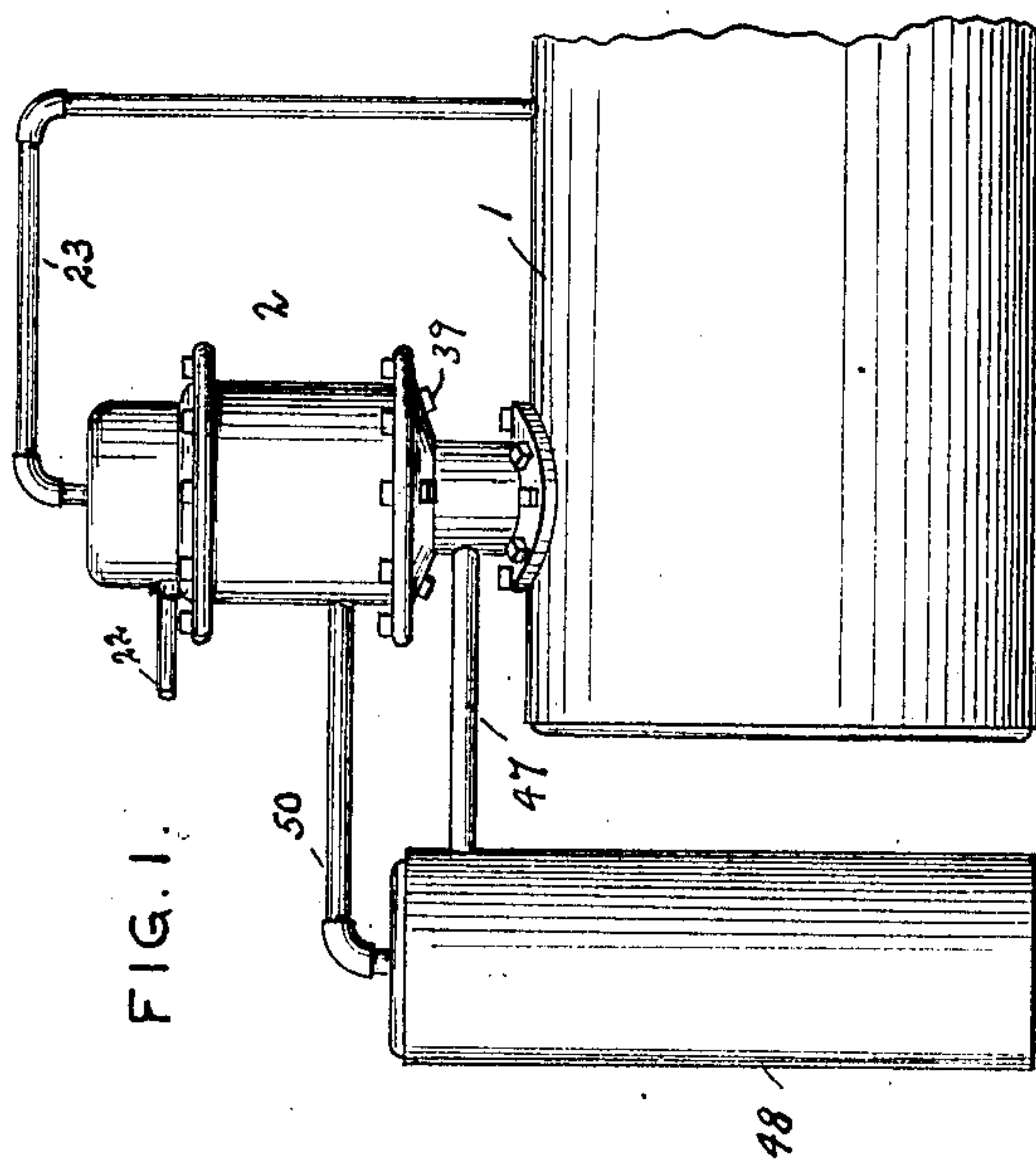
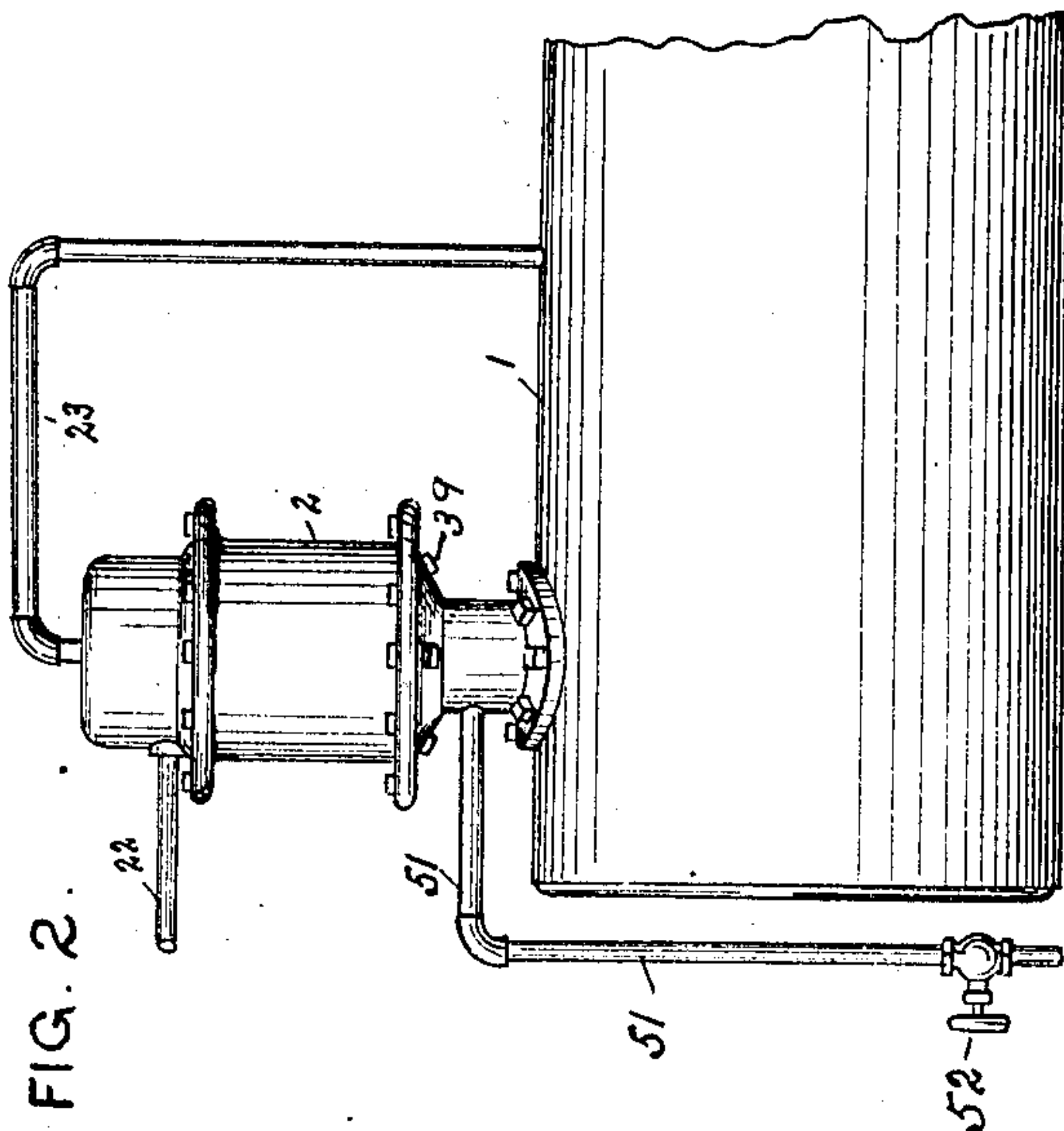


No. 885,554.

PATENTED APR. 21, 1908.

H. WHITE.
FEED WATER PURIFIER.
APPLICATION FILED MAY 26, 1905.

2 SHEETS—SHEET 1.



WITNESSES:
William F. Bauer.
Irvine Miller.

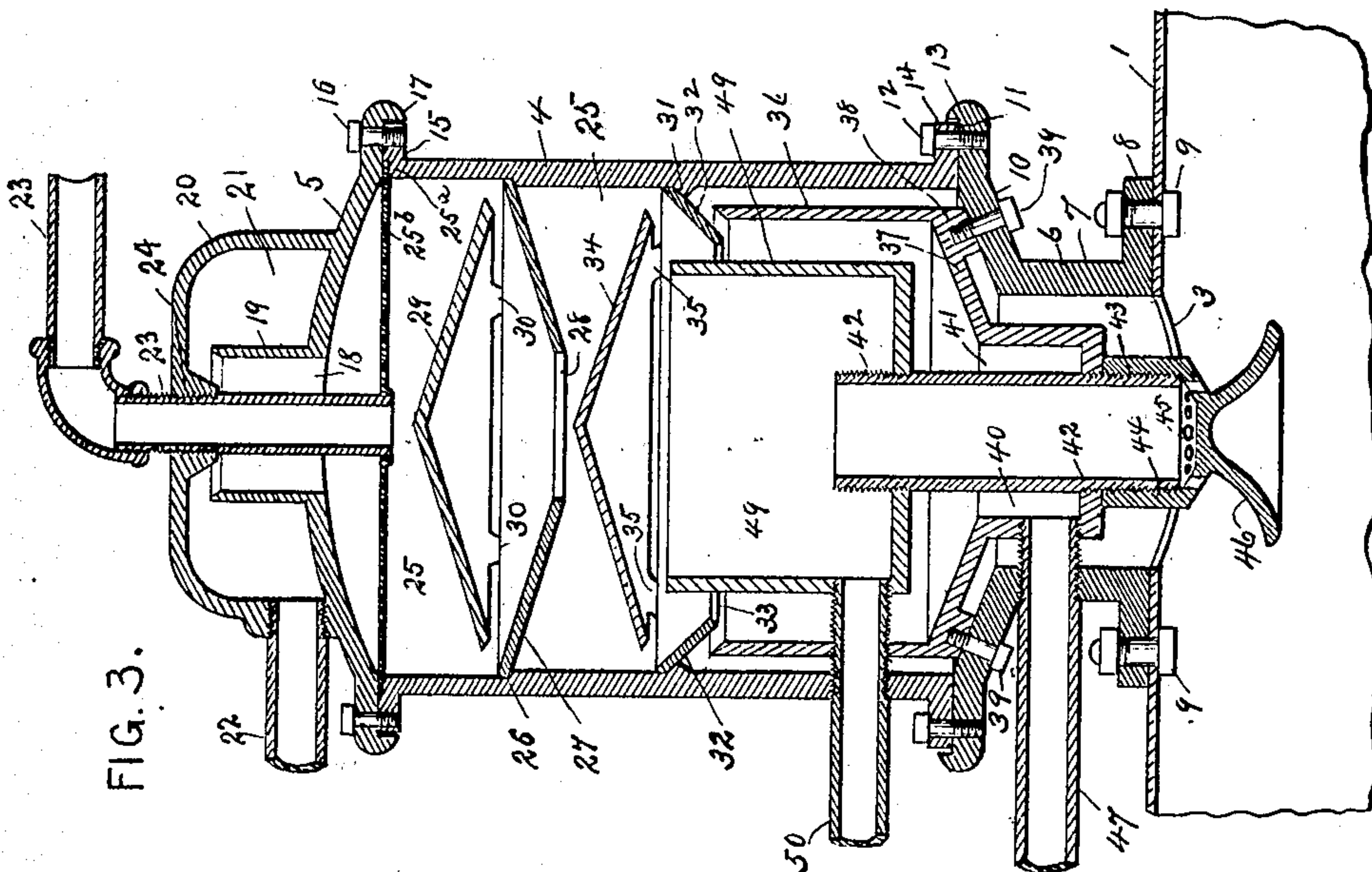
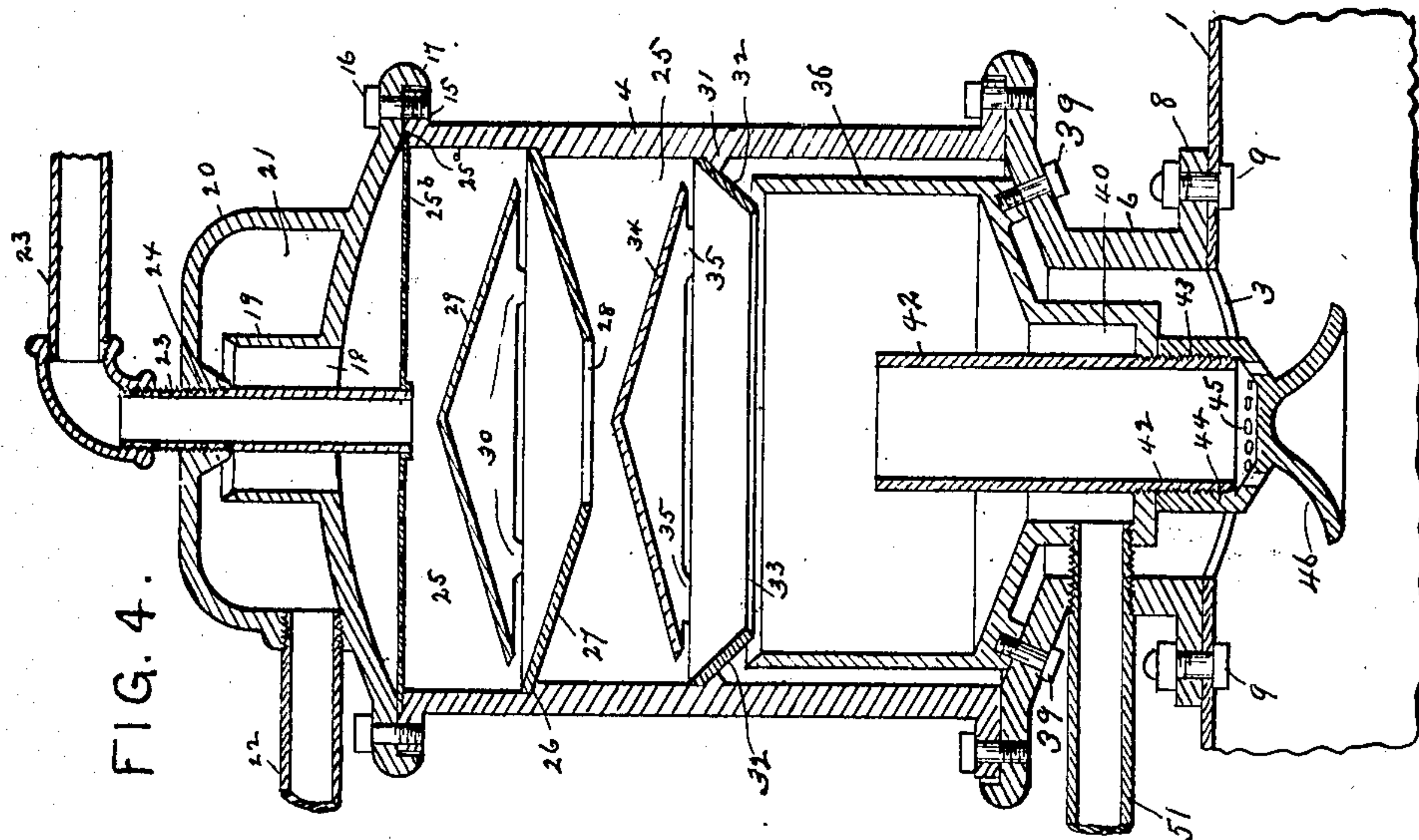
INVENTOR.
Henry White
BY
H. A. Toulmin,
ATTORNEY.

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UNITED STATES PATENT OFFICE.

HENRY WHITE, OF MARION, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO ANNIE F. McNEAL, OF MARION, OHIO.

FEED-WATER PURIFIER.

No. 885,554.

Specification of Letters Patent.

Patented April 21, 1908.

Application filed May 26, 1905. Serial No. 262,402.

To all whom it may concern:

Be it known that I, HENRY WHITE, a citizen of the United States, residing at Marion, in the county of Marion and State of Ohio, have invented certain new and useful Improvements in Feed - Water Purifiers, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to feed water purifiers, being in the nature of an improvement upon the construction set forth in my prior Letters Patent No. 756,750, of August 2, 1904, the structure being in the nature of a
15 device for removing lime and other sedimental material, as well as other injurious elements, from the feed water before it is finally delivered into the boiler.

The object of my present invention is to
20 provide a simple and efficient device of this character, which may be readily attached to or removed from the boiler, which may be readily taken apart to be cleaned, and again assembled, which will be compact and self-
25 contained, and which will effectually remove the objectionable materials from the feed water and deliver the same to the boiler at a high temperature, thereby preventing foaming and incrustation of the boiler and in-
30 creasing its efficiency.

To these ends my invention consists in certain novel features which I will now proceed to describe, and will then particularly point out in the claims.

35 In the accompanying drawings, Figure 1 is an elevation of a structure embodying my invention in one form; Fig. 2 is a similar view, illustrating another embodiment of my invention; Fig. 3 is a central vertical sectional view through the purifier or extractor, in the form shown in Fig. 1; and Fig. 4 is a
40 similar view with relation to Fig. 2.

In the said drawings, 1 indicates a boiler, shown in the present instance as a cylindrical boiler of the horizontal type, although
45 it will be understood that my improvements are equally applicable to other types of boilers. Referring first to the construction shown in Figs. 1 and 3 of the drawings, 2 in-
50 dicates the purifier or separator as a whole, which I prefer to mount directly upon the top of the boiler, as shown, although it may be otherwise located relatively thereto. In this

construction, there is provided in the top of the boiler an opening 3, through which com- 55
munication is established between the boiler and one end of the purifier.

The purifier consists of a vessel or receptacle comprising a cylindrical body 4, a top 5 and a bottom 6, the latter forming a base by 60
which the purifier is supported and connected to the boiler 1. Referring first to the base, it comprises a cylindrical body portion 7, having at its lower edge an outwardly extending flange 8, by means of which it is secured to the 65
boiler by bolts 9, said flange being shaped to a curvature corresponding to the boiler, so as to seat thereon snugly and permit the forming of a tight joint. The cylindrical body 7
of the base is open at the top and bottom, 70
thus establishing a connection between the steam space in the upper part of the boiler and the interior of the purifier.

From the upper edge of the cylindrical body 7 of the base, said base is extended out- 75
ward, preferably at an inclination, as shown at 10, to a distance equal to the diameter of the cylindrical body 4 of the purifier, and beyond this portion 10 of the base there is provided an outwardly extending horizontal 80
flange 11, on which the lower end of the body 4 rests, and to which it is secured by means of bolts 12. At the outer margin of the seat flange 11 there is provided an upwardly ex-
tending rib or flange 13, which surrounds and 85
fits against the lower portion of the body 4 so as to form a seat for the same and hold it firmly in position against lateral displacement.

The body 4 of the purifier is provided at its 90
lower edge with a horizontal outwardly extending flange 14, through which the securing bolts 12 pass. At its upper end, the body 4 is provided with a similarly outwardly extending horizontal flange 15, to receive the 95
bolts 16 which connect it to the top 5, and said top is provided with a depending flange 17, fitting against the outer margin of the flange 15 and forming a seat therefor so as to hold the top firmly in place on the body. 100
The top 5 is provided with an inlet opening 18 for the feed water, said opening being surrounded by an upwardly extending annular partition or wall 19, and said opening and annular flange or wall are inclosed by a 105
hood or cap 20, thereby forming a receiving

chamber 21 for the feed water, which is admitted thereto by means of a pipe 22 from any suitable source of supply.

The flange or wall 19 terminates a short distance below the top of this chamber, so that when the incoming feed water has filled the chamber to a height level with the top of the wall or flange 19, the water may overflow into the interior of the passage or conduit formed by said flange, and may enter the main chamber of the purifier through the inlet opening 18.

23 represents a steam pipe passing down through the top of the purifier into the main chamber thereof at the top portion of said chamber, said pipe being in free communication with the interior of said chamber at one end, while its other end is in communication with the steam space in the upper part of the boiler. As a simple and effective means for introducing this pipe into the purifier, I provide a threaded aperture 24 in the top of the hood 20, and the section of pipe which enters the purifier is correspondingly threaded, so as to screw into this aperture with a steam-tight fit, projecting downward into the main chamber of the purifier and upward to receive the remaining sections of the pipe 23. It will be observed that this steam pipe passes through the center of the water receiving chamber 21.

The main chamber of the purifier is indicated by the reference numeral 25, and in the same are supported a plurality of distributing plates, by means of which the incoming feed water is spread out into thin sheets over a large area and then subdivided by permitting it to fall or drop by gravity, said operations being repeated, so as to thoroughly expose all of the water to the steam within the chamber 25. Said main chamber also has within it a collecting receptacle or receptacles, by means of which the water thus treated is collected prior to its delivery to the interior of the boiler, said collecting receptacle being provided with means for disposing of the sediment and for supplying to the boiler that portion of the water therein which has been thus freed from sediment.

Proceeding to a specific description of the device just referred to, it will be seen that the body 4 is provided on its interior, at the upper portion thereof, with an internal seat 25^a, in which rests the outer marginal portion of the first distributing plate 25^b. This plate is held in position in its seat by means of the top 5, which clamps it against the body 4 in the manner shown in the drawings. Said first distributing plate is a flat horizontal plate provided with a number of perforations through its body, so that the water, as it enters the main chamber from the receiving chamber, falls upon said plate and is distributed thereby so as to enter the

chamber in the form of a shower of small drops. The steam pipe 23 extends down through and terminates below its upper distributing plate, so that a supply of steam is provided to heat the water as it enters the main chamber.

Below the upper distributing plate are a series of conical distributing plates, two in number in the present instance, although the number may be varied, and alternating with collecting plates by which the water is collected or gathered toward the central part of the chamber after each distribution, in order to be delivered to the next distributing plate in such a way as to be again distributed thereby. In the construction shown, the body 4 is provided near its upper portion with an internal upwardly-directed shoulder 26 upon which rests the outer margin of an annular collecting plate 27, having a central opening 28, toward which the body of said plate slopes or inclines downwardly. This plate supports a conical distributing plate 29, located above the plate 27 with its apex centrally arranged with regard to the chamber 25, and its upper surface sloping thence downwardly and outwardly in all directions towards the body 4, short of which it terminates. The plate 29 is supported clear of the plate 27 by means of legs or projections 30, so that there is formed around the outer margin of the plate 29 a space between said plate 29 and the plate 27 for the free passage of the water and steam.

Below the shoulder 26 there is formed within the body 4 a second upwardly-directed annular shoulder 31, which serves to support an annular collecting plate 32, having a central opening 33, towards which the upper surface of said annular plate 32 converges downwardly. This plate 32 supports a conical distributing plate 34, similar to the plate 29, and supported by legs 35 which rest on the plate 32. This conical plate 34 has its apex arranged centrally under the opening 28 of the plate 27, and its upper surface diverges downwardly and outwardly therefrom in all directions, the plate 34 terminating short of the body 4 and having a free space between its outer margin and said body, and also between its outer margin and the ring 32, so as to permit free passage of the water and steam.

Below the lowermost plate 32 there is located within the chamber 25 a collecting receptacle 36, the external diameter of which is less than the internal diameter of the chamber 25, so as to leave a free space between the receptacle 36 and body 4 for the free passage of the steam. The receptacle 36 is open at its upper end, and the mouth thus formed is of greater diameter than the lower or inner edge of the plate 32, which latter plate extends somewhat downward

into this mouth, so that its opening 33 lies within the receiving mouth of the receptacle 36, and discharges into the same.

The receptacle 36 is supported within the chamber 25 in any suitable manner. I prefer for this purpose the construction shown, in which the receptacle 36 is provided with a downwardly inclined conical bottom 37, extending parallel with the inclined portion 10 of the base 6, and supported above the same so as to form a steam passage by legs or projections 38. Bolts 39 pass through the part 10 of the base and screw into the legs 38, thereby securing the receptacle in position.

Below the inclined bottom 37 there is located a sediment cup 40, preferably formed in one piece therewith, its open upper end being coincident with the central opening 41 in the said bottom 37.

42 indicates a pure water supply pipe, extending up through the bottom of the sediment cup into the interior of the receptacle 36 to a height sufficient to be above the sediment deposits in the lower portion of said receptacle, and also above the sediment-charged water in the lower part of said receptacle. This pure water supply pipe may be supported in any suitable manner, but I prefer to effect its support by threading the aperture in the bottom of the sediment cup through which said pipe passes, the pipe being correspondingly threaded, as indicated at 43. The lower end of the pipe 42 extends into the steam space of the boiler through the opening 3 therein, and is provided with a cap 44, screwed onto the lower end of the pipe and provided with an annular series of outlet apertures 45 for the discharge of the water, and with a deflecting or distributing cone 46, located below said discharge apertures and serving to distribute the feed water through the steam space as it enters the boiler.

47 indicates a sediment discharge pipe which passes through the body 7 of the base and through the steam space between said body 6 and the sediment cup, said pipe also passing through the wall of the sediment cup and communicating with the interior thereof so as to form a discharge conduit for the sediment. In the particular form of construction shown in Figs. 1 and 3, this sediment discharge pipe 47 extends to a settling tank 48, and in this case I employ in connection with the main collecting receptacle 36 an auxiliary pure water receptacle 49. This latter receptacle is located within the receptacle 36, being supported by the pure water delivery pipe 42, upon the threaded upper end of which it is screwed so that said pipe 42 extends some distance above the bottom thereof. This pure water receptacle is connected with the settling tank 48 by means of a pipe 50.

The apparatus thus described receives the feed water from the pipe 22 into the feed water receiving chamber 21, where it accumulates until it overflows through the central conduit and enters the main chamber through the inlet opening 18. It will be seen that the steam from the steam space of the boiler has free access to all parts of the purifier, entering from below through the opening 3 in the boiler and the hollow body 7 of the base 6, passing up through the space between said hollow body and the sediment cup, and also through the space between the inclined portion 10 of the base and the inclined bottom 37 of the collecting receptacle 36, and also between the cylindrical body wall of said receptacle and the cylindrical body wall 4 of the purifier. The steam is then deflected by the inclined annular plate 32 as it passes over the upper edge of the receptacle 36, passing downward under the lower edge of the plate 32 and upward through the opening 33 thereof. The steam also passes between the plates 33 and 34, over the upper surface of the plate 34, through the opening 28 of the plate 27, over the upper surface of said plate, between the plates 27 and 29, and over the upper surface of the plate 29, also rising into and filling the upper part of the feed water receiving chamber 21. A full supply of steam to all parts of the purifier is assured by the fact that it is connected to the steam space of the boiler at both its upper and lower ends, its upper connection assuring a supply of hot steam to the upper part of the purifier.

As the feed water accumulates in the receiving chamber 21 in the manner already described, it obtains a preliminary heating before it enters the body of the purifier. As already stated, it enters the said body or main chamber 25 through the inlet opening 18, falling by gravity upon the upper plate 25^b, and through the same upon the upper surface of the conical plate 27. This plate, diverging downwardly in all directions, spreads the water out into a relatively thin sheet of constantly increasing tenuity, so that it is thoroughly exposed to the steam which fills the adjacent space. The water thus distributed falls by gravity from the outer margin of the plate 29 in a minutely subdivided condition, falling by gravity through the steam passage between the outer edge of the plate 29, the upper edge of the plate 27 and the body wall 4 of the purifier, so that it is still further exposed to contact with the steam. Being next received by the plate 27, it is conducted by this latter to its central discharge opening 28, being further exposed to the steam while passing over the upper surface of said plate 27, and as it passes through the central steam passage formed by the opening 28, it is still further

exposed to the action of the steam. This operation of spreading out the water and dropping it through steam passages is again performed in the same manner by the plates 5 34 and 32, and the water is finally discharged from the plate 32, through the opening 38 thereof, into the collecting receptacle 36, being again exposed to the steam as it drops into said receptacle. As the water accumu- 10 lates in said receptacle, the sediment is deposited on the inclined bottom 37 thereof, and gathers in the sediment cup 40.

In the particular construction shown in Figs. 1 and 3, the water and sediment are 15 drawn together from the sediment cup through the pipe 47 to the settling tank 48, this flow occurring by gravity. As the water accumulates in the settling tank, where it deposits all its sediment, it rises gradually until 20 it flows back through the pipe 50 into the pure water receptacle 49, and accumulates therein until it rises above the mouth of the pure water supply pipe 42, whereupon it flows downward through this latter, escaping 25 through the outlet openings 45 into the boiler, and being distributed as it is discharged into this latter by means of the distributor 46. The extension of the pipe 42 above the bottom of the receptacle 49 provides for the deposit in this latter of any sedi- 30 ment which may have been carried thus far, this deposit being effected before the water enters the boiler.

The construction shown in Figs. 2 and 4 is 35 identical with that just described, except that the settling tank 48, the auxiliary receptacle 49 and the connecting pipe 50 are dispensed with. The sediment discharge pipe which is connected with the sediment 40 cup 40 in this case constitutes a blow-off pipe, indicated by the reference numeral 51, and extends to a suitable point of discharge, where it is provided with a blow-off valve 52. In this case, the water, after having been 45 fully exposed to the action of the steam in the manner just described, accumulates in the collecting receptacle 36, depositing its sediment in the cup 40, until the water reaches the level of the top of the pure water 50 delivery pipe 42, whereupon it is discharged through this pipe into the boiler in the manner already described.

In practical operation of the purifier, I have found that it serves most effectually to 55 remove from the feed water all of the lime and other sedimental impurities, delivering the feed water to the boiler free from scale forming material and at a very high temperature. I have also found that it frees the 60 water from the acids or acid-forming substances which have heretofore been a source of rapid deterioration of boilers by reason of the corrosion arising from their presence. The provision made for a preliminary heat-

ing of the feed water prevents this latter from 65 chilling the upper part of the purifier and thereby maintains all parts thereof in efficient working condition. The thoroughness of the exposure of the water to the steam is such that practically all of the sediment- 70 forming material is removed therefrom before the water enters the boiler, while the arrangements for gathering and disposing of the sediment are such as to permit continuous use of the device without clogging there- 75 of, thus avoiding the necessity of frequent cleaning. In case such cleaning or repairs are required, however, access may be readily had to the interior of the purifier by removing the top 5, whereupon the distributing 80 plates may be readily removed and cleaned, as may also the collecting receptacle or receptacles.

If desired, the entire purifier may be removed from the boiler with the exception of 85 the base, by simply disconnecting the pipes and removing the screws 12 and 39, the opening in the boiler and the internal diameter of the cylindrical body 7 of the base being of sufficient size to permit the passage of the 90 distributor 46. This is advantageous because it is not desirable to disconnect the base from the boiler after the same has been properly secured thereto, as such disconnect- 95 ing and reconnecting is a matter of considerable difficulty, involving much labor and time. It will also be observed that the entire structure may be readily taken apart when necessary and as readily assembled.

I do not wish to be understood as limiting 100 myself to the precise details of construction hereinbefore described and shown in the accompanying drawings, as it is obvious that these details may be varied without departing 105 from the principle of my invention.

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

1. In a feed water purifier, the combination, with a boiler, of a vessel in communication with the steam space of the boiler at its upper and lower ends, whereby all parts of the interior of said vessel are penetrated by steam at substantially boiler pressure, a feed water supply connected with the upper 110 end of said vessel, a combined sediment and pure water receptacle in the lower part of said vessel with steam spaces or passages between said vessel and said receptacle, and a pure water discharge from a point above 115 the bottom of said receptacle to the boiler and a sediment discharge to a point outside the boiler, and distributing plates located between said receptacle and the feed water inlet, substantially as described. 120 125

2. In a feed water purifier, the combination, with a boiler, of a vessel in communication with the steam space of the boiler at its

upper and lower ends, a feed water supply connected with the upper end of said vessel, a combined sediment and pure water receptacle in the lower part of said vessel having a
 5 pure water discharge from a point above the bottom of said receptacle to the boiler and a sediment discharge to a point outside the boiler, distributing plates located between said receptacle and the feed water inlet, and
 10 steam spaces or passages between said receptacle and vessel and between said plates, the lowermost plate having a central opening discharging into the collecting receptacle, substantially as described.

15 3. In a feed water purifier, the combination, with a boiler, of a main vessel communicating with the steam space of the boiler and provided internally with distributing plates and a collecting receptacle, the latter
 20 having a pure water discharge to the boiler and a separate sediment discharge, a feed water supply conduit, and a feed water receiving chamber into which said conduit opens and which communicates with the interior of the main vessel, whereby the entering feed water receives a preliminary heating as it accumulates in said receiving chamber, said receiving chamber being located at the top of the main vessel and said main vessel
 30 communicating with the steam space of the boiler at its lower end and having a steam pipe extending through said receiving chamber and also communicating with the steam space of the boiler, substantially as described.
 35

4. In a feed water purifier of the character described, the combination, with a vessel adapted for connection with a boiler at its lower end and having a collection receptacle
 40 comprising an upper portion for the pure water and a lower reduced portion for the sediment, and steam passages extending between said receptacle and said vessel, of a sediment discharge pipe connected to the lower portion of said receptacle, and a pure water supply pipe having its receiving mouth located in the upper part of said receptacle and its lower end extending through said

steam passage and discharging into the boiler thereby providing separate passages 50 for the steam and water, substantially as described.

5. In a feed water purifier of the character described, the combination, with a vessel communicating with the steam space of the boiler and provided with an internal collecting receptacle having at its bottom a sediment cup, of a pure water supply pipe extending from the boiler through said sediment cup and above the bottom of the receptacle, within the upper part of which its receiving mouth is located, substantially as described. 60

6. In a feed water purifier of the character described, the combination, with a vessel 65 having distributing and collecting devices, of a removable top provided with a receiving chamber for the feed water, a feed water conduit opening into said chamber, a passage connecting said chamber with said vessel, an annular partition in said chamber, and a steam pipe extending through said chamber and within said partition. 70

7. In a feed water purifier, the combination, with a boiler, of a vessel in communication with the steam space of the boiler at its upper and lower ends, a feed water supply connected with said vessel at its upper end, a collecting receptacle in the lower part of said vessel having a pure water discharge pipe 80 leading to the boiler, distributing plates located between said receptacle and the feed water inlet, a settling tank connected with the lower part of said collecting receptacle, an auxiliary pure water receptacle in which the receiving mouth of the pure water discharge pipe is located, and a pipe connecting said auxiliary receptacle and the settling tank, substantially as described. 85

In testimony whereof, I affix my signature 90 in presence of two witnesses.

HENRY WHITE.

Witnesses:

K. C. CROMER,
 L. B. McNEAL.