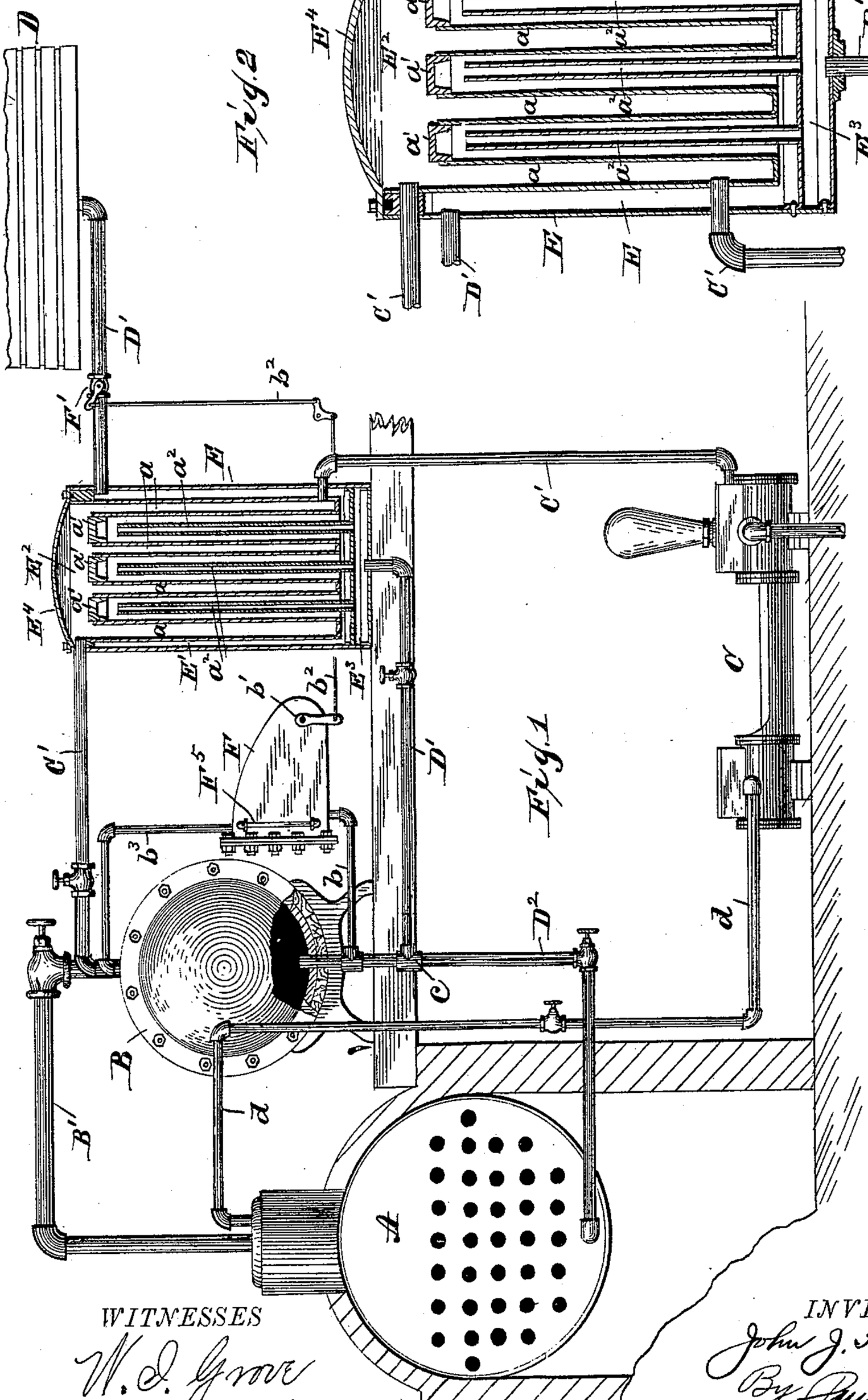
(No Model.)

2 Sheets—Sheet 1

J. J. HOPPES.

SYSTEM OF PURIFYING WATER.

No. 419,446. Patented Jan. 14, 1890.



WITNESSES

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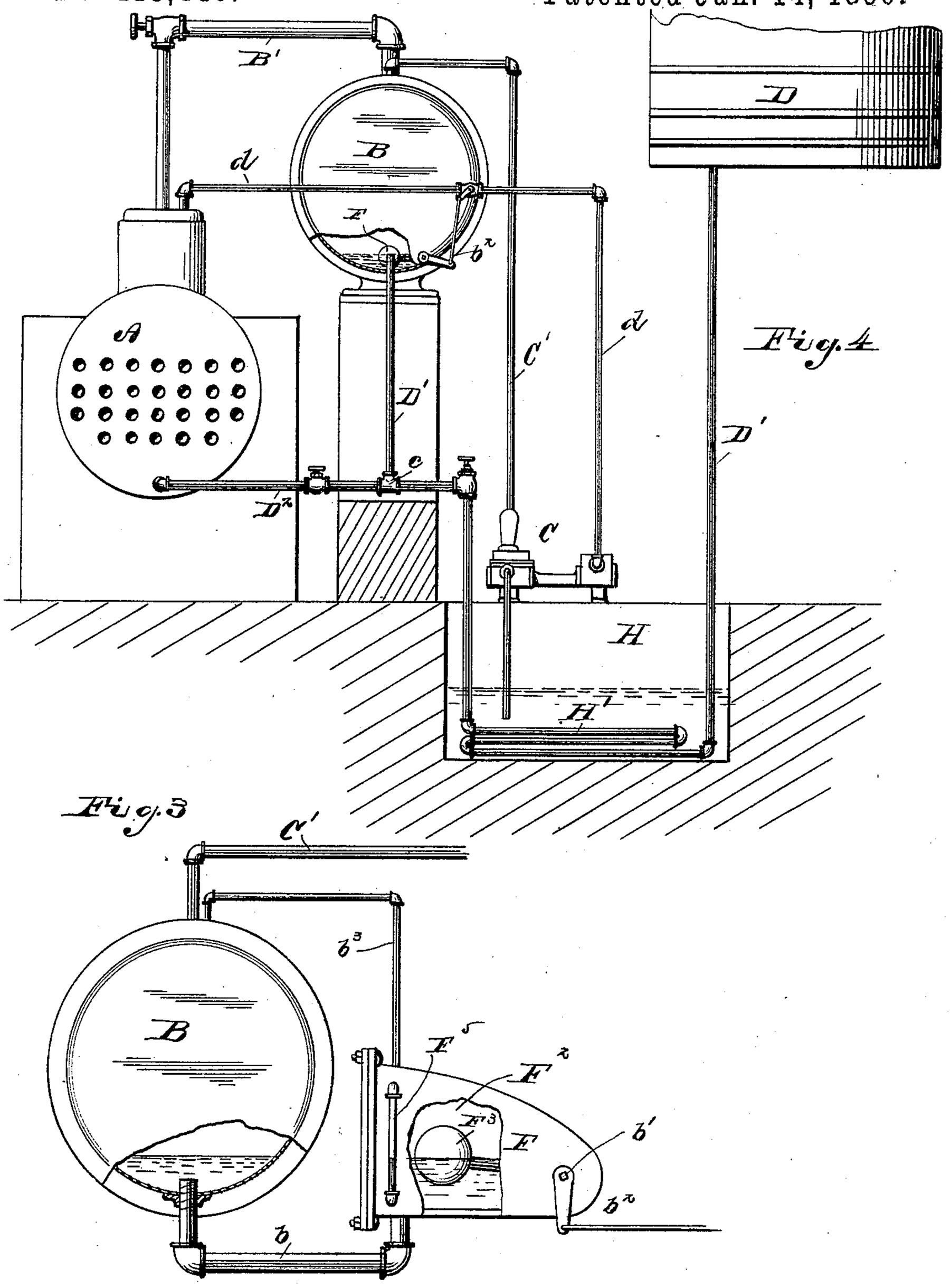

Fig. 4

Fig. 3

WITNESSES

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UNITED STATES PATENT OFFICE.

JOHN J. HOPPES, OF SPRINGFIELD, OHIO.

SYSTEM OF PURIFYING WATER.

SPECIFICATION forming part of Letters Patent No. 419,446, dated January 14, 1890.

Application filed March 9, 1888. Serial No. 266,774. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. HOPPES, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in a System of Purifying Water, of which the following is a specification.

My invention relates to a system of purifying water for steam-boilers and similar purposes.

It particularly relates to a system of purifying water at the different supply-stations for locomotive-boilers, so that the water supplied to the said boilers will be free from the incrustating substances and free solids, and thus prevent the accumulation of such substances in the locomotive-boilers.

The apparatus and mechanical constructions described herein are made the subject-matter of my pending application, Serial No. 317,035.

In the accompanying drawings, Figure 1 is an elevation view, partly in section, of an arrangement of mechanical devices for carrying out my invention. Fig. 2 is a sectional elevational view of a cooling device, to which reference is made hereinafter. Fig. 3 is an elevation view, partly in section, showing the automatic regulating device enlarged. Fig. 4 is a sectional elevational view of a modified form of cooling device.

Like parts are indicated by similar letters of reference throughout the several views.

In the said drawings, A represents a steam-boiler of any suitable and well-known construction.

B is a purifying device adapted to purify water and remove the incrustating substances therefrom by bringing the same in contact with the live steam at the boiler pressure and temperature. The purifier B is connected directly with the boiler A by the steam-pipe B′.

The water to be purified is fed to the purifier B by means of an ordinary feed-pump C or other suitable feeding device, the pipe C′ being adapted to convey the water from said pump to said purifier. The water fed by the pump C into the purifier B comes in contact with the live steam therein and is subjected to substantially the same conditions and the same temperature as in the boiler from which the steam is supplied. After passing through the purifier B the purified water is forced by the steam-pressure therein through a discharge-pipe D′ into the tank D, where it is stored and supplied to locomotives or such other receptacles as is desired.

The water which is discharged from the purifier B, it is understood, will be at substantially the same temperature as the temperature in the boiler A, while the feed-water pumped through the pipe C′, if brought directly from the well, will be at the normal temperature of the well or cistern from which it is supplied, so that if the water is discharged into the tank D direct from the purifier B, and the water is fed into the purifier B direct from the pump C or direct from the well from which it is supplied, considerable less of heat will be sustained. In order to overcome this, I provide a cooling device E, consisting of two compartments in close contact with each other, through one of which the purified water is adapted to pass on its way from the purifier to the tank, and through the other the feed-water is adapted to pass before entering the purifier. By this construction I not only partially cool the water which is discharged from the purifier, but I raise the temperature of the feed-water before it is fed into the purifier, the temperature of the water supplied to the purifier after passing through the cooler being the mean temperature between the temperature of the purifier and the feed-water in the well or source of supply.

The cooler E, I preferably construct as shown in Fig. 2, which consists of a suitable outer casing having therein an outer chamber E′ and an inner chamber E^2, the two chambers being separated by a suitable partition, preferably in the form of a cylinder supported at the top and depending into the outer chamber E′. The outer chamber E′ is preferably divided by a transverse partition therein, forming an auxiliary chamber E^3. Extending upwardly from the chamber E′ into the chamber E^2 is a series of tubes *a*, preferably of plain cylindrical form on the outside and closed at the top by plugs *a*′, or in any other suitable manner. Extending

upwardly from the auxiliary chamber E^3 and into the tubes a is a series of open-ended tubes a^2.

The water which comes from the purifier B enters the auxiliary chamber E^3 and passes up through the inner tube a^2, and thence down through the outer tubes a into the main or outer chamber E′, from whence the water is discharged into the tank or other place of storage. The water fed from the pump or other source of supply enters at the bottom of the inner chamber E^2, and, surrounding the tubes a, rises to the top of said chamber and passes to the purifier through the pipe C′. It will thus be seen that a complete circulation of the hot or purified water is secured in direct contact with the cold water on its way to the purifier, so that the water from the respective chambers E′ and E^2 is discharged at substantially the same temperature, the water from the heater being thus considerably cooled and that from the pump or supply correspondingly heated.

The feed-water passing around the tubes a, being heated in the chamber E^2, will part with some of the impurities therein and become partly purified before entering the heater and purifier B.

In order to clean the cooler from any incrustations or other impurities collected therein, I provide a removable head E^4 at the top of the chamber E^2, and a blow-off or discharge-pipe E^5 at or near the bottom thereof. The head E^4 is preferably of the same diameter as the chamber E^2, so that the entire end of the said chamber is left open when the said head is removed, and thus complete access is secured thereto. The tubes a, being of plain cylindrical form on their outside, may be readily cleaned by means of a cylindrical scraper adapted to fit over the same, and the impurities washed out through the discharge-pipe E^5. The water which passes through the outer chamber E′ and through the interior of the tubes a and a^2, having been purified before entering the same, no incrustating substances will be found therein, and consequently no cleaning thereof will be required.

It will be understood from the above that the water is forced from the source of supply into the purifier B against the boiler-pressure by the pump C. This pressure will be sufficient to force the water through the cooler E and into the tank D after it is purified. Now in order to prevent the water from all being forced out of the discharge-pipe D′, in the event that the feed-supply should be cut off, I provide an automatic regulating device F, adapted to operate a valve F′ in the discharge-pipe D′, so that when the water in the heater falls below a given point the valve F′ in the pipe D′ will be closed and thus prevent the steam from escaping from the purifier through the pipe D′ into the tank D. This I accomplish as follows: Extending from the discharge-pipe D′ is a small pipe b, which leads to a chamber F^2, the top of which extends above the top of the discharge-pipe D′ in the purifier. Located in the chamber F^2 and pivoted at the outer end, so that it may rise and fall therein, is a float F^3, provided with a projecting trunnion b', which extends through the outer casing and connects, through the medium of a suitable bell-crank mechanism and connection b^2, with the valve F′ in the pipe D′. This float F^3 is so situated with reference to the inner pipe D′ that when the water in the purifier falls below the top of said pipe the float F^3 drops down and closes the valve F′. When the water rises considerably above the top of the pipe D′, the float F^3 is raised and opens the valve F′ to its fullest extent, thus allowing the water to pass therefrom to the tank D. It will thus be seen that no matter what quantity of water is being forced into the purifier by the pump C the automatic regulator F will determine the position of the valve F′, so that the water shall never fall below the end of the pipe D′ in the purifier. In addition to the regulator F, I preferably provide a water-gage F^5, which extends up from the pipe b, and by a suitable pipe-connection b^3 is connected to the upper part of the purifier, so that the position of the water in the purifier may be determined at any time at a glance.

In order to provide for feeding the boiler which furnishes steam to the purifier, I place a T-connection c in the pipe D′, and from the same extend the pipe D^2, provided with a suitable check and cut-off valve at the boiler-inlet. In this way the pump C acts as a boiler-feeder as well as to supply the purifier B, the water used in the boiler A being purified and the incrustating substances removed therefrom before passing into the same.

In Fig. 4 I have shown a modified form of cooling device. In this case I provide a well H, in which, below the water-line, is placed a coil of pipe H′, or other suitable water-passage having sufficient outer surface. Through this coil and the pipe D′ the water passes on its way to the tank D. The water in the well becomes thus heated and is drawn therefrom by the pump C and forced into the purifier B. In this arrangement I have shown the regulator F placed directly in the heater or purifier, and instead of having the valve F′ in the pipe D′, I place a variable throttle-valve in the pipe d, which furnishes steam to the pump C, the said valve being operated by the automatic regulator F, and in this way the speed of the pump will be automatically varied, so that the water in the heater will at all times cover the top of the pipe D′.

For the purifier and heater I preferably use a purifier in which the water passes over a series of pans and flows down on the under side of said pans, as set forth in my Letters Patent No. 318,112, issued May 19, 1885; but

any other live-steam heater may be used, if desired.

The advantages of this system of purifying water for use with railroads are numerous and will be comprehended at once. Not only will the incrustating substances and free solids be kept from the locomotive-boilers, but the water-tanks will be kept from freezing in the winter, and as the water will be kept constantly warmed therein they will be kept perfectly tight. In addition to this, there will be the advantage of securing warm water in the locomotive-tenders, thus saving considerable fuel in the locomotives.

It is obvious that this system of purifying water may be used for many other purposes, aside from railroads, where it is desired to obtain pure water for any purpose. It is further obvious that the arrangement and construction of the various parts may be modified in a variety of ways without departing from the spirit of my invention. I do not, therefore, limit myself to the constructions herein shown and described; but

I claim, broadly—

1. The system of purifying water at railroad-stations or for similar purposes, which consists in passing the water through a purifier connected directly with the steam-boiler and discharging the same into a tank or reservoir by the pressure of the steam in the boiler, substantially as set forth.

2. A system for purifying water for locomotives or similar purposes, which consists in passing the water through a purifier connected directly with the steam-boiler, and by the pressure of the steam in the boiler discharging the water into a tank or reservoir through a cooling device in which the purified water imparts a portion of its heat to the water fed to the purifier, substantially as set forth.

In testimony whereof I have hereunto set my hand this 27th day of February, A. D. 1888.

JOHN J. HOPPES.

Witnesses:
PAUL A. STALEY,
JOSHUA SCOTT.