No. 869,875. PATENTED NOV. 5, 1907.

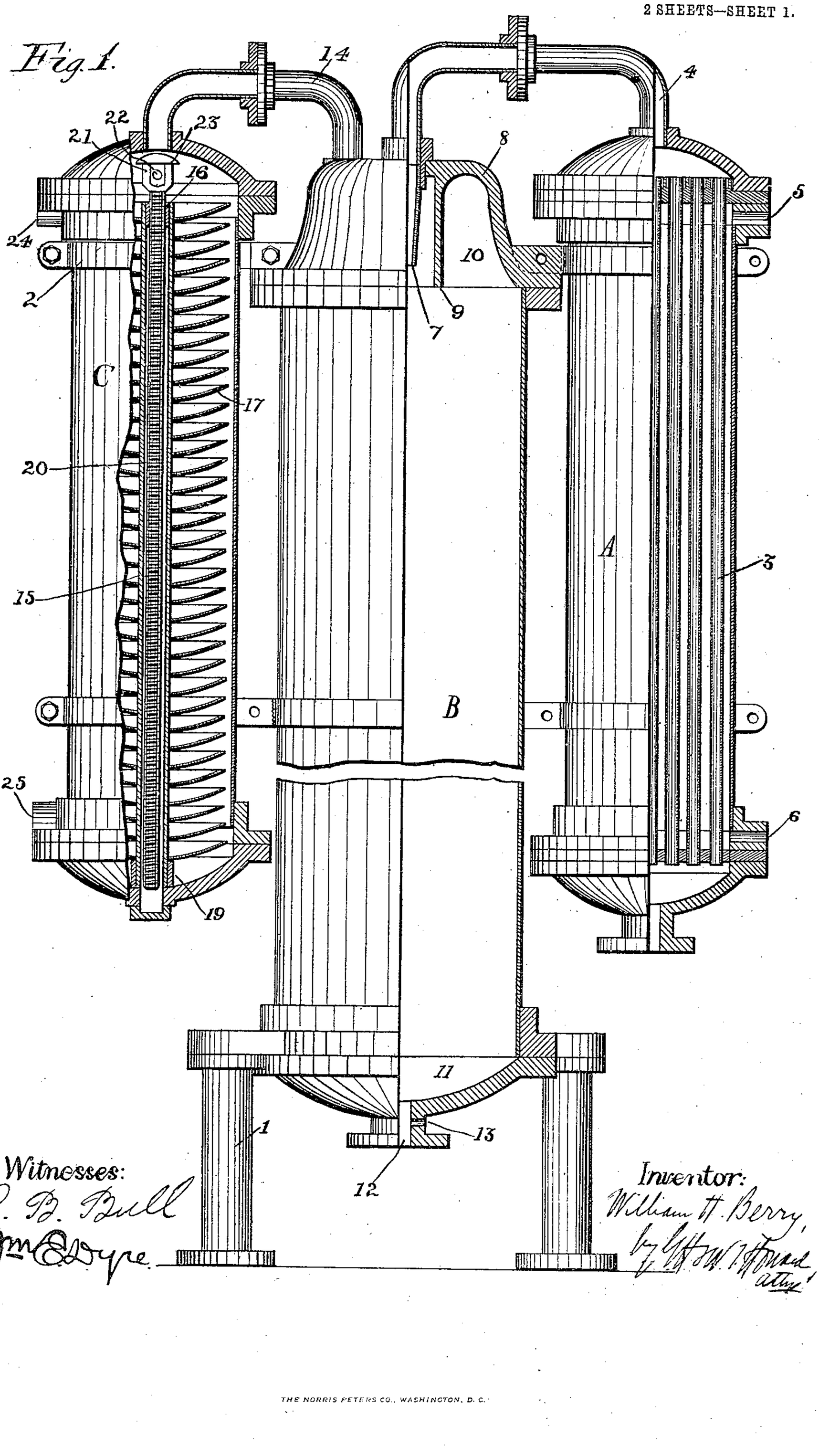
W. H. BERRY.

FEED WATER HEATER AND PURIFIER.

APPLICATION FILED SEPT. 16, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

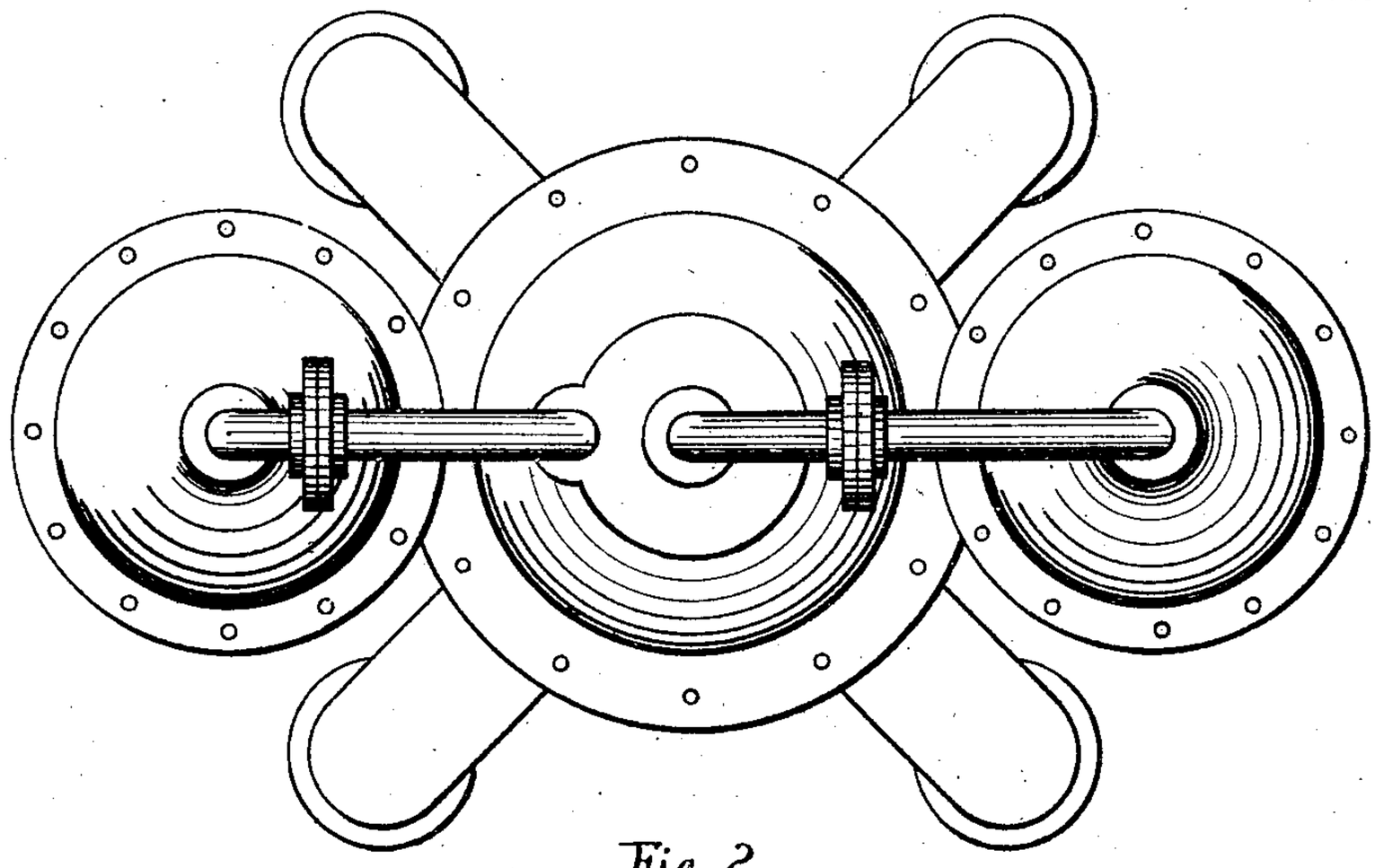

Fig. 2.

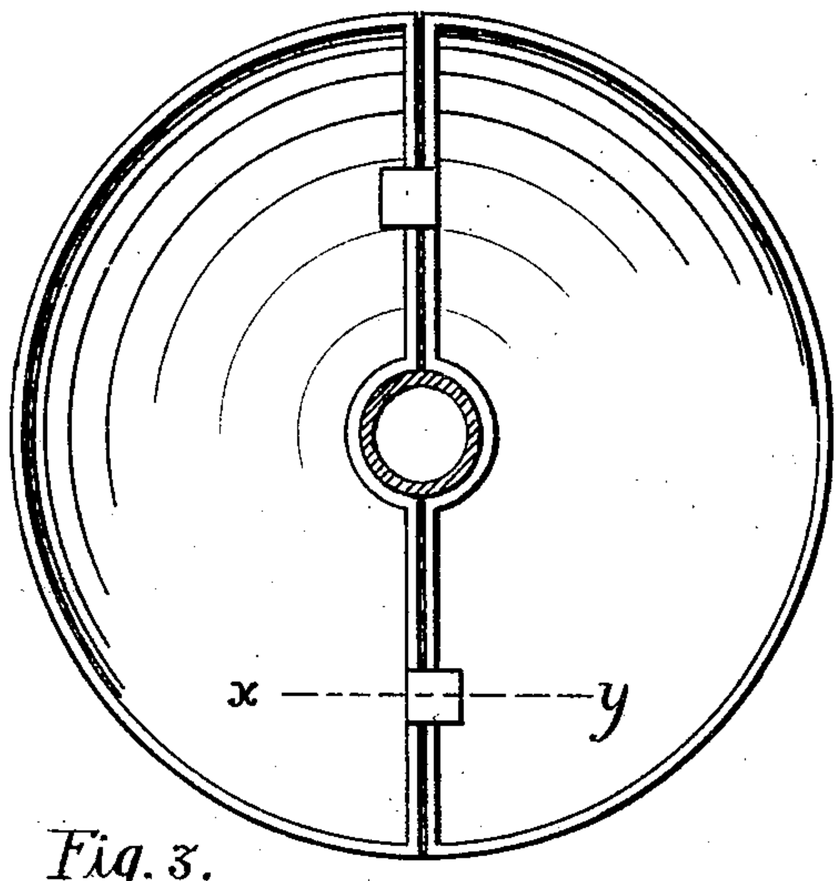

Fig. 3.

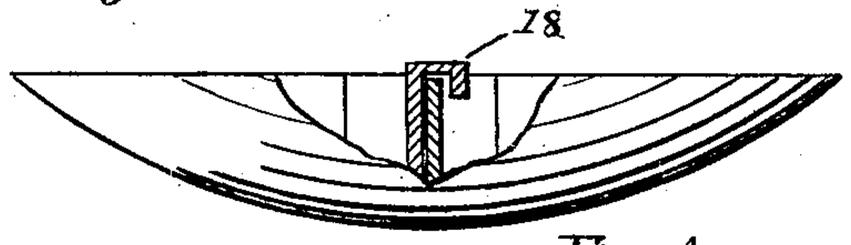

Fig. 4.

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UNITED STATES PATENT OFFICE.

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FEED-WATER HEATER AND PURIFIER.

No. 869,875. Specification of Letters Patent. Patented Nov. 5, 1907.

Application filed September 16, 1904. Serial No. 224,730.

To all whom it may concern:

Be it known that I, WILLIAM H. BERRY, a citizen of the United States, residing at Chester, in the county of Delaware and State of Pennsylvania, have invented new and useful Improvements in Feed-Water Heaters and Purifiers, of which the following is a specification.

This invention relates to the separation of impurities held in suspension in liquids and is intended more especially for use in purifying the feed water for steam boilers although it is not confined to such use.

One object of the invention is to provide an apparatus in which the purification of the liquid will be effected automatically.

A secondary object of the invention is to so construct such an apparatus that it will be free of complicated arrangements of the parts and that ready access may be had to the various parts for the purpose of cleaning or repairing the apparatus.

With these objects in view the invention consists in the provision of a separating chamber in which the liquid is caused to flow in two opposed currents and deposit the heavy impurities where they may be easily discharged.

The invention further consists in combining with this main separating chamber a supplemental separator consisting of a series of arresting surfaces or pans which catch and hold the lighter impurities which may be left in the liquid after its passage through the main separating chamber.

The invention further consists in certain novel features of the construction all of which will be hereinafter first fully described and then particularly pointed out in the appended claims.

In the annexed drawings, which illustrate the preferred form of the invention, Figure 1 is a view showing the apparatus partly in side elevation and partly in vertical section. Fig. 2 is a plan view of the apparatus, and Figs. 3 and 4 are details showing one of the pans or arresting surfaces in plan and vertical section, respectively.

Primarily, the apparatus consists of a heating chamber A, a separating chamber B, and a supplemental separating chamber C. The main separating chamber B is supported by a base or number of columns 1, and the chambers A and C are supported at the proper height by brackets or clamping arms 2, projecting laterally from the chamber B. The heating chamber A is of the usual form, having longitudinal water tubes 3, through which the water passes and which are surrounded by a steam space as will be readily understood. From one end (the upper end in the form shown) of the heating chamber, a pipe 4 passes over to the top of the main separating chamber B, while the opposite end of the heating chamber is connected with a pump or source of liquid supply. On the sides of the heating chamber, at or near its opposite ends, are ports 5, 6, in communication with the steam and water spaces of the boiler, respectively, whereby steam may be admitted to the said chamber and the water of condensation returned therefrom to the boiler. The pipe 4, leading from the end of the heating chamber, has its end slightly contracted so as to form a nozzle 7, and passes centrally into a cap 8 secured to the separating chamber B and constituting the end of the same. This cap is provided with an internal ring or annular partition 9 which incloses the nozzle 7 and separates the incoming and outgoing streams, the outgoing stream being received in the annular chamber 10 around the partition.

The separating chamber B is preferably cylindrical with a cap 11, having a central outlet tube or collar 12 at its lower end. The inner surface of the cap 11 is concave so as to direct all the impurities deposited thereon positively to the outlet tube, and the said outlet tube may be provided with a small discharge opening 13 through its side so as to permit the continuous discharge of the impurities. If preferred, however, this small opening 13 may be closed by a suitable plug and the extremity of the outlet tube opened at intervals to permit the accumulated impurities to be blown out under pressure. Leading from the annular chamber 10 in the cap 8 is a pipe 14 which extends over to the supplemental separating chamber C and enters the end of the same, the said chamber being preferably in the form of a cylinder having removable heads or caps at its ends. Rising centrally from the lower head is a hollow standard 15, which may be integral with or secured rigidly to the said head, and is provided with an internally threaded bearing or nut 16 at its upper end. Upon this standard are mounted the arresting surfaces or pans 17 which are constructed in halves so as to be readily fitted around the standard, the halves being held together by a hook 18 projecting from the straight diametrical edge of one half and engaging over the corresponding edge of the other half as shown in Figs. 3 and 4. The lowermost pan or arresting surface is supported on an annular offset 19 at the lower end of the hollow standard, and each superimposed pan rests upon and is supported by the pan below it. The internally threaded bearing 16 at the upper end of the standard is engaged by a bolt or threaded rod 20 which passes within the standard and is about equal in length to the standard. The upper extremity of the said rod or bolt is formed into an eye 21 which passes over a cross pin or suspending bar 22 in the upper head of the chamber and is provided with a convex hood or deflector 23 above the said pin or bar. At its upper end the chamber C is provided with a port 24 for connection with the steam space of the boiler, and at its lower end is furnished with a similar port 25 for connection with the water space of the boiler.

In operation, the feed water is preferably given a preliminary heating and then passed into the heating

chamber at as high a temperature as possible, and it may be treated with chemicals if deemed necessary. In the heating chamber the water will rise through the tubes and be heated to the temperature of the boiler steam, after which it will pass out through the pipe 4 and enter the separating chamber B through the nozzle 7 at a high velocity. This chamber is always full of water so that the incoming stream is projected against a uniform resistance and, as a result of the kinetic energy of the particles, the heavy impurities will be projected the greater distance and will collect at the bottom of the chamber, while the lighter particles of pure water will separate from the descending stream and will rise to the top with the slowly ascending body of water around the walls of the chamber. As before stated, a constant minute discharge may be utilized at the lower end of the chamber to carry off the impurities or they may be blown out at intervals. The water freed of the heavy impurities, and carrying such impurities as have the same or less specific gravity, leaves the chamber B through the pipe 14 and enters the chamber C, striking upon the deflector or hood 23 so as to be scattered and fall upon the top pan or arresting surface 17 in a thin sheet. This chamber C is filled with steam at boiler pressure so that the water is heated and runs down over the successive pans in a thin film, the impurities being arrested by and adhering to the pans and the pure water finally passing out through the lower port 25 with the water of condensation to the boiler.

The caps or heads constituting the ends of the several chambers are secured in place by bolts in the usual manner and may, of course, be removed by loosening the said bolts, as will be readily understood, to permit access to the interior of the chambers for cleaning of the same. To clean the pans 17, the bolts which secure the lower head or cap of the chamber C are loosened. The said lower head or cap will then drop slightly so as to clear said bolts and will be suspended by the eye of the bolt 20 resting on the cross pin 22, the said pin preventing turning of the bolt. The cap or head is then rotated so as to cause the hollow standard 15 to turn upon and ride down the said bolt 20, and the pans will thus be brought down below the end of the chamber, when they may be easily removed from the standard, cleaned and returned to their positions. After all the pans have been cleaned and refitted to the standard, the cap or head is rotated in the opposite direction so as to cause the standard to rise on the bolt to its former position. The cap is then secured when the apparatus again will be ready for use.

It will be observed that the apparatus is simple in its construction, and that all the parts are conveniently accessible. The process not only utilizes the purification of water by heating, but also takes advantage of the force of gravity and accentuates this force by employing the kinetic energy imparted by the pump to hasten the separation and precipitation, throwing the heavy impurities to a "dead" end of the separating chamber.

I do not restrict myself to the exact details of construction, combination and arrangement herein set forth, it being obvious that minor variations thereof, not involving the exercise of invention, may be made by the skilled mechanic; and such departures from what is herein described and claimed, not involving invention, I consider as within the scope and terms of my claims.

Having thus described my invention, I claim:—

1. In an apparatus for the purpose set forth, the combination of the separating chamber having closed ends and having an annular partition projecting inward from one end, an inlet nozzle entering said end and encircled by said partition, and an outlet leading from the annular chamber between the side of the same and the said partition, substantially as set forth.

2. In a separating apparatus, the combination of a separating chamber having an inlet at its upper end, a hollow standard rising from the bottom of the chamber, a series of pans mounted on the standard, and a bolt suspended within the casing and engaging the hollow standard and having a deflector on its upper end below the inlet in the path of the liquid escaping through said inlet, substantially as set forth.

3. In a separating apparatus, the combination of a separating chamber, a hollow standard rising from the end of the chamber and having an internally threaded bearing at its upper end, a series of pans mounted on said standard, a cross pin in the upper end of the chamber, and a bolt fitting within the standard and engaging the threaded bearing of the same and provided at its upper end with an eye engaging the cross pin, substantially as set forth.

4. In an apparatus for separating impurities held in suspension in liquids, the combination of a heating chamber and a supplemental separating chamber each adapted for communication with the steam and water spaces, respectively, of the boiler, an interposed main separating chamber, means connecting the steam end of the heating chamber with the upper end of the main separating chamber, and means for connecting the same end of said main separating chamber with the upper end of the supplemental separating chamber, substantially as set forth.

5. In an apparatus for separating impurities held in suspension in liquids, the combination of a heating chamber and a supplemental separating chamber each adapted for communication with the steam and water spaces, respectively, of the boiler, an interposed main separating chamber, means connecting the steam end of the heating chamber with the upper end of the main separating chamber, means for connecting the same end of said main separating chamber with the upper end of the supplemental chamber, and successive means within the supplemental separating chamber for arresting the impurities, substantially as set forth.

6. In an apparatus for separating impurities held in suspension in liquids, the combination of a heating chamber and a supplemental separating chamber each adapted for communication with the steam and water spaces, respectively, of the boiler, an interposed main separating chamber supporting the said heating and supplemental separating chambers, means connecting the steam end of the heating chamber with the upper end of the main separating chamber, and means for connecting the same end of said main separating chamber with the upper end of the supplemental chamber, substantially as set forth.

7. In an apparatus for separating impurities held in suspension in liquids, the combination of a heating chamber and a supplemental separating chamber each adapted for communication with the steam and water spaces, respectively, of the boiler, an interposed main separating chamber, a pipe leading from the steam end of the heating chamber and having a contracted nozzle connection with the upper end of the main separating chamber, and means for connecting the same end of said main separating chamber with the upper end of the supplemental separating chamber, substantially as set forth.

8. In an apparatus for separating impurities held in suspension in liquids, the combination of a heating chamber and a supplemental separating chamber each adapted for communication with the steam and water spaces, respectively, of the boiler, an interposed main separating chamber having an annular chamber formed at its upper end, a pipe leading from the steam end of the heating chamber and having a contracted nozzle connection with the upper

end of the main separating chamber, and a pipe leading from the annular chamber of the main separating chamber to the upper end of the supplemental separating chamber, substantially as set forth.

9. In an apparatus for separating impurities held in suspension in liquids, the combination of a heating chamber and a supplemental separating chamber each adapted for communication with the steam and water spaces, respectively, of the boiler, a main separating chamber, means connecting the steam end of the heating chamber with the upper end of the main separating chamber, and means for connecting the same end of the main separating chamber with the upper end of the supplemental chamber, substantially as set forth.

10. In an apparatus for separating impurities held in suspension in liquids, the combination of a heating chamber and a supplemental separating chamber each adapted for communication with the steam and water spaces, respectively, of the boiler, a main separating chamber having an annular chamber formed at its upper end, a pipe leading from the steam end of the heating chamber and having a contracted nozzle connection with the upper end of the main separating chamber, a pipe connection leading from said annular chamber of the primary separating chamber to the upper end of the supplemental separating chamber, successive means within the supplemental separating chamber for arresting the impurities, and means for deflecting the liquid and scattering it upon the first of said successive means, substantially as set forth.

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

WILLIAM HARVEY BERRY.

Witnesses:
CHARLES PALMER,
EDNA EEN NUTTALL.