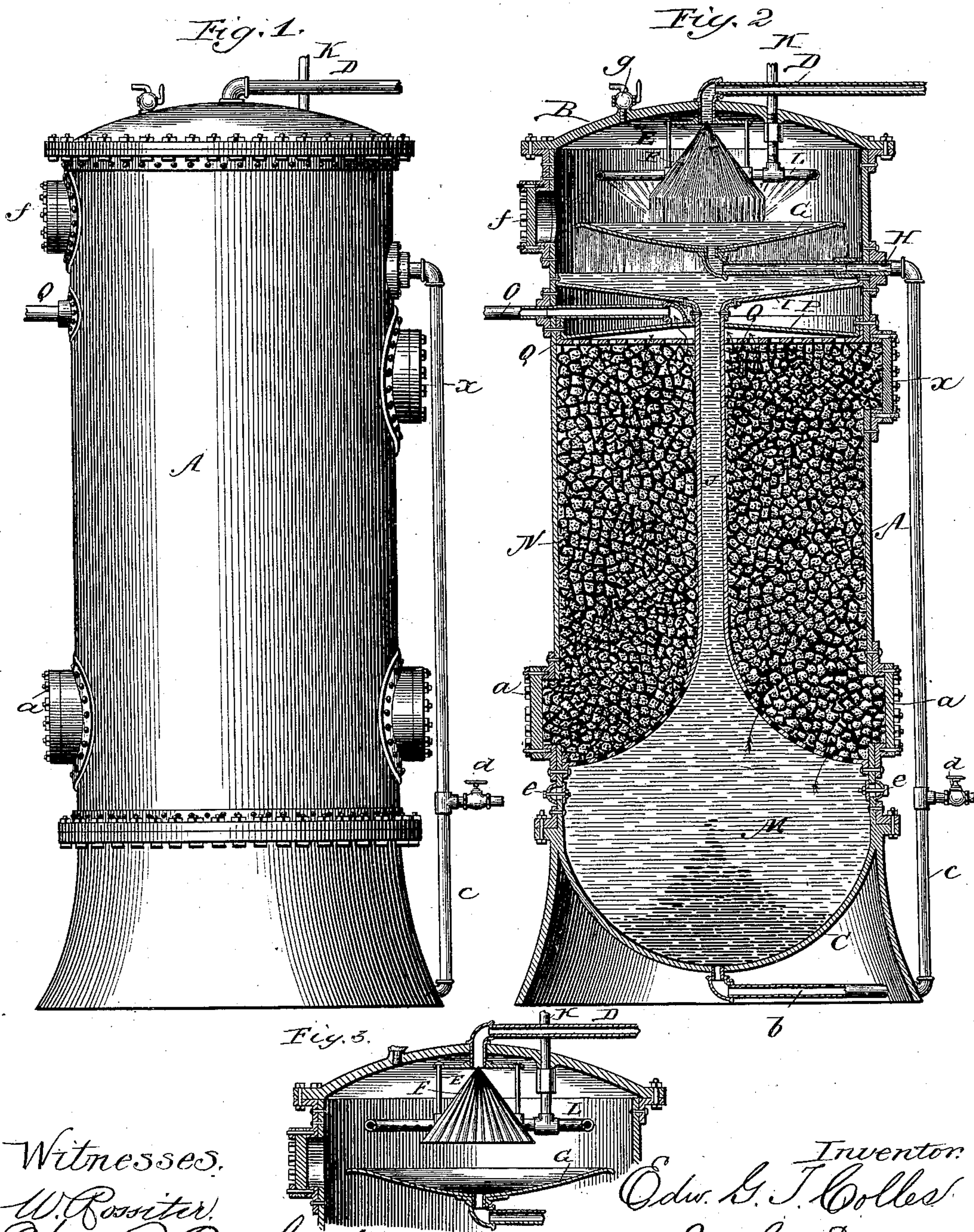


(No Model.)

E. G. T. COLLES.  
LIVE STEAM PURIFIER.

No. 343,436.

Patented June 8, 1886.



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# UNITED STATES PATENT OFFICE.

EDWARD G. T. COLLES, OF CHICAGO, ILLINOIS.

## LIVE-STEAM PURIFIER.

SPECIFICATION forming part of Letters Patent No. 343,436, dated June 8, 1886.

Application filed March 2, 1886. Serial No. 193,712. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD G. T. COLLES, a citizen of the United States, residing in Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Live-Steam Purifiers, of which the following is a specification.

This invention relates to improvements in feed-water purifiers in which live steam is employed to raise the temperature of the feed-water, and at the same time precipitate the scale-forming impurities in said water.

Prior to my invention a feed-water heater has been constructed in which the water is first passed through a steam-chamber in a sprayed form, thence conducted to a precipitating-chamber, and from there passed through a filtering-chamber, and thence to the boiler; but practice has demonstrated that it is not sufficient to simply bring the water in contact with the steam, or, rather, pass it through a steam-chamber, in order to precipitate the impurities contained therein, and for this reason a feed-water heater as heretofore constructed is objectionable from the fact that the water is not thoroughly purified and cleansed before being delivered to the boiler, and as a result of such imperfect cleansing there is a liability to the formation of scales within the boiler, which of course would defeat the very object of the invention. So, also, the manner of conducting the water from the steam-chamber to the precipitating-chamber is objectionable, for the reason that the constant inflow of water is delivered into the precipitating-chamber in such manner that the mud, scale-forming substances, and other impurities precipitated therein are kept in a constant state of agitation, and are consequently frequently carried through the filtering-chamber and into the boiler, being retained in solution by the feed-water in its passage from the said chamber.

The object of my invention is to cleanse and purify the feed-water prior to its delivery to the boiler by the action of jets of live steam forcibly injected into a steam-chamber into which water is introduced in a sprayed or sheet form, whereby the mud and scale-forming substances will be effectually precipitated and removed therefrom.

Another object is to provide means for introducing the water into the steam-chamber in the form of sprays, jets, or sheets, whereby the water may be subjected to the action of jets of live steam in a form that will best promote the removal therefrom of all impurities, and at the same time raise the temperature of the water to a proper and advantageous degree.

Further objects are to provide such a connection between the steam-chamber and the precipitating-chamber that the water when passing into the latter may precipitate its impurities therein and without agitation of the impurities already contained in said chamber, to provide means for the filtering of the water after its passage through the precipitating-chamber, to provide for in part conducting the precipitations from the steam-chamber and prior to the passage of the water to the precipitating-chamber proper, and, finally, to provide certain details of construction hereinafter described.

I attain these objects by devices illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a purifier embodying my invention; Fig. 2, a central vertical section thereof, and Fig. 3 a detail section showing the construction and arrangement of the steam-chamber.

Similar letters of reference indicate the same parts in the several pages of the drawings.

Referring by letter to the accompanying drawings, A indicates a suitable cylindrical receptacle provided with a removable cap or cover, B, and a removable bottom or base, C, which latter is curved or rounded, as shown in Fig. 2, for the purpose of forming a precipitating-chamber, as hereinafter described.

Entering through the cap or covering B of the receptacle A, and preferably near the center thereof, is a feed-water-supply pipe, D, which may be connected with a feed-water heater or directly with the supply-reservoir, to the end of which pipe, projecting inside of the receptacle A, is secured a frame, E, for supporting and suspending a conical-shaped deflector, F, the apex of which just enters the discharge end of the pipe D. Immediately below this deflector, and of a diameter nearly equal to that of the receptacle A, is a shallow dish or funnel, G, supported at the center



thereof by a pipe, H, projecting through the side of the receptacle A, connecting with a suitable blow-off cock for the purpose herein-after described, and below this funnel or dish, and rigidly secured to the walls of the receptacle, is a funnel-shaped diaphragm, I, to which, at the center thereof, is united a pipe, J, leading to the precipitating-chamber. This diaphragm, by reason of its location and construction, forms a steam-chamber in the upper part of the receptacle A, into which steam is introduced through the supply-pipe K, uniting with a circular pipe or coil, L, arranged in a horizontal plane surrounding but at some distance from the deflector F, and suspended in said chamber preferably by its connection with the supply-pipe. This pipe L is perforated on the inner surface thereof by a series of holes at suitable intervals apart extending around the entire circle thereof, which holes are disposed sufficiently below the center line of said pipe to inject the steam into the chamber at an oblique angle. As the water enters the steam-chamber through the pipe D, it strikes the apex of the cone-shaped deflector F, the surface of which may be either plain or corrugated, and is immediately spread out in the form of a sheet, covering the entire surface of said deflector, from the lower edges of which it drops or falls, in the form of a spray or sheet, into the pan or funnel G; but before striking the surface of this pan or the water contained therein the steam-jets, which are constantly emitted from the pipe L, will be forcibly injected through the said water, and thereby not only raise the temperature of the water even above that of the steam-chamber, but will also effectually and thoroughly cleanse the water of all the scale-forming substances and other impurities contained in the water, part of which impurities will be precipitated to the bottom of the pan or funnel G, from which the water will overflow onto the diaphragm I again in the form of a spray or thin sheet, and again be subjected to the heat of the steam, in order to separate whatever remaining particles of impurity may be held in the water, and although not so shown in the drawings may be subjected to the action of the steam in exactly the same manner as the water falling from the deflector F. Owing to its funnel shape, the water, after flowing onto the diaphragm I, will flow toward the center thereof, and be conducted through the pipe J into the precipitating-chamber M, to the bottom of which will be precipitated the remaining impurities contained in the water. This pipe J has the form of an inverted funnel with the lower flaring end thereof, and in fact up to the point where it unites with the straight portion of the pipe, suitably perforated, and through which perforations water will now pass and rise upwardly through the filtering-chamber N, containing any well-known filtering material—such, for instance, as charcoal, gravel, and the like.

By reason of the peculiar construction of

the lower end of the pipe J the action of the water in flowing into the precipitating-chamber is so smooth and diffused over such a surface that the sediment and precipitations contained in the said chamber will not be agitated or disturbed in the least, for the water in part begins to leave the said chamber at about its point of introduction therein, and the downward force of this water through the pipe J, which sometimes assumes the form of a hydrostatic column, as illustrated in the drawings, instead of being exerted in a direct line toward the bottom, as in the prior constructions, is diffused in a lateral direction, and escapes through the perforations in the said pipe, leading to the filtering-chamber, without in anywise disturbing the sediment in the precipitating-chamber, as before described.

Leading from the receptacle A, and between the diaphragm I and the lower end of the pipe J, is a pipe, O, leading to the boiler for conducting thereto the purified water, which pipe preferably connects with another diaphragm, P, located just below the diaphragm I, and between which diaphragm and the lower end of pipe J is located a perforated plate, Q, the space between which plate and the lower end of pipe J constituting the filtering-chamber N, to which access is gained for filling in and removing the filtering material through the hand-holes *a a*.

As before described, the bottom of the receptacle A is curved or semicircular in form, the space between which and the bottom of the pipe J constituting the precipitating-chamber, for which the bottom covering, C, of the receptacle A forms the bottom. The curvature of this bottom of the precipitating-chamber is essential in order that the sediment therein may gravitate to the center thereof, to which is connected a suitable blow off pipe, *b*, which, if desired, may connect with a vertical pipe, *c*, in turn connected at its upper end with the blow-off pipe H of the primary precipitating pan or funnel G, and the pipe *c* may be provided with any suitable blow-off cock, *d*, in order that the sediment may be drawn off from the pan G and the precipitating-chamber at the same time.

Access is gained to the precipitating chamber by means of hand-holes, *e*, and to the steam-chamber through the hand-hole *f*, and the cap or covering B is provided with a suitable blow-off cock, *g*, connecting with the said steam-chamber.

All of the joints or unions of the pipes with the receptacle A may be suitably packed and made steam-tight.

I am aware that prior to my invention the feed-water has been introduced into a steam-chamber and subjected to the action of live steam while in the form of a spray or thin sheets of water, but in this form it has only been subjected to the heat of the live steam by merely being passed through a chamber containing steam, whereby its temperature would be raised, and by which action they must nec-



essarily depend on the heat of the steam alone for removing and precipitating the impurities contained in the water, and which action practice has demonstrated is insufficient for effectually and thoroughly cleansing the said water; but I am not aware that water in this form has ever been subjected to the direct action of steam-jets in addition to the heat of the live steam contained in the steam-chamber, and therefore I claim this feature as broadly new; nor have any means ever been employed prior to my construction for so effectually reducing the water supplied to the steam-chamber to the form of sprays or sheets, and this is more readily and effectually accomplished by the employment of my deflector and primary precipitating pan or funnel G than by any other means heretofore employed.

It is obvious that subjecting the water in the form of sprays or thin sheets, as before described, to the direct action of the steam in the form of jets has the effect of so thoroughly cleansing or washing the water, by reason of the agitation and the forcible injection therethrough of the steam, as to remove or precipitate almost every particle of the scale-forming and other impurities which may be contained in the water, a part of which will be precipitated into the primary precipitating-pan G, while the balance of them will overflow with the water from this pan onto the diaphragm I, and from thence be conducted to the precipitating chamber proper, where the remaining impurities and sediment will be effectually removed; and, if desired, the water in its passage from the pan G to the diaphragm I may be again subjected to the same action of steam-jets as in its passage from the deflector F to the pan G.

I am aware that prior to my invention water has been fed into a steam-chamber to be submitted to the action of the steam therein contained; but in such prior construction the water has either been fed in through a pipe, as ordinarily obtained, or else through a perforated nozzle for converting the water into spray at the instant of its delivery into the said chamber, which construction is obviously objectionable for the reason that the perforations soon become closed by the lodgment therein of the scale-forming substances separated from the water by the action of the steam, and so reduce the feed of water as to render the employment of such devices in connection with a boiler-feed both objectionable and dangerous, while in my construction the water is fed through an opening of the same diameter as the pipe in which it is fed, and spread out in the form of a thin sheet after its introduction into the steam-chamber by means of my deflector, by which construction all the objections to the prior construction are effectually removed.

I do not limit myself to the exact construction of any of the parts herein shown and described, nor the pipe-connections herein illustrated, for various forms and means of connection

may be used without materially departing from the spirit of my invention. For instance, the deflector may have a plain or corrugated surface, and may be hollow or solid, and it may be supported by the frame E, as shown and described; or it may be supported by suitable arms depending from the under side of the cap or covering B, and the steam pipe or coil L, for injecting the steam into the chamber in the form of jets, may be supported in a like manner, or by horizontal pipe-connection, or in the manner shown.

I am aware that prior to my invention steam has been fed into a steam-chamber between two hollow cones placed one within the other, upon the apex of one of which the feed-water has been discharged; but as this form of construction does not permit of subjecting the feed-water to the direct action of jets of live-steam I do not therefore desire to claim such a construction; but,

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

1. In a live-steam purifier, the steam-chamber and cone-shaped deflector for separating the water introduced therein into thin sheets, in combination with a steam-injector surrounding the deflector, provided with a series of perforations, whereby said water may be subjected to the direct action of distinct steam-jets during the passage of the water through the said steam-chamber, substantially as described.

2. In a live-steam purifier, the steam-chamber, a cone-shaped deflector suspended in said chamber, and a water-supply pipe entering said chamber and discharging its contents on the apex of said cone-shaped deflector, in combination with a perforated steam-supply pipe surrounding said deflector, substantially as described.

3. In a live-steam purifier, the steam-chamber, a cone-shaped deflector suspended therein, and a primary precipitating-pan located in said chamber, in combination with a water-supply pipe opening into said chamber at the apex of the said cone-shaped deflector, and a perforated steam-supply pipe surrounding said deflector, substantially as described.

4. In a live-steam purifier, the steam-chamber, a cone-shaped deflector located therein, a water-supply pipe entering said chamber, a primary precipitating-pan located in said chamber, and a perforated steam-supply pipe surrounding said deflector, in combination with a diaphragm forming the bottom of said steam-chamber, a pipe leading to the precipitating-chamber, and the precipitating-chamber, substantially as and for the purpose set forth.

5. In a live-steam purifier, a pipe connecting the steam-chamber with the sediment-chamber, and having the form of an inverted funnel, with the flaring mouth thereof perforated, substantially as described.

6. In a live-steam purifier, a pipe connect-



ing the steam-chamber with the precipitating-chamber, and having its lower end flared and perforated, in combination with the precipitating-chamber and the curved or rounding  
5 bottom of said chamber, substantially as described.

7. In a live-steam purifier, the steam-chamber, the deflector suspended therein, a primary precipitating-pan located in said chamber, a  
10 water-supply pipe connecting with said chamber, and a perforated steam-supply pipe surrounding said deflector, in combination with

a diaphragm forming the bottom of the steam-chamber, a pipe connecting said chamber with the precipitating-chamber, and having the  
15 lower end thereof flaring and perforated, the precipitating-chamber, a pipe leading from said chamber to the boiler, and a filtering-chamber between said pipe and the precipitating-chamber, substantially as described.

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