(No Model.)

E. G. T. COLLES.

COMBINED FEED WATER PURIFIER AND BOILER CLEANER.

No. 343,435. Patented June 8, 1886.

Fig. 1.

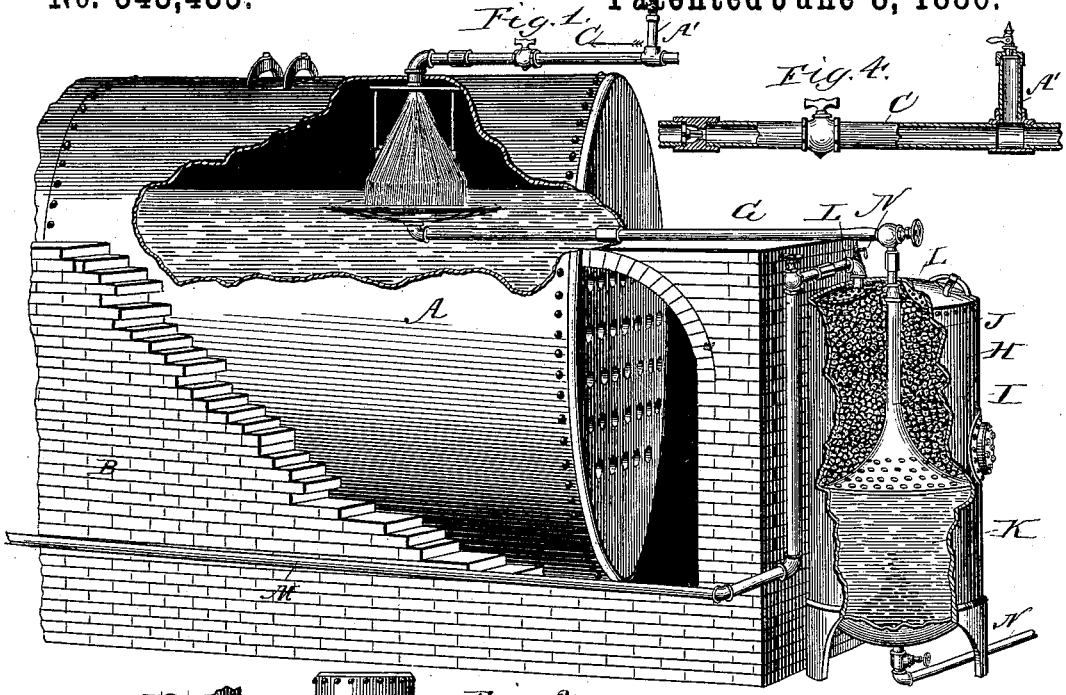


Fig. 4.

Fig. 2.

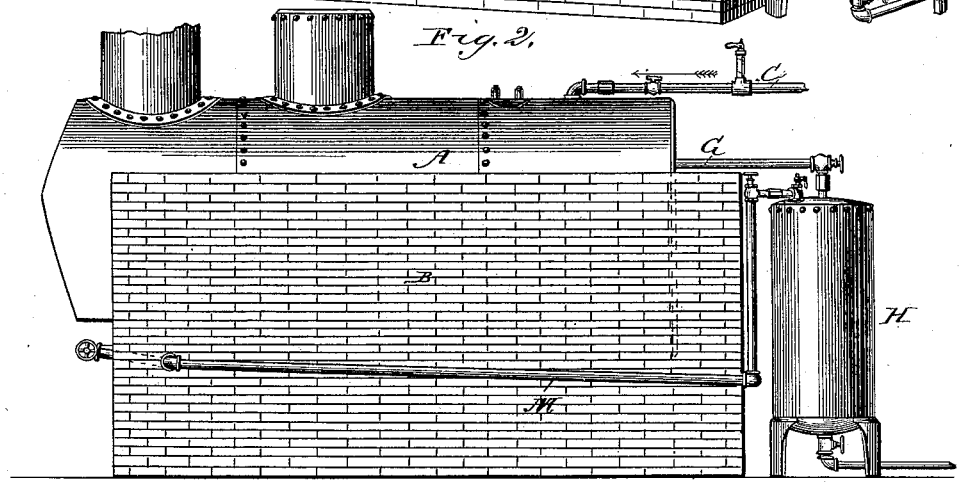
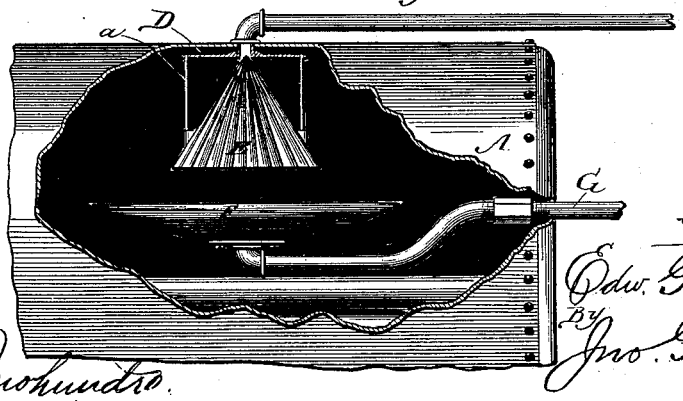


Fig. 3.



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

COMBINED FEED-WATER PURIFIER AND BOILER-CLEANER

SPECIFICATION forming part of Letters Patent No. 343,435, dated June 8, 1886.

Application filed March 2, 1886. Serial No. 193,711. (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 Combined Feed-Water Purifiers and Boiler-Cleaners, of which the following is a specification.

This invention relates to improvements in boiler-cleaners in which the scum and other extraneous matter, which rises to the surface of the water during ebullition, is removed by being drawn off, together with a small quantity of the surface-water, and passed through a filtering apparatus, from whence the cleansed water is returned to the boiler; but my invention is designed, in addition to the foregoing operation, to automatically produce a constant agitation and circulation of the water in the boiler and of the surface-water toward my scum or drain pan and to act as a feed-water heater and purifier in conjunction therewith.

Prior to my invention the scum has been collected from the surface-water of the boiler by means of a perforated tube or shallow dish-shaped drainer located in the boiler near the surface-line of the water; but in all of these prior constructions the effectiveness of these drainers has been totally dependent on the natural circulation of the water in the boiler to bring the scale-forming substances floating on the surface of the water within reach of the said drainers, and such means are obviously inadequate to effect the desired and necessary result, because when boilers are fed at the bottom in the usual way the heavier impurities do not rise to the surface, but form scales on the lower heating-plates, while others on their passage to the surface adhere to the boiler-flues with which they come in contact, the lighter and less important substances only reaching the surface and coming within reach of the sediment-collector.

I am aware that it is not new to feed into the steam-space in a boiler, there being various "spray-feeders" for that purpose, some in which the water is forced through small holes, others in which a valve is closed with a spring, and others still in which the water is forced down through a pipe and, ascending outside of the same, passes through openings and flows over shelves or ledges in a spray or sheet; but all of these devices become useless after a time, owing to the sediment separated by the steam clogging up the openings through which the water is forced, so that the supply of water to the boiler gradually diminishes, thus incurring the risk of explosion.

In addition to the foregoing objections, when water is fed into the steam-space of a boiler, it is often necessary to abandon that method of feeding, owing to a loud report like an explosion in the feed-pipe, usually near the boiler, the vibration resulting from the report often being so great as to loosen the joints and sometimes to burst the check-valve and feed-valve or a portion of the pipe weaker than either of them, and it is usually heard with every stroke of the pump, when one is used, which is due to the air in the feed-water coming in contact with the steam from the boiler.

The prime object of this invention is to utilize the inflow of the feed-water to the boiler for creating a circulation of the surface-water toward the draining-pan, and by the same means create a constant circulation of all the water contained in the boiler, whereby the scale-forming foreign and extraneous matters contained therein will rise to the surface thereof.

Another object is to combine with a boiler-cleaner a feed-water heater and purifier for raising the temperature of and purifying the said water prior to its delivery to, for use in, the boiler, by subjecting the water to the steam in the boiler, whereby the impurities will be precipitated into a suitable receptacle prior to the delivery of said water to the boiler, to effectually cleanse and purify the same.

A further object is to combine with a feed-water heater a purifier and precipitating-chamber, through which the feed-water shall pass prior to its delivery for use in the boiler, whereby the impurities separated therefrom by the action of the heat will be precipitated therein and the water effectually cleansed and purified.

Other objects are to combine with a feed-water heater an air or expansion chamber on the feed-pipe located between the water-supply and the boiler, whereby explosions in the said pipe, in consequence of the contact of the steam with the air in said water, may be effectually avoided and the feed-water per-

mitted to rise in said expansion-chamber, to prevent straining of the joints or valves of said feed-water pipe.

Further objects are to utilize the steam contained in the boiler for heating and purifying the feed-water during its passage through the boiler, but prior to its delivery thereto for use in the boiler, whereby a separate feed-water heater may be dispensed with; to provide means for submitting this feed-water to the action of the steam during its passage through the boiler in a form that will best promote the heating and purifying of said water; to combine with a boiler-cleaner a precipitating or filtering apparatus so constructed as to have the maximum cleansing and purifying effect upon the water passed therethrough, and to provide certain details of construction hereinafter described.

I attain these objects by devices illustrated in the accompanying drawings, in which Figure 1 represents a perspective view of the rear end of a boiler with my improvements applied thereto, with parts shown broken away for the purposes of illustration; Fig. 2, a side elevation of the same, showing the preferred manner in which my feed-water supply and circulating-pipe is connected with the boiler; Fig. 3, a detailed sectional elevation showing the construction, location, and arrangement of my feed-water purifier and drain-pan or feed-water receiver; and Fig. 4, a detail section through a portion of the feed-water pipe, showing the check and feed valves and the air or expansion chambers.

Referring by letter to the accompanying drawings, A indicates the boiler, and B the setting thereof, which may be of any desired or well-known form of construction, and connected with this boiler at the top side, and preferably near the rear end thereof, with a feed-water pipe, C, which may be connected at its opposite end with a feed-water heater for raising the temperature of the water prior to its delivery to the boiler or with any suitable reservoir for containing the same, in which case the water may be delivered to the boiler in either a cold or heated state. The end of this feed-water pipe projects a short distance into the boiler, to the end of which is secured by screwing, as shown, or any other well-known and convenient manner, a suitable frame, D, to the ends of the depending arms *a a* of which is in turn secured a cone-shaped spreader or deflector, E, the apex of which projects slightly into the opening in the discharge end of the pipe C, but not sufficiently to interfere with the flow of the water therefrom; but the exact relative positions of this deflector and the discharge end of the pipe is not essential so long as the apex of the said cone-shaped deflector is in a vertical line with the center of said pipe, so that the water, when discharged onto the said deflector, will be evenly spread or distributed in the form of a thin sheet over the entire surface of the deflector. The said deflector may also be supported by means of a suitable flange secured to the inside of the boiler or suspended inside the boiler, without being actually connected with the feed-pipe in any manner, so long as it is located directly beneath the discharge end of the feed-pipe. This deflector may be formed hollow and of sheet or cast metal, if desired, of one or more sections or pieces, and the surface thereof may be fluted, as shown; or it may be plain, corrugated, or of any other form or configuration which will best subserve the purposes for which it is intended.

Located within the boiler, just below the deflector, is a dish-shaped receiver-pan or scum-gatherer, F, of a diameter somewhat greater than that of the cone-shaped deflector, which pan is preferably supported on the end of a pipe, G, to which it is united at the bottom and center or side thereof, and which pipe passes out through the head, side, or top of the boiler and connects with an upright cylinder, H, or any other suitable receptacle, in which is contained a precipitating-chamber and filtering apparatus, or without the latter, as may be desired.

The upper edge of the pan, scum-gatherer, or feed-water receiver G, over which the said scum flows, is designed to be located at about the normal water-line of the boiler, so that the scum and other extraneous matters floating on the surface of the water will flow over the edge of the said pan, together with a small quantity of surface-water, and be conducted through the pipe G, carrying with it that portion of the feed-water not already evaporated, for the purpose hereinafter described. To facilitate the outflow of these impurities, and thereby promote a more rapid and effective circulation of the surface-water toward this receiver pan or scum-gatherer, I design to utilize the inpour of the feed-water into and through the boiler, for it will be understood that a portion of the feed-water, when admitted through the pipe C, will be evaporated on entering the steam in the boiler, and that the portion not evaporated will flow down over the deflector, and from thence fall, in the form of a circular sheet or spray, into the said scum-gatherer, and in its passage be heated to about the temperature of the steam through which it passes, which liberates the scale-forming substances, and, by reason of the greater diameter of the said gatherer, this fresh water will be caught and conducted by the gatherer and pipe G out of the boiler to the filterer without materially mingling with the water contained in the boiler, except so much thereof as immediately covers and surrounds the scum gatherer and receiver. This constant passage of the stream of feed-water through the boiler, carrying with it all of the surface-water, and consequently the scale-forming and other impure substances therein contained, produces a circulation of all the surface-water in the boiler toward the scum-gatherer to supply the place of that drained off, and this circulation is materially aided by the readmission of the sur-

face and feed water to the boiler after being cleansed and purified, preferably at the bottom thereof, and at a point removed from the feed-water receiver, as will be more particularly described further on.

Should the water in the boiler be sufficiently high even to entirely cover the receiver-pan, still the action of the suction of said pan will be sufficient to draw off that portion of the feed-water not already evaporated by the heat of the steam in the boiler discharged over it first, and thus prevent the intermingling of said water to a serious extent with the water contained in the boiler; and should the water-line in the boiler be below the level of the receiver-pan, then the feed-water would fall directly into said pan and be conducted off through the pipe G to the filterer.

The receiver-pan or scum-gatherer is further employed as a primary precipitating receptacle, into which the scale-forming and other impurities separated from the feed-water in its passage through the steam in the boiler are precipitated, and conducted from thence along with the surface-water and scum to the precipitating-chamber proper, located in the cylinder H; for when the feed-water is introduced into the boiler and passes through the live steam contained in said boiler in the form of a thin sheet, (as a result of its flow over the deflector,) the action of the said live steam is not only to raise the temperature of the said water to nearly that of the steam, but also to separate and precipitate all of the scale-forming scum and other extraneous matter contained in said water.

The drain-pipe G passes, preferably, through the cap or covering of the cylinder or receptacle H, and connects with the upper end of a vertical pipe, I, though it may instead enter the side of the cylinder, or bottom of same, extending part way up, thus doing away with pipe I, and substituting a plain perforated plate instead of the flaring end of pipe I. The said pipe I is located in said chamber, and has the form of an inverted funnel, and extends downwardly part of the length of the receptacle H, where its discharge end flares sufficiently to come in contact all around with the walls of the said receptacle. By reason of such construction the said receptacle is divided into two compartments or chambers, the upper one, J, of which constituting a filtering-chamber, and the lower one a precipitating-chamber, from which latter access or communication is obtained with the former by means of a suitable number of perforations in the lower flaring end of the pipe I.

The feed-water, scum, surface-water, and all the impurities contained therein are conducted from the boiler through the pipes G and I and discharged into the chamber K, wherein all the sediment will separate and be precipitated from the water to the bottom of said chamber K, from whence the water will rise through the perforations in the pipe I to the filtering-chamber to be further purified and cleansed, and the remaining impurities removed therefrom by filtration prior to its delivery to the boiler for use in generating steam.

Just below the cap or covering of the receptacle H, and within the said receptacle, is located a perforated diaphragm, L, between which and the flaring mouth of the pipe I is confined the material employed for filtering, which may consist of charcoal or any other suitable material. This perforated diaphragm prevents the escape of the filtering material into the pipe M, which connects with the chamber formed in the top part of the receptacle H, between the cap and the said diaphragm, and conducts the water from said chamber to the boiler, which it enters preferably at or near the bottom or mud-drum thereof after or without being subjected for a suitable portion of its length to the heat of the fire. It also is designed to form a spray of water when forced with boiler-pressure back from the boiler to wash out the filtering material and settling-chamber K, when the blow-off N is opened. It will be no departure, however, from the spirit of my invention to dispense with the filtering-chamber altogether and supply the water to the boiler direct from the precipitating-chamber, for in some cases where the purifying of the feed-water is previously in a great measure effected the remaining impurities may be readily separated therefrom and deposited in the precipitating-chamber without the necessity of employing the filtering-chamber.

It will be understood that the cylinder or receptacle H and a pipe leading therefrom to the boiler are located on the outside of the boiler-setting, except so much of the said pipe as passes through the fire-box for the purpose of raising the temperature of the water to the boiling-point before it enters the boiler, and I have found it of great practical utility to have the pipe just before its connection with the boiler pass out of the fire-box, and outside of the boiler-setting, before connecting therewith, for should it happen that the section of pipe in the fire-box (owing to its being defective or other cause) becomes so burned and worn as to suffer fracture or explosion, without some means for shutting off the flow of water from the boiler, serious damage might result; and this means is easily provided for by placing a suitable stop-cock in the exposed section of the pipe between the fire-box and the boiler. I do not confine myself, however, to connecting this feed-water pipe for supplying water to the boiler in the manner herein shown and described, for, if desired, it might be connected at any point between the ends of the boiler, through the rear end thereof, or it may be connected with the mud-drum; but I have illustrated the connection preferred, for the reason set forth.

It is well known that the circulation of the water in that portion of the boiler not subjected to extreme and constant heat is sluggish

and variable, and this is more particularly the case regarding that portion just forward of the rear end thereof, where the water is sometimes almost at a stand-still, while in other parts of the boiler the water is in a constant state of ebullition and consequently circulation. Such a condition of affairs is necessarily injurious to the boiler, and to some extent dangerous, but may be in part overcome by introducing the feed-water into the boiler near the rear end thereof after it leaves the precipitating receptacle; still the circulation in the boiler will always be more sluggish near the rear end thereof, or where subjected to less heat than at any other point, and it is there that I design to place my draining-pan, feed-water receiver, and scum-gatherer, for, in addition to the means previously described for producing a circulation in the boiler, the constant ebullition of the water will materially aid in effecting this result.

To prevent the explosions which take place in the feed-pipe when the water is fed directly into the steam-space, and usually near the boiler, the vibration resulting from which often being so great as to loosen the joints and sometimes to burst the check and feed valves, or a portion of the pipe weaker than either of them, and which explosion is due to the air in the feed-water coming in contact with the steam from the boiler in a vacuum, I provide an air or expansion chamber, A′, connected with the feed-water pipe at a point between the feed-water supply and entrance of the pipe to the boiler, and preferably at the highest point and just back of the feed-valve, which chamber is hollow and designed to draw off from the feed-water during its passage thereby, in addition to the air already contained therein, whatever air may be contained in the feed-water, which air will serve as a cushion for the feed-water when it backs up into the said chamber when the explosion takes place. This air-chamber may be a piece of ordinary piping connected by a T-joint with the feed-pipe and having the upper end thereof closed and provided with a suitable air-cock, so that the air may be allowed to escape therefrom from time to time, as desired.

The explosions or reports in the feed-water pipe take place at intervals, and always during the back-stroke of the piston when the water is pumped therein, and if a single-acting pump be used a vacuum will be created just back of the check-valve at each reverse stroke thereof, and this vacuum is at times so powerful that, in conjunction with the pressure of the steam in the boiler, the check-valve is broken or disabled and the steam allowed to pass in varying quantities and in a superheated condition into the vacuum; and when the forward stroke of the pump-piston takes place the forcible and sudden contact of this superheated steam in the vacuum, with the feed-water and the air contained therein, produces these explosions, and at very best, with the most improved check-valves, it is next to impossible to prevent such explosions occurring. Therefore, to avoid the resultant strain of the joints and bursting of the valves and pipes, I have provided the air-chamber A′, into which the feed-water may back when the explosion takes place, the air contained in said chamber serving as a cushion to instantly expel the feed-water therefrom when the reverberation from the explosion has subsided. This air or expansion chamber I consider an important element in my invention, for without it feed-water heaters designed to feed directly into the steam-space are rendered practically useless.

In devices wherein the water is fed into the steam-space in the form of a spray it mingles with and saturates the steam-supply to the engine, carrying therewith the scale-forming and other impurities, injurious alike to the boiler and steam-cylinder; but in my device, though the water is passed through the steam it is not mingled with it to any appreciable extent, and consequently does not interfere with the dry steam being supplied to the engine, nor permit the escape therewith of any of the scale-forming or other extraneous matters.

Although I have shown and described the deflector in the boiler as conical in shape and the drain-pan or feed-water receiver as circular, I do not desire to limit myself to such construction, for the deflector may be made quadrangular, triangular, or prism-shaped to extend entirely across the boiler, the inflow-pipe elongated and extending in the same manner to correspond, and the receiver-pan formed rectangular in shape and in the same proportion to the deflector as herein shown and described; or an inverted funnel having the lower end thereof closed, or else a V-shaped trough extending the entire length of the boiler may be substituted, having the upper edge thereof serrated, toothed, or notched, so as to distribute the water along each side as it falls into the live steam, which funnel or trough may or may not have a covering or top therefor, and in either case, as before stated, the feed-water receiver would have a shape corresponding substantially to that of the funnel or trough; hence it is obvious that numerous minor changes in the general construction of these and other parts of my device may be made without departing from the spirit of my invention.

The construction of the receptacle H, and particularly of the pipe I contained therein, is incorporated and combined with other elements, and all described and claimed in an application for Letters Patent, Serial No. 193,712, filed March 2, 1886; hence I do not deem it necessary to more particularly describe or illustrate the said device in this application.

I am aware that prior to my invention an air-chamber has been provided in the feed-water pipe; but this chamber has been located forward of the check or feed valve in the said pipe, and therefore obviously could not oper-

ate to permit a recoil or backing of the water in the feed-pipe, which takes place behind the check or feed valve, as in my device, to prevent the explosions or reports which occur at that point in the said pipe, while in my invention this air-chamber is located to the rear of the check or feed valve, between said valve and the supply-reservoir, and is especially designed to perform a function not possible in the prior construction—namely, that of an air-cushion, against which the water may rise to prevent the racking explosion, which takes place in the feed-water pipe just behind the check-valve, due to the condensation of live steam, producing a vacuum in the pipe into which the feed-water is drawn faster than the stroke of the pump forces it and faster than it can pass through the check-valve, thereby producing a back-pressure or recoil of the water close to the valve, which, when met by the forward force of the remaining water in the pipe, if not permitted to expand and spend its force, would produce the loud reports or explosions, seriously racking and detrimental to the valves and connections of the feed-water pipe.

In conclusion I may add that suitable cocks or valves may be provided at desired points in all of the pipe-connections herein shown and described.

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

1. In a combined feed-water purifier and boiler-cleaner, the boiler, a deflector located therein, and a feed-water-supply pipe connected with the boiler above said deflector, in combination with a receiver-pan or scum-gatherer located in said boiler beneath said deflector, substantially as described.

2. In a combined feed-water purifier and boiler-cleaner, the boiler, a deflector suspended therein above the water-line, and the feed-water-supply pipe connected with said boiler over said deflector, in combination with a receiver-pan or scum-gatherer located in said boiler about the water-line therein, a filtering apparatus outside of said boiler, and a pipe-connection between the said filter and scum-gatherer, substantially as described.

3. In a combined feed-water purifier and boiler-cleaner, the combination, with the receiver-pan or scum-gatherer and a pipe connecting with the boiler, of a filtering and purifying receptacle intermediate and connecting said pan and pipe, the precipitating-chamber in said receptacle, a pipe-connection between said pan and chamber having a flaring and perforated mouth opening into said chamber, and filtering-chamber between said precipitating-chamber and the pipe leading to the boiler, substantially as described.

4. In a combined feed-water purifier and boiler-cleaner, the boiler, a deflector located therein, a feed-water pipe connecting with the boiler over said deflector, and a receiver-pan or scum-gatherer located in the boiler, in combination with a filtering apparatus, a pipe-connection between said apparatus and the draining-pipe, and a pipe-connection between the said filter and the boiler, substantially as described.

5. In a combined feed-water purifier and boiler-cleaner, the boiler, a deflector located therein, a feed-water pipe connecting with the boiler over said deflector, and a receiver-pan or scum-gatherer located in the boiler, in combination with a filtering apparatus, the precipitating-chamber in said apparatus, a pipe-connection between said pan and chamber having a flaring and perforated mouth opening into said chamber, a pipe-connection between said apparatus and the boiler, and a filtering-chamber between said pipe-connection and the precipitating-chamber, substantially as described.

6. In a feed-water heater and purifier, the supply-pipe, the check and feed valves located therein, in combination with an air or expansion chamber connected with said pipe intermediate the supply-reservoir and the said valves, substantially as described.

7. The herein-described method of heating and purifying the feed-water supplied to a boiler, the same consisting in first passing the water through the steam-space of the boiler in the form of a thin sheet or spray, then catching the water in a suitable dish or pan and conducting it through suitable pipes to a precipitating-chamber, then drawing it off from said chamber and conducting it to the boiler through suitable pipes, whereby the water will first be heated and the impurities separated therefrom, thence conducted, together with the impurities, to a chamber, where the latter are precipitated, and the water then passed through suitable pipes to any portion of the boiler lower than the water-line, substantially as described.

8. The herein-described method of maintaining a circulation of the water in the boiler, the same consisting in drawing off the surface-water through a receiver-pan or scum-gatherer into which falls the feed-water, thereby creating a suction toward said pan, then conducting the water to a filtering apparatus, where the scum, scale-forming, and other impurities of the feed-water are precipitated and the water filtered, cleansed, and purified, and then conducted from the said apparatus to the boiler after being subjected to the heat of the furnace by bringing a portion of the conducting-pipe in contact with the fire, whereby a rapid circulation of the water in the boiler is maintained, the feed-water heated and purified, and the boiler cleansed, substantially as and for the purpose set forth.

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