

(No Model.)

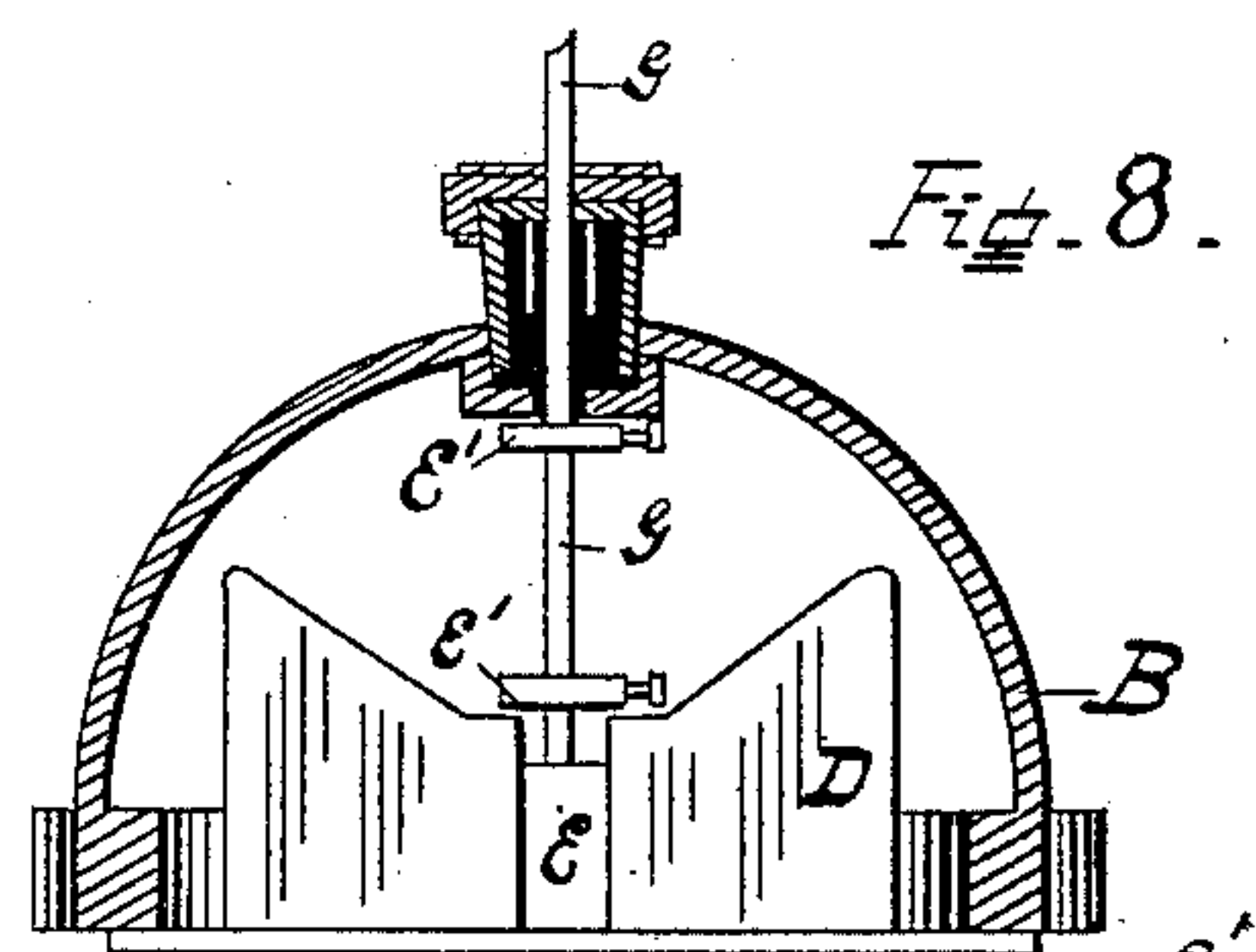
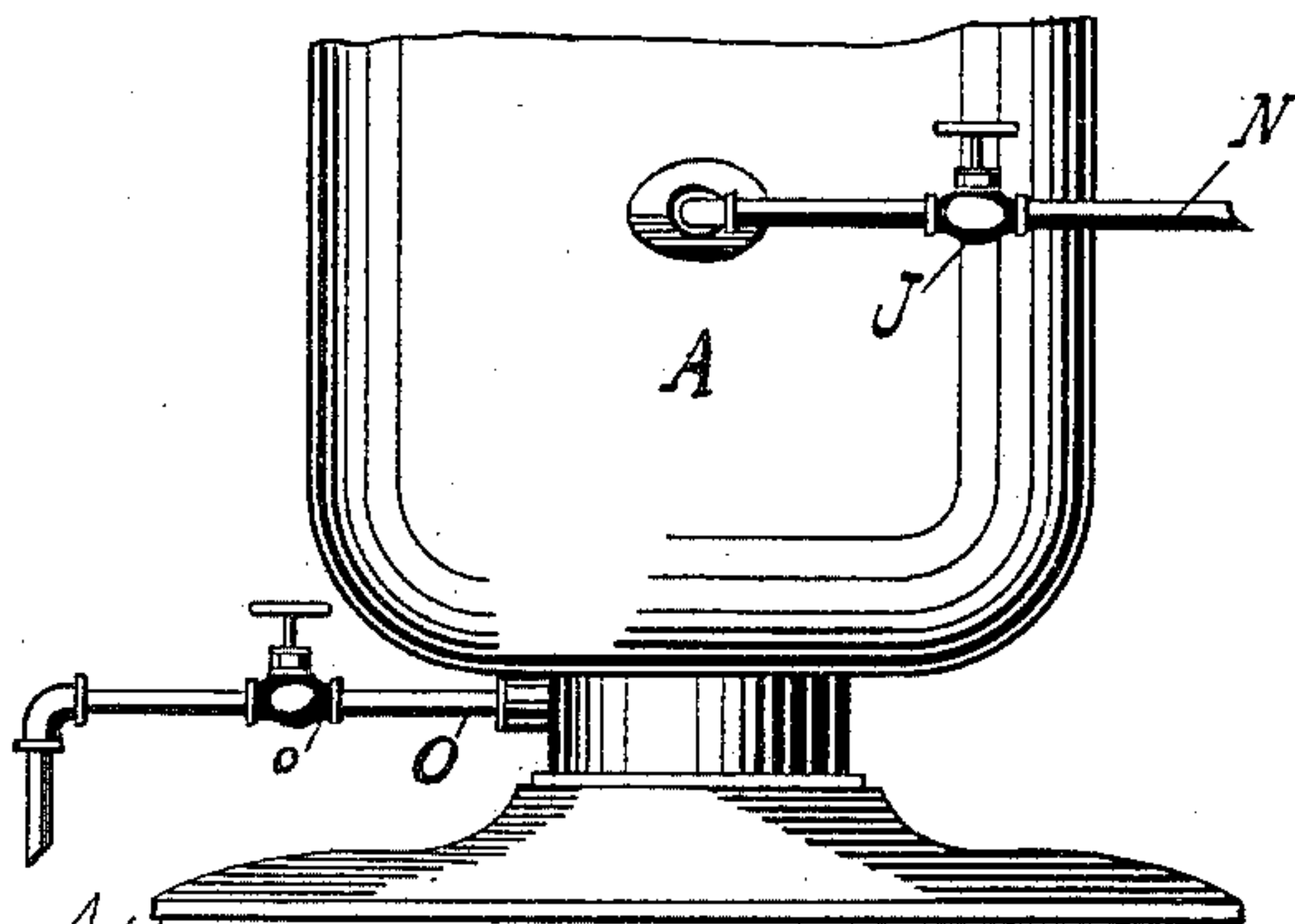
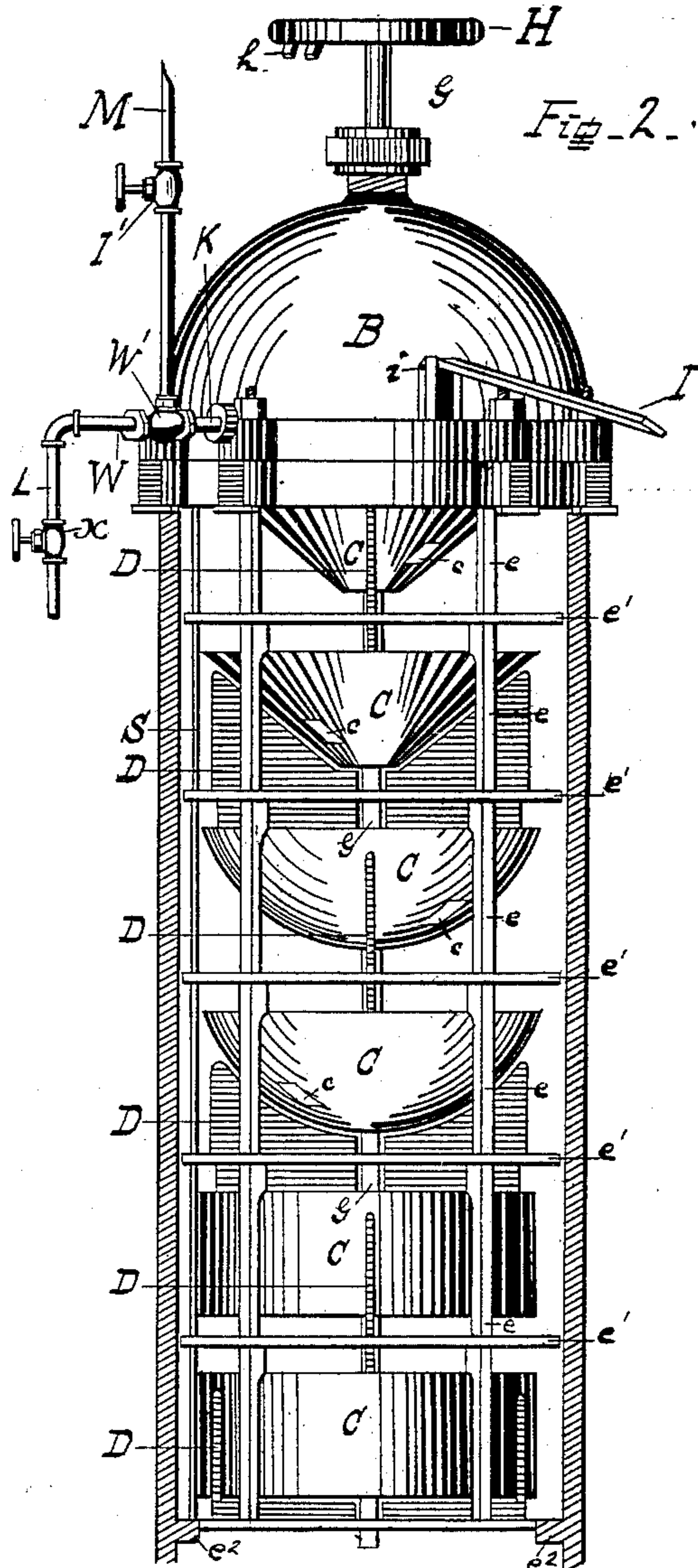
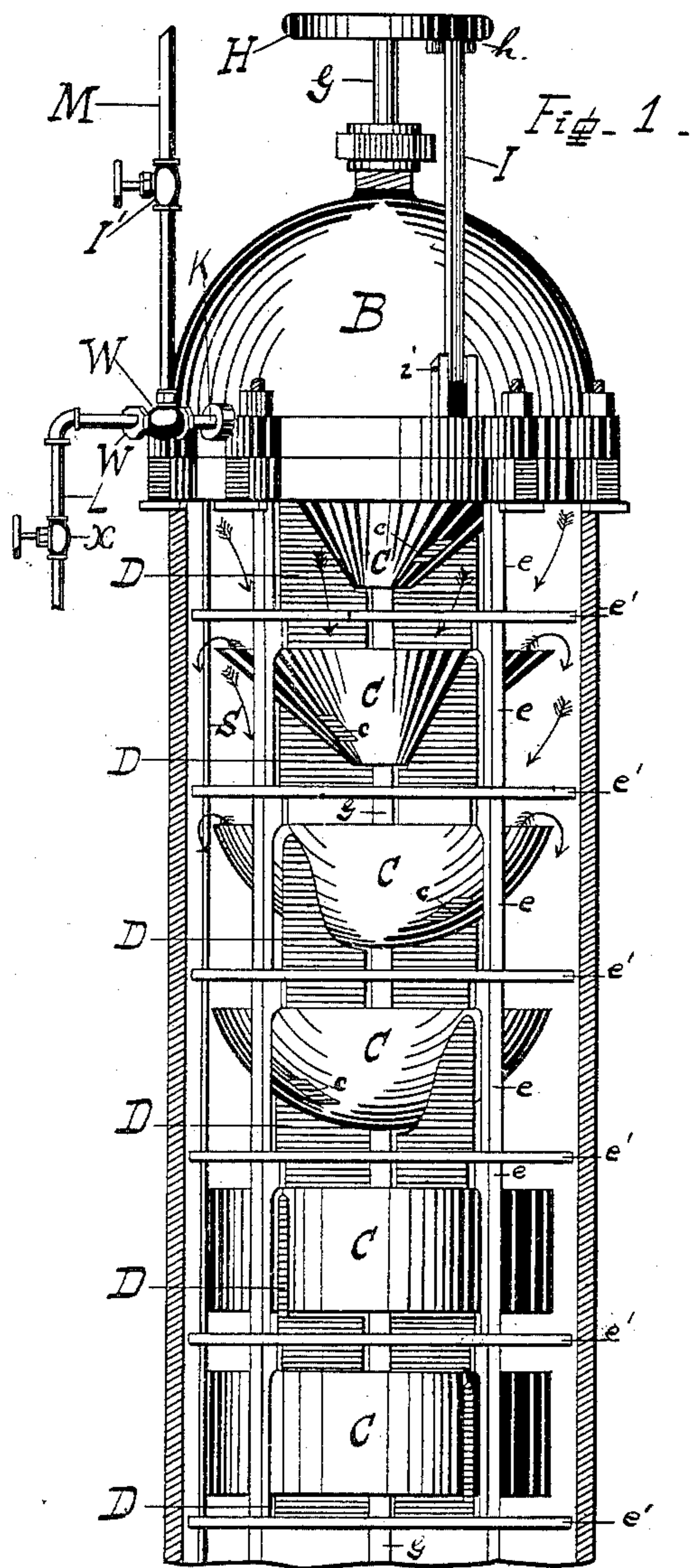
2 Sheets—Sheet 1.

E. W. VANDUZEN.

PURIFIER OF THE WATER OF STEAM BOILERS.

No. 339,244.

Patented Apr. 6, 1886.



Attest—
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UNITED STATES PATENT OFFICE.

EZRA W. VANDUZEN, OF NEWPORT, KENTUCKY.

PURIFIER OF THE WATER OF STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 339,244, dated April 6, 1886.

Application filed July 3, 1884. Serial No. 136,784. (No model.)

To all whom it may concern:

Be it known that I, EZRA W. VANDUZEN, a resident of the city of Newport, in the county of Campbell and State of Kentucky, have invented certain new and useful Improvements in Purifiers of the Water of Steam-Boilers, of which the following is a specification.

The several features of my invention and the advantages resulting from their use, conjointly or otherwise, will be apparent from the following description and claims.

In the accompanying drawings, Figure 1 represents a purifying apparatus illustrating my invention, the central portion of the outer shell being shown in section and the rest of the apparatus in elevation, the parts being in their working position. Fig. 2 represents a similar view of the same apparatus, except that the basal portion is omitted, the parts being in position for being flushed and cleaned. Fig. 3 shows the arrangement of the pipes connecting the purifier with the boiler. Fig. 4 represents a perspective view, showing a catch-basin, its preferred supports, and scraper and valve in position for cleaning the catch-basins. Fig. 5 is a sectional elevation of the catch-basin. Fig. 6 is a plan view of the catch-basin. Fig. 7 represents in perspective a view of the valve without the scrapers. Fig. 8 represents a vertical central section of dome or top B, showing the preferred manner in which top scraper and shaft G are held in place by collars E' and stuffing-box of valve.

The outer exterior shell, A, of the purifier is preferably of a cylindrical form, as shown. This shell is provided with a top, B, which may preferably be made dome-shaped, as shown. Within this shell A are placed a series of catch-basins or settling-pans, C, one above the other. These catch-basins may be made of any suitable form. Some of these suitable forms are cylindrical shells, and having a bottom of segments of a hollow sphere, or of a truncated cone, as shown; but the form I prefer is that of the truncated cone.

The scrapers D are vertical plates, shaped to fit the inner surface of the pan in which they rest and their upper edge corresponding in outline to the bottom of the settling-pan above. Each pair of scrapers has a center

piece, E, which unites them. The preferred means of supporting these catch-basins are as shown, the legs *e*, three or more in number, and which project downwardly and preferably extend below the bottom of the catch-basin which they support. Near to but located above the top of the catch-basin is a deflecting-ring, *e'*, whose periphery is close against the interior surface of shell A. This deflecting-ring may consist of one ring or a series of deflecting-wings. This ring or rings *e'* may be supported by the shell A, or in any other suitable manner. A preferred mode of support is to make the catch-basin or its supports uphold the ring, and in the present instance I carry out this mode of supporting the ring by extending the legs *e* upward above the catch-basin and resting the ring upon their upper ends.

For convenience of manufacture and in putting the apparatus together and taking it apart, and other reasons, the ring *e'*, legs *e*, and the catch-basin C are all cast together in one and the same piece. The legs of the lowest catch-basin are suitably supported. I have shown a preferred means of supporting this lowest basin—viz., by an annular flange, *e''*, cast or otherwise attached to the inner side of the shell A. On this flange the legs of the lowest catch-basin rest. The ring *e'* next above this lowest basin C affords a convenient support for the legs of the catch-basin next above, and the ring next above this last-named basin affords a support for the legs of the basin next above. Thus each ring *e'* in turn supports the catch-basin next above throughout the upward extent of the whole or the principal portion of the shell. This series of rings and basins are suitably held down firmly in position. A desirable means for thus holding them consists of making the interior diameter of the top or head B (when the latter meets the shell A) less than the interior diameter of the shell A, and thus causing the head B to extend onto and press down the uppermost ring, *e'*, the location of the flange *e''* or equivalent support and the interrelative height of the basins and rings being previously adjusted, so that the uppermost ring, *e'*, shall come up to the lower portion or the top or head B.

Instead of making the interior diameter of

the top B everywhere less than the interior diameter of shell A, lugs or projections might project inwardly from said top B at suitable points around the interior of said top.

5 By screwing or otherwise fastening down the head B to the shell, the series of rings and basins are likewise held firmly in position.

A preferred means for preventing the basins and rings from rotating within the shell A consists as follows: A vertical bead or rib, S, is cast on or connected to the inside of shell A. In the periphery of the ring e' is a notch, t , and when the basin C and its ring e' are slipped into the shell the rib S enters the notch t and prevents the ring and basin from turning. The notches are preferably so arranged with reference to the catch-basins, that the notch in the lowest ring being opposite one point—as, for illustration, say, V, Fig. 6—the notch in the ring over and belonging to the basin next above is at a point ninety degrees away—say, for such illustration, W^2 of the said second basin—the notch on the ring immediately over the third basin is again at the point V of said third basin, and the notch on the ring immediately over the fourth basin is at the point W^2 again with reference to said fourth basin, and thus the position of the valve opening or openings c (to be hereinafter described) in each basin will be at least ninety degrees away from those of the basin next above it.

By making two notches in the periphery of the ring e' ninety degrees apart, the same pattern will do for casting all of the basins with their legs and rings.

In the bottom or lower portion of the catch-basin are one or more openings, c , of any desired shape. Two of such openings is the preferred number, and when two are present they are preferably at opposite sides of the vertical axial center of the basin. A suitable valve, preferably lying upon and fitting the bottom of the basin, is present, and this valve covers or uncovers at will, through the agency of any desired means, its respective opening c .

The preferred means for operating the valve consists of a vertical rod or shaft, G, preferably square, and passing down through a collar, E, having a correspondingly-shaped opening, the shaft G engages the collar. This collar is attached to the valve d , and where there are two openings c arranged as shown, the two valves are respectively located at opposite sides of the collar. By turning the shaft G, the valve or valves are moved on the basin.

Preferred means for operating the collar consist in extending the shaft G through a suitable air-tight joint or stuffing-box in the top B of the shell and above the said top, and connecting to the top of the shaft G a hand or wheel crank, H. Turning the wheel H rotates the shaft G and moves the valve or valves in each catch-basin.

Preferred means for preventing the shaft G from slipping up through the top B consist of a collar, as E' , inclosing and fastened by a set-screw or other suitable means to the

shaft G, directly beneath the top of the interior of the head B.

Preferred means for preventing the shaft G from slipping down through the catch-basins consist of a collar, as E' , inclosing and fastened by set-screw or other suitable means to the shaft G, and resting down on the collar E of the uppermost valve.

It becomes desirable to lock the shaft G when the openings in the catch-basins are closed by their respective valves, and any suitable mode of locking is to be adopted. A desirable mode is as follows: A pawl or locking-arm, I, is pivoted at its lower end to a support, i , cast or otherwise secured to the head B. The upper end of this pawl engages the wheel or crank H, preferably by engaging, as shown, a recess or opening, h , with which latter the said wheel or crank H is provided.

For the purpose of cleaning the under side of the bottom of the catch-basin, and of cleaning any portion of the upper surface of the bottom of the catch-basin which may not be scraped by the valves, and for the purpose of cleaning the deflecting plate or ring e' , I employ a device which I will term a "scraper," and which is preferably constructed as follows: The scraper consists of two wings, D D, located, respectively, on the opposite sides of the collar E, and attached thereto. Each wing is preferably attached, also, to the valve, which lies on each side of collar E. The collar E and valves and wings are preferably cast together in one piece. The bottom edge of the wing at the outer end of the valve descends and impinges directly on the upper surface of the bottom of the catch-basin. This part of the wing which thus impinges I will indicate by letter p . The wing also projects over in projection p' , and scrapes the upper edge of the catch-basin. The wing impinges against the inner surface of the deflecting-ring e' , and also projects over in projection p^2 , and scrapes all or a portion of the upper side of ring e' . The outer vertical edge, p^3 , of the scraper cleans the inner side of the legs e of the catch-basin above and the extensions of legs e which support the ring e' immediately over the catch-basin in which the scraper is located. The top edge, p^4 , of each wing of the scraper scrapes the bottom of the basin next above. As the scraper is fixed to the collar E, the rotation of the shaft G turns the scrapers as well as the valve. I employ this purifier for a two-fold purpose. The first purpose is to take the water from the boiler and clean it and return it thereto. This operation I will first describe. The feed-pipe M from the boiler to the purifier is preferably at its end in the boiler provided with a suitable skimmer, P. This end of the inlet-feed pipe M is located just below the surface of the water in the boiler. The other end of this feed-pipe M communicates with the interior of the shell at K, being connected to the purifier near or at the top of the latter. The exit-pipe N for delivering water (after passing through the

purifier) to the boiler communicates with the interior of the purifier near the bottom, preferably above the settling-chamber V and below the lowest catch-basin. This exit-pipe N passes into that end portion of the boiler which is opposite where the inlet-pipe enters, and passes down into the boiler, and this end of this pipe N is lower than that end of pipe M which is in the boiler. The pressure of steam on the water in the boiler forces the water through the pipes M and K into the purifier. The water thus introduced into the purifier will become somewhat cooled and will fall and seek an outlet through exit-pipe N into the boiler. Thus a circulation of water through the purifier is established. This circulation is preferably accelerated as follows: I cause the feed-water which is to be fed to the boiler (to supply the deficiency of water caused by evaporation) by the feed-pump or feed-inspirator, or other suitable means, to pass into and through the purifier. This feed-water from the pump passes through a pipe, as L, into the purifier. Preferably an ejector, W, is located at the junction W' of the pipe L and the pipe M, and this feed-water passes through the ejector before reaching the purifier. The pipe M is also preferably connected to the ejector W, as shown, and thus the water from the boiler will pass through the ejector on its way to the purifier. The ejector will thus aid in rapidly drawing the water from the boiler and sending it into the purifier. The ejector may be placed in the pipe N, the pipe L being connected to pipe N at the ejector. The ejector will in such event draw water from the boiler into the purifier; but such a mode is not as desirable as the other mode, as in such case the fresh feed-water from the feed-pump or like source will pass into the boiler directly, and without first passing through the purifier, and the heavier portions of sediment and dirt held in suspension in this fresh feed-water will be dropped in the boiler instead of in the purifier. Water when boiled will more readily deposit the matter it has carried in solution and suspension. Thus if the feed-water passes into the pipe N, and directly thence into the boiler without first passing through the purifier, it will be first heated in the boiler and will deposit in the boiler most of the heavier portions of the matter which it has heretofore held in suspension and solution.

The mode in which my purifier operates is as follows: The fresh feed-water through the pipe L passes through ejector W and enters the purifier, and in this the ejector draws boiling water from the boiler through pipe M and forces it rapidly into the purifier along with the fresh feed-water coming from pipe L. The fresh feed-water being mixed with the boiling water from the boiler is heated, and is in better condition for depositing the matters it has held in suspension and solution. This mixed water from the boiler and pipe L now passes down inside the first ring and

moves toward and into the first upper catch-basin, C. It now seeks an outlet over the upper edge of the first basin and passes outward over said edge and under the said first ring, e', and, striking against the interior of the shell or cylinder A, is deflected toward the central portion of the catch-basin C next below. It again moves outwardly over the edge of this basin and under the ring immediately above said basin, and passing downward and outward it again strikes against the shell A and is again deflected inward toward and into the central portion of the next catch-basin. In the same manner the water passes down through the purifier, coming successively into each catch-basin. As it passes toward and into each catch-basin, the heavier portions—viz., the foreign matters in the water, assediment, other dirt, and heavy impurities—are thrown downward and toward the center of the catch-basin and settle down there while the water freed from such impurities passes over the upper edge of the basin. Ordinarily the water in the lower central portion of the basin is comparatively quiet. The water coming rapidly down into the catch-basin, imparts to the dirt and sediment it (the water) contains a momentum which projects these foreign matters down into the center of the basin beyond the current of water which is moving outwardly over the edge of the basin, and thus these foreign matters are projected into the still water into the center of the basin, and settle quietly down there. Thus, in passing down from basin to basin the water is freed from all or the largest portion of the sediment, dirt, &c., which it contained when it entered the purifier. After leaving the lowest basin the water may pass directly into the outlet-pipe N, but preferably enters a mud-chamber, V, and depositing any remaining impurities (usually lighter vegetable matter) it may contain, which passes out of the pipe N, the opening from the shell A into pipe N being preferably at the upper portion of the mud-chamber. Thus the water purified by the purifier passes into the boiler and there mixes with the other water in the boiler. The water from the boiler is continually being drawn out of the boiler from the other end, and along with fresh feed-water is passed through the purifier and the impurities abstracted therefrom. During this operation no heat is wasted, except that little which may be lost by radiation from the purifier and its connecting-pipes, and if said purifier and pipes are jacketed the loss of heat is merely nominal. The direction of the current of water through the purifier may be reversed, the inlet-pipe K being located in the lower portion of the purifier and the exit-pipe N in the upper portion of the purifier. The water will then pass upward through the purifier, and passing up outside of a catch-basin will be forced inward by the deflecting-ring e' next above said basin, and then passing over the ring will again pass upward between the shell A and the next

catch-basin above and be deflected over this catch-basin by the next higher ring, and thus it will pass upward over successive catch-basins.

5 The mode in which the sediment and dirt will be deposited will be substantially the same as in the case where the water passes downward through the purifier. I prefer, however, to pass the incoming current of water
10 down through the purifier and out at the lower portion thereof, as first mentioned.

As before mentioned, when the end of exit-pipe N in the boiler is lower than the end of inlet-pipe M in the boiler, the injector may be
15 dispensed with, and, also, when desired, the addition of the fresh feed-water from pipe L may also be dispensed with, and a slow movement of water from the boiler through the purifier and back to the boiler will take place.
20 Thus the purifier can be well used as boiler-cleaner without being used as a feed-water cleaner. So, also, the communication through pipe M from the boiler may be cut off, and a suitable exit-pipe be present, and the purifier
25 will then work upon and to a great extent purify the fresh feed-water to be finally used in the boiler.

When the device is used simply or primarily as a feed-water heater and purifier, the pipe
30 M will be omitted, and the ejector W will be omitted, and the fresh feed-water will enter through an inlet-pipe, K, which latter will be elongated within the shell, so as to deliver the water over or nearly over the center of the
35 first basin. The outlet-pipe N will in such event pass to a pump-inspirator or other apparatus for taking the water from the purifier and forcing it into the boiler. The water in the purifier may (and usually will) in such event be
40 heated by the exhaust-steam from the engine, and will enter the heater A preferably through an inlet, as Y, and pass up through the heater and out at the outlet Z, this inlet-pipe Y and outlet-pipe Z being shown in dotted lines
45 in Fig. 3. In such event an additional scraper is located in the mud-chamber V and operated by and in connection with shaft G. As the water passes through the purifier, more or less mud will adhere to the bottom of
50 the basin and to the legs and deflecting-ring, and where much vegetable matter is mingled with the water—as in the case where paper-mills, sewers, gas-works, &c., empty their refuse into the water—the deposit of matter at
55 said points in the purifier will be very great, and the scrapers become very important.

In cleaning the purifier, the steps preferably followed are as follows: The supply of fresh feed-water is stopped by closing a valve, as X,
60 and closing the valve I' in the pipe M, and closing the valve J in the pipe N, and opening the blow-off valve in the blow-off pipe O, and unlocking the locking device by disconnecting the rod I from the wheel H. The shaft
65 G is rotated and the valves and scrapers are moved around in the catch-basins. The openings *c* in the catch-basins are uncovered. The

valves and scrapers scrape the upper surface of the bottom or lower portion of the catch-basins, and the scrapers scrape the under side
70 or bottom of the catch-basins and the inner side of the legs and the inner and upper surfaces of the rings *e'*, removing therefrom the deposit of mud, sediment, matter, &c., which is adhering to them. The pressure of steam
75 in the purifier forces all the mud, sediment, refuse matter, &c., down through the openings of the basins and out through blow-pipe O.

To facilitate the removal of mud, &c., from
80 the purifier, the valve I' may be suddenly opened for a short period of time, and the sudden rush of water from the boiler will supplement in cleaning out the purifier. This valve I' may be again closed and again suddenly
85 opened and quickly closed to cleanse the purifier. Fresh feed-water may now be admitted for a short time through the pipe L to the purifier to wash the basins and scrapers and valves clean, the valves and scrapers being
90 rotated a few times to assist the fresh feed-water in cleansing the purifier. When the purifier has been sufficiently cleansed, the openings in the catch-basin are closed, the shaft G is locked in position, and the blow-off
95 pipe O is closed.

The preferable mode of now employing the purifier is as follows: The communication between the boiler and the purifier through
100 pipes M and N is now again gradually established, and then the fresh feed-water is again fed to the purifier.

In using the purifier principally as a feed-water heater and purifier, the mode of cleansing the same is preferably as follows: I close
105 the valve in the pipe between the heater and the pump, I cut off the fresh water in the feed-pipe, and I open the blow-off or exit mud-pipe O in the bottom of the heater and rotate the shaft G to loosen up the mud, &c.,
110 on the catch-basins (heating-pans) C, and uncover the openings *c* in the basin, and the water in the basin flowing through the purifier will flow out at the exit-pipe O and carry off the mud, dirt, lime, &c., contained in and on
115 the pans. I now turn on the fresh feed or supply water, and rinse out the basins and the purifiers. When the basins are sufficiently rinsed, the openings in basins C are closed and the shaft G locked. I close the exit-pipe O,
120 and open the communication between the heater and the pump.

The valves may (when preferred) be extended so as to scrape the upper surface of the entire bottom of the basin.
125

When the deposit of vegetable and other matter on the under side of the basins is little or nothing, the scrapers may be dispensed with.

The number and shape of the catch-basins
130 may be varied at pleasure. The preferred shape is that of a truncated cone. When the catch-basins are of certain forms—as, for instance, cylindrical—the opening on openings

c in the bottom of the basin may be retained, and the valve or valves be dispensed with, a scraper or scrapers being retained to scrape the mud from the basins.

5 When desired, the valves, either the valves or scrapers, or both, may be stationary, and the catch-basins be rotated, and yet be included under certain prominent features of my invention.

10 While the various features of my invention are preferably employed together, one or more of said features may be employed without the remainder. One or more of said features may, so far as applicable, be employed in connection with purifiers other than those specifically herein described.

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

1. In a purifier, the catch-basin having an opening or openings, *c*, in its lower portion, and valve for closing said opening or openings, substantially as and for the purposes specified.

2. In a purifier, a shell, *A*, and a series of catch-basins located within the shell and placed one above the other, the basins having openings *c* in their bottom or lower portions, and a valve or valves for closing and opening said openings, substantially as and for the purposes specified.

3. In a purifier, the catch-basin having opening *c* and valve for closing said opening and deflecting ring or device *e'*, located above the edge of the basin, substantially as and for the purposes specified.

4. In a purifier, a series of catch-basins located one above another and having openings *c* and deflecting-rings *e'*, each one of such rings being located proximately above its respective basin, substantially as and for the purposes specified.

5. The shell *A* and a catch-basin having legs *e* at or near the periphery of the basin, and ring *e'*, located above the basin and supported on extensions *e*, substantially as and for the purposes specified.

6. The shell *A* and a catch-basin having legs *e* at or near the periphery of the basin, and ring *e'*, located above the basin and supported on extensions *e*, all cast together in one piece, and the basin having openings *c* and valve, substantially as and for the purposes specified.

7. The shell *A* and catch-basins having legs *e* and rings *e'*, supported on extensions *e*, resting on the upper legs of its respective basin, the legs *e* of all except the lowest basin resting on the ring *e'* of the basin next below, substantially as and for the purposes specified.

8. The shell *A*, having ring *e''* affixed to its interior, and catch basin or basins having legs *e*, and a ring, *e'*, located above its respective catch-basin, the legs *e* and the periphery of the ring *e'* being in substantially the same annular vertical plane, substantially as and for the purposes specified.

9. The shell *A* and catch-basins having legs *e* and rings *e'*, supported on extensions *e*,

resting on the upper legs of its respective basin, the legs *e* of all except the lowest basin resting on the ring *e'* of the basin next below, the basins having openings *c*, and valves for closing and opening same, substantially as and for the purposes specified.

10. In a purifier, two or more catch-basins arranged one above another and having openings *c*, and valve for closing and opening said openings, the opening in the one catch-basin being located to one side of (that is, not directly over) the opening in the catch-basin next below, substantially as and for the purposes specified.

11. In a purifier, two or more catch-basins arranged one above another and having openings *c*, and valve for closing and opening said openings, the opening in the one catch-basin being located to one side of (that is, not directly over) the opening in the catch-basin next below, and rings *e'*, one of such rings being near and above its respective catch-basin, substantially as and for the purposes specified.

12. In a purifier, two or more catch-basins arranged one above another and having openings *c* and valves, the openings *c* of one catch-basin being located therein, so as to be to one side of (that is, not directly over) the opening in the catch-basin next above, each basin being provided with notch or notches *t* in its periphery, and the shell *A*, provided with bead or rib *S*, for engaging said notch, substantially as and for the purposes specified.

13. In a purifier, a catch basin or basins having openings *c* and rotatable valves *d*, and shaft *G*, for rotating said valves, substantially as and for the purposes specified.

14. In a purifier, the catch-basins provided with openings and valves, the valves having collar *E*, and the shaft *G*, for rotating said valves, substantially as and for the purposes specified.

15. In a purifier, the catch basin or basins having opening or openings *c*, each basin having a valve, *d*, and the shaft *G*, for rotating the valve or valves, and a locking device for locking the shaft *G* and the valves, so that they cannot rotate, substantially as and for the purposes specified.

16. In a purifier, the catch basin or basins having opening or openings *c*, each basin having a valve, *d*, and the shaft *G*, for rotating the valve or valves, and the arm *I*, pivoted at *i*, and the hand-wheel *H*, provided with recess *h*, for locking the shaft *G* and the valves, substantially as and for the purposes specified.

17. In a purifier, the catch basin or basins having one or more openings, *c*, and one or more scrapers for cleaning the basin, substantially as and for the purposes specified.

18. In a purifier, the catch-basin having opening or openings in the bottom and valve or valves for controlling said opening or openings, and one or more scrapers for cleaning the upper surface of the bottom of the basin, substantially as and for the purposes specified.

19. In a purifier, the catch-basin having openings *c* and valve *d*, and scrapers *D*, touching the upper surface of the bottom of the basin where the valve does not touch, substantially as and for the purposes specified. 5
20. In a purifier, the catch-basins having openings *c* and valve *d*, and scrapers *D*, touching the under surface of the basin next above, substantially as and for the purposes specified.
- 10 21. In a purifier, the catch-basins having openings *c* and valve *d*, and scrapers *D*, touching the upper surface of one basin and the under surface of the basin next above, substantially as and for the purposes specified.
- 15 22. In a purifier, the catch-basins having openings *c* and valve *d*, and rings *e'*, and scrapers *D*, touching the rings *e'* and the basins, substantially as and for the purposes specified.
23. The series of catch-basins provided with opening or openings *c*, valves and scrapers, and rings *e'*, and fresh feed-supply at pipe *K*, exit water-pipe *N*, leading to the pump, and exhaust-steam inlet *Y* and outlet *Z*, substantially as and for the purposes specified. 20
24. The series of stationary catch-basins provided with opening or openings *c* and central opening, *T*, and shaft *G*, and scrapers, substantially as and for the purposes specified. 25
25. The series of stationary catch-basins provided with opening or openings *c* and central opening, *T*, and shaft *G*, and scrapers and the valves, substantially as and for the purposes specified. 30

EZRA W. VANDUZEN.

Witnesses:

JNO. W. STREHLI,
O. M. HILL.