said unfiltered-water chamber and lying to the outside thereof and provided with a valve for controlling the inflow of water, a waste or discharge passage leading from the said unfiltered-water chamber and provided with a valve for controlling the same, a hand-lever connected with and operating each of said three valves and normally holding closed the valve of the drawing-off pipe likewise the supply-valve and normally holding open the valve of the waste or discharge passage of said unfiltered-water chamber, and operating to open the two said valves which are normally closed and to close the one that is normally open, substantially as and for the purpose set forth.

2. A self-cleansing filter comprising an unfiltered-water chamber, a closed filtered-water and air chamber, a filtering medium between and separating the two said chambers, a valve for controlling the drawing off of the water from the filtered-water chamber and normally closed, a supply-pipe for supplying the water to the unfiltered-water chamber and a valve controlling such supply, a waste or discharge passage leading from said unfiltered-water chamber and a valve controlling the same and normally open, an operating-lever and connections between the same and each of said three valves adapted to be set in an intermediate position between the full closed and full open one, whereby the supply-valve may be opened without closing the waste-valve to permit the unfiltered water to pass from the supply through the unfiltered-water chamber and out of the waste-passage, substantially as and for the purpose set forth.

3. A self-cleansing filter comprising an unfiltered-water chamber, a closed filtered-water and air chamber, a filtering medium between and separating the two said chambers, a valve for controlling the drawing off of the water from the filtered-water chamber and normally closed, a supply-pipe for supplying the water to the unfiltered-water chamber and a valve controlling such supply, a waste or discharge passage leading from the unfiltered-water chamber and a valve controlling the same and normally open, a spring for nor-

mally keeping the drawing-off valve closed, an operating-lever and connections intermediate the same and each of said valves and normally holding the supply-valve closed and the waste-valve open and adapted when moved into full open position to close the waste-valve and open both the supply and drawing-off valve and when moved into closed position to open the waste-valve and close both the supply and drawing-off valves, substantially as and for the purpose set forth.

4. A self-cleansing filter comprising an unfiltered-water chamber, a closed filtered-water and air chamber, a filtering medium between and separating the two said chambers, a supply-pipe for supplying water to the unfiltered-water chamber and provided with a reciprocating valve normally held closed on its seat by the pressure of the water thereon, a drawing-off pipe connected with the filtered-water and air chamber and a spring-actuated valve normally closing the outlet thereof, a waste-passage leading from said unfiltered-water chamber and provided with a normally open valve, and an operating-lever with connections intermediate between such lever and each of such valves and serving when the lever is in closed position to keep the waste-valve open and both the supply and drawing-off valves closed and when in open position to keep the waste-valve closed and both the supply and drawing-off valves open, substantially as and for the purpose set forth.

5. A self-cleansing filter comprising an unfiltered-water chamber, a closed filtered-water and air chamber, a filtering medium between and separating the two said chambers, a supply-pipe connected with said unfiltered-water chamber and having a reciprocating valve provided with a stem and normally closed upon its seat, a waste-passage leading from said unfiltered-water chamber and provided with a reciprocating valve having a stem and normally open, a drawing-off pipe or passage leading from said filtered-water and air chamber and provided with a valve having a stem and a spring for normally keeping the valve closed, an operating-lever connected with the stem of said supply and also said waste-valve, and connections between the waste-valve stem and the drawing-off-valve stem whereby the former in its complete inward movement is operative upon the latter to open said drawing-off valve but is inoperative upon the same in its outward movement, substantially as and for the purpose set forth.

6. A self-cleansing filter comprising an unfiltered-water chamber, a closed filtered-water and air chamber, a filtering medium between and separating the two said chambers, a main-fitting provided with a supply-passage for connecting with the main, a valve-chamber therein and a reciprocating supply-valve mounted in said chamber and provided with a valve-stem and normally held closed on its seat, a

supply-pipe connecting said supply-valve chamber with the unfiltered-water chamber, the said main-fitting being also formed with a waste-passage adapted to be connected with
 5 said unfiltered-water chamber and said passage being connected with a valve-chamber having a reciprocating valve mounted therein and provided with a valve-stem and normally kept open, the said main-fitting being also pro-
 10 vided with a drawing-off-valve chamber having a valve mounted therein and provided with a stem and a spring for normally keeping said valve closed and the said drawing-off-
 15 valve chamber having a passage leading therefrom and a drawing-off pipe connecting the same with the said filtered-water and air chamber, substantially as and for the purpose set forth.

7. A self-cleansing filter comprising an un-
 20 filtered-water chamber, a closed filtered-water and air chamber, a filtering medium between and separating the two said chambers, a main-fitting provided with a supply-valve chamber
 25 25, a supply-passage 23 adapted to be connected with the main leading through the fitting and connected with said valve-chamber 25, a reciprocating valve 26 mounted in the valve-
 30 chamber 25, a supply-pipe connected with said valve-chamber 25 and also with the unfiltered-water chamber and such pipe being controlled by the valve 26, the said main-fitting being
 35 also formed with a valve-chamber 37, having a discharge-passage 3 connecting therewith and adapted to communicate with the said un-
 40 filtered-water chamber and also connected with a discharge 39 controlled by said valve 36, the said main-fitting being also formed with a drawing-off-valve chamber 47 having
 45 a valve 22 mounted therein and provided with a discharge-port and also with a passage 21^a extending through said fitting, and a pipe connecting said passage 21^a with the said filtered-
 50 water and air chamber, and an operating-lever for controlling the three said valves and when in closed position serving to keep the
 supply and drawing-off valve closed and the waste-valve open, and when in open position to keep the waste-valve closed and the supply
 and drawing-off valves open, substantially as
 and for the purpose set forth.

8. A filter comprising the combination of a lower inclosing casing and also an upper inclosing casing, a filter-body provided with a
 55 laterally-projecting head having a rigid band surrounding the same and adapted to be clamped between the said upper and lower casing to suspend the filter-body in position
 60 within the casing, an unfiltered-water chamber lying to one side of said filter-body and a filtered-water chamber lying to the other side thereof and means for supplying water to the
 former and drawing it off from the latter, substantially as and for the purpose set forth.

9. The combination of an upper and lower
 65 casing adapted to be clamped together, a cup-

shaped filter-body having the upper end thereof provided with a sealing-head projecting laterally therefrom, a band of rigid material surrounding the said head and adapted to be
 70 clamped between said upper and lower casing for suspending the filter-body in position within the casings, an unfiltered-water chamber lying to one side of said filter-body and a
 75 filtered-water chamber lying to the other side thereof and means for supplying water to the former and drawing it off from the latter, substantially as and for the purpose set forth.

10. The combination of an upper and lower casing adapted to be clamped together, a rigid
 80 filter-body provided with a suitable space for retaining therein loose filtering material, and a sealing-head of non-filtering plastic material molded upon and securely fixed to said filter-
 85 body and sealing the space therein, the said sealing-head being provided with a lateral projection or shoulder adapted to be clamped between the two said casings for suspending the
 said filter-body in operative position, substantially as and for the purpose set forth.

11. A cup-shaped filter-body having the upper
 90 end thereof provided with a central tubular portion whereby there is constituted an annular space within said filter-body and said annular space being filled with filtering material, a non-filtering head of plastic material
 95 placed over the head of said filter-body to seal the annular space therein, substantially as and for the purpose set forth.

12. The combination of a lower main casing constituting the unfiltered-water chamber, an
 100 upper casing constituting the filtered-water chamber and the said two casings being adapted to be clamped together, a filter-body having a head for sealing the upper end thereof
 105 and projecting laterally therefrom, a band of rigid material surrounding said projecting head and adapted to be clamped between the said upper and lower casing, and suitable washers
 110 interposed between each of said casings and the rigid band for making the joints both air and water tight, substantially as and for the purpose set forth.

13. The combination of the lower main casing provided with a flange such as 4, the upper
 115 casing provided with a flange such as 7 and having the circular extension 8 adapted to fit over upon the flange 4 of the lower casing, and means for clamping the two said casings together, a filter-body provided with a head
 120 having a lateral projection and such projection being clamped between the two said casings to suspend the filter-body in position, an unfiltered-water chamber upon one side of the
 125 filter-body and a filtered-water chamber upon the other side and means for supplying the water to the former and drawing it off from the latter, substantially as and for the purpose set forth.

14. A self-cleansing filter comprising an un-
 130 filtered-water chamber, a closed filtered-water

and air chamber, a filtering medium between
and separating the two said chambers, the said
unfiltered-water chamber being provided with
a valved supply and a valved waste and the
5 said supply having an outwardly-closing air-
valve adapted to close when the water is being
supplied and to open to admit the exterior air
when the reverse flow of water takes place
through the filtering medium and passes out
10 of the waste, and a valved drawing-off-pipe
connection leading from the filtered-water
chamber, and means for controlling said valves
to keep the supply and drawing-off valves
closed and the waste-valve normally open and
15 adapted to close the waste-valve and open
both the supply and drawing-off valves, sub-
stantially as and for the purpose set forth.

15. A self-cleansing filter comprising a
lower main casing an upper casing secured
20 thereto, a filter-body mounted within said cas-
ings and an unfiltered-water chamber upon
one side thereof and a filtered-water chamber
upon the other side, a waste-discharge leading
from said unfiltered-water chamber through
25 which the reverse flow passes in cleansing the
filter, the said lower casing being provided
with a part 60 formed with a supply-passage
18 leading to the unfiltered-water chamber and
a supply-pipe 19 connecting with said supply-
30 passage, a drawing-off-pipe connection extend-

ing through said part 60 and connecting with
the drawing-off passage leading from the fil-
tered-water chamber, substantially as and for
the purpose set forth.

16. The combination of an unfiltered-water 35
chamber provided with a water-supply, a fil-
tered-water chamber having means for draw-
ing the water therefrom, a filtering medium
arranged between the two said chambers,
means for confining the air above the filtered 40
water under pressure thereof, means for si-
multaneously supplying water to the unfil-
tered-water chamber and drawing it off less
rapidly from the filtered-water chamber than
said supply, mechanism for closing both said 45
supply and drawing-off means and at the same
time opening the unfiltered-water chamber to
the waste for the backwash, and an inwardly-
opening valve located in said supply-pipe for
admitting air thereto but preventing the es- 50
cape of water therefrom, substantially as and
for the purpose set forth.

In testimony whereof I have hereunto set
my hand in the presence of two subscribing
witnesses.

BRYCE METCALF.

Witnesses:

WILLIS FOWLER,
MELVILLE H. CANE.