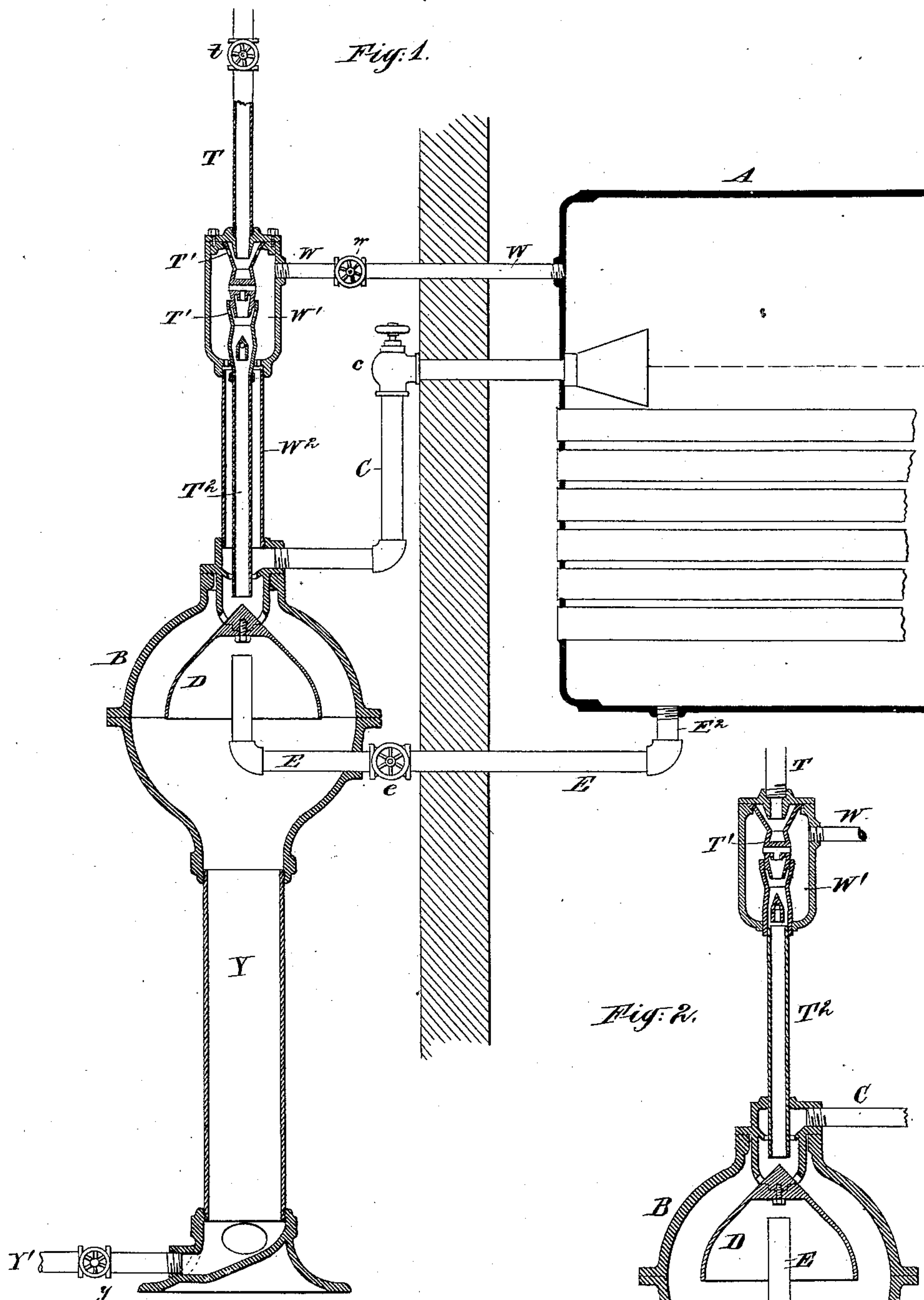


(No Model.)

J. S. ROAKE.
FEED WATER PURIFIER.

No. 428,695.

Patented May 27, 1890.



Witnesses:
Charles F. Searle,
Chas. F. Barden.

Inventor:
John S. Roake
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Thomas Drew Peterson

UNITED STATES PATENT OFFICE.

JOHN S. ROAKE, OF BROOKLYN, NEW YORK.

FEED-WATER PURIFIER.

SPECIFICATION forming part of Letters Patent No. 428,695, dated May 27, 1890.

Application filed July 11, 1889. Serial No. 317,185. (No model.)

To all whom it may concern:

Be it known that I, JOHN S. ROAKE, of Brooklyn, in the county of Kings, in the State of New York, have invented a certain new and useful Improvement in Feed-Water Purifiers, of which the following is a full and exact description.

Letters Patent heretofore issued to me have set forth provisions for inducing a gentle flow of the water outward from a steam-boiler, downward through a chamber favorably conditioned for allowing the loose solid matter therein to settle, and inward again to the boiler. A patent to me, dated September 18, 1888, No. 389,718, shows such apparatus taking the water from the level of the water-line, where it will be likely to receive any scum which will float either permanently or temporarily, and after allowing to move very tranquilly through the chamber outside provides three exits from such chamber—one from the top discharging at intervals all which persists in floating, one from the bottom discharging at intervals all which can be induced to get out of the gentle current by sinking, and another—the main passage—constantly open, carrying the pure water back to the boiler. The moderate flow in this last direction was promoted by the heating of the pipe through which the water was allowed to flow upward from a lower point in re-entering the boiler. My present invention may have all these qualities. I have invented a further improvement.

There have been proposed at various times provisions for heating the feed-water up to or near the temperature of the boiler before its introduction thereto. I provide for effecting this by the same apparatus which purifies the water already in the boiler. It requires but a small addition to the weight, bulk, or expense. Any solid matter which can be precipitated from the feed-water by thus heating is caused to settle in the same chamber as the solid matter from the water already in the boiler, and is blown out or otherwise removed by the same means. The apparatus may be adjusted to work upon only the water already in the boiler, or upon the water which is being received from the feed-pump or injector, or the apparatus may

work with some success performing both functions at once. I provide special facilities for removing the solid matter and for preserving the heat of the water.

The following is a description of what I consider the best means of carrying out the invention:

The accompanying drawings form a part of this specification.

Figure 1 is a vertical section showing my invention applied at the back end of a tubular boiler, and Fig. 2 is a corresponding section through a portion of the apparatus on a larger scale, showing a modification.

Similar letters of reference indicate like parts in both the figures where they occur.

A is the boiler; B, the cleaning-chamber; D, the interior dome or shield within such chamber; C, the pipe bringing water from the boiler to the chamber, and E the pipe conveying the pure water from the chamber to the boiler, all substantially or exactly as in my patent of September 18, 1888, above referred to.

T is a feed-pipe bringing feed-water in a cold or partially-heated condition from a feed-pump or other forcing device (not shown) controlled by a valve *t*, which is adjusted by the attendant, or by any ordinary or suitable automatic device to supply and shut off the feed as required.

T' is a series of oblique and other apertures, which allows the direct contact of steam to the feed-water thus brought, the arrangement being such that the steam thus rushing into contact with the colder water and becoming condensed therein shall move in the same direction as the feed-water is moving, and its momentum, thus suddenly arrested by its change from a large to a small volume, shall promote the motion of the feed-water. The effect in this respect is analogous to that of the strong jet of steam employed in what is known as the "Gifford injector," sometimes relied on as the only means of inducing the movement of the feed-water into the boiler.

T² is an extension of the feed-pipe downward from T' into the top of the chamber B. It carries down into the chamber the feed-water which enters through the feed-pipe T

and whatever additional water is due to the condensation of steam received through the apertures in the portion T'.

W is a steam-pipe which allows steam to flow from the boiler A at full pressure into a chamber W', somewhat larger than T' and surrounding the latter.

W² is a pipe larger than T² and surrounding it, with sufficient apertures into W' and B to allow a free flow of steam or water up or down. The flow of steam through W is controlled or arrested when required by the cock or valve *w*. The pipe W² is strongly tapped into the chambers B and W' and forms a firm and reliable support for the several parts inclosed and connected.

Y is a deep chamber below the cleaning-chamber B and forming in effect an extension thereof downward, in which solid matter deposited from the water may be stored for a considerable period.

In my patent of 1888, above referred to, I provided for automatically discharging the sediment from the bottom of the cleaning-chamber B at short intervals into the open air. With a good quality of water it is not necessary to discharge into the open air, except at long intervals. I can in my present apparatus use the automatic discharging means set forth in my said former patent, if desired in any case; but for most situations I propose to dispense with them and to effect the discharging at intervals of a few hours or a few days by opening and closing by hand a proper valve *y* in the blow-off pipe Y', which leads from the bottom of the deep chamber Y and discharges into any suitable drain or escape-passage. (Not shown.)

When the valve *t* is closed and the feed-water is entirely shut off, the steam received through the steam-pipe W heats the parts W' T' and holds them at about the temperature of the boiler A, but performs no useful work. There will ordinarily be but little, if any, circulation in the upper portion of my apparatus under these conditions; but in the lower part there will be the same action as if the upper part were not there—that is to say, the water in the pipe C and cleaning-chamber B, becoming slightly cooled by radiation, will tend to descend, and becoming heated in the pipe E, and especially in the rising part E² thereof, by its being bathed in the hot products of combustion flowing along under the boiler, will tend to rise, both of which causes will tend to induce, and I have determined by trial will induce, a circulation of water, the hot water flowing outward from the boiler A, through the pipe C, downward through the chamber B, depositing its mud in the chamber Y, and back to the boiler A in a cleaner condition through the pipe E E². This moderate action continues and the water in the boiler is thus continually purified so long as the feed through the pipe T remains shut off. When the cock or valve *t* is opened and a fresh supply of feed-water is received by my

apparatus, if such feed is previously led through any proper heater, (not shown,) it may be warmed up to or near the temperature of the exhaust-steam; but it will still be cooler than the boiler and requires to be warmed from some source. My apparatus gives it heat in the chamber W' by means of steam received from the boiler through the pipe W. The heat thus abstracted is not less than would be required to warm it if it were allowed to enter cold and mingle with the water of the boiler, there is no special economy of heat; but the advantage is found in the superior cleanliness of the boiler. Foreign matter is more easily precipitated when the water is heated. Some objectionable foreign matter—as carbonates and sulphates of lime and magnesia—are completely soluble to a certain point in cold water, but are precipitated by heat. Nearly all the foreign matter not in complete solution—in ordinary language, mud—is more easily precipitated when the water is hot than cold. My apparatus contributes materially to the purifying of the feed-water by heating it and allowing the mud to settle before its induction into the boiler, and this end is attained by the same apparatus which purifies the water of the boiler after it has been inducted.

The deep mud-chamber Y is important, because it allows a great accumulation of the solid matter before it will cease to be deposited and retained. I can clean my apparatus if solid matter ever cakes within it. To do this it is only necessary to shut off the feed by closing the valve *t* and then to close the several pipes W, C, and E by means of their several valves *w*, *c*, and *e*, and after discharging all which flows of itself on opening the valve *y* to remove the hand-hole cover Y' and introduce a hose-pipe, and, if necessary, any proper wires or scrapers, in addition to a jet of water. Such labor will not be necessary unless the proper blowing out through the pipe Y² is neglected for a long period.

The pipe W², surrounding the pipe T², is of advantage in stiffly supporting the parts, as above explained, and also in allowing the water of the boiler to be drawn freely upward to fill the chamber W' when the steam condenses therein on closing the cock or valve *w*. The apertures through which steam is projected against the surfaces of the feed-water, after the fashion of an injector in pipe T', are finely formed and quite contracted and a backflow of dirty water from the scum in the boiler might clog these passages. My arrangement of the pipe W² and the sufficient openings therefrom into the chambers B and W' avoid the risk of such backflow. This pipe and its connected apertures also afford a clear passage for any water which is present from any cause in the chamber W' to flow freely downward into the chamber B.

Modifications may be made by any good mechanic without departing from the principle or sacrificing the advantages of the inven-

tion. Parts of the invention can be used with some success without the whole. I can dispense with the pipe W^2 . Fig. 2 shows such modification.

5 I claim as my invention—

1. The combination, with a steam-boiler A, feed-pipe T, having aperture T' , steam-pipe W, and chamber W' , of the pipe W^2 , pipe T^2 , purifying-chamber B, and pipes C and E, all arranged and operated as herein set forth.

2. The boiler A, boiler-cleaning chamber B, having a dome D, pipes C and E, and blow-off passage Y^2 , in combination with each other
15 and with a feed-pipe T, steam-pipe W, and

chamber W' , arranged to serve substantially as and for the purposes herein specified.

3. The deep mud-chamber Y and blow-off pipe Y' , having the valve y , in combination with the cleaning-chamber B and inclosed dome D, and with the pipes T^2 and E, all substantially as herein specified. 20

In testimony whereof I have hereunto set my hand, at New York, N. Y., this 9th day of July, 1889, in the presence of two subscribing
witnesses. 25

JOHN S. ROAKE.

Witnesses:

CHAS. F. BARTER,

CHARLES R. SEARLE.