No. 646,885. Patented Apr. 3, 1900.

C. STICKLE.

PURIFYING FEED WATER FOR BOILERS.

(Application filed Aug. 6, 1898. Renewed Feb. 21, 1900.)

(No Model.) 2 Sheets—Sheet 1.

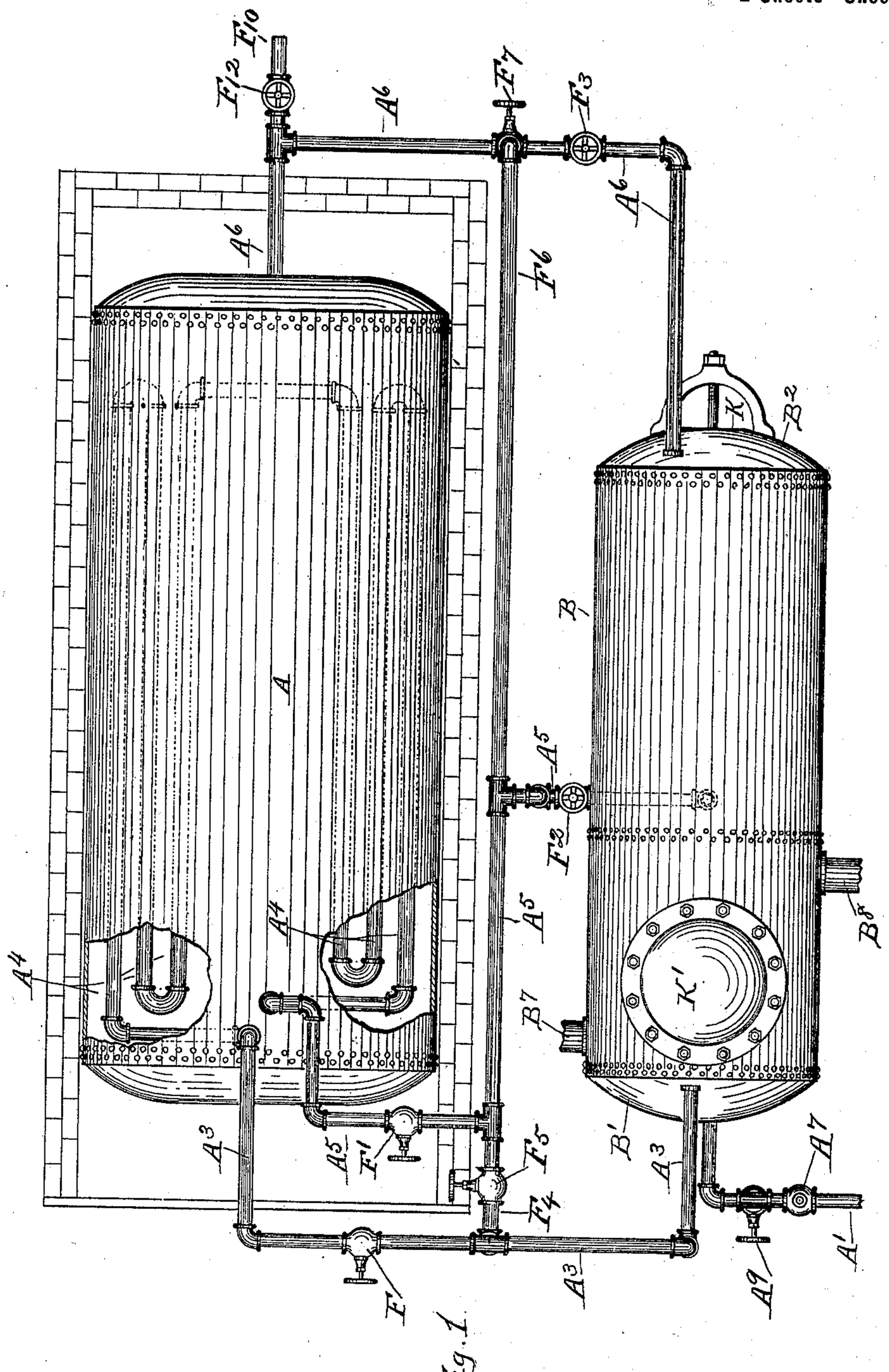

Fig. 1.

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Fig. 2.

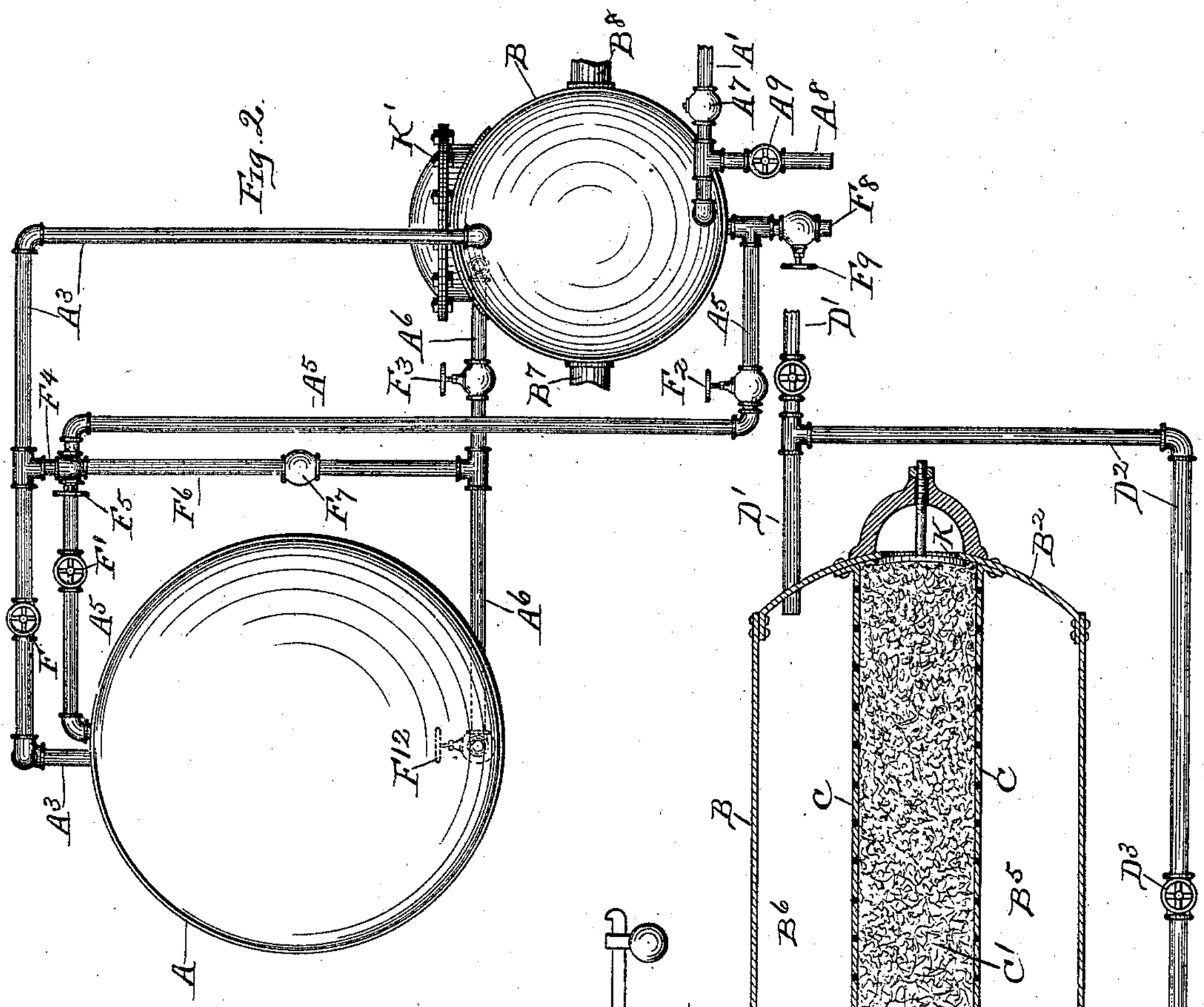

Fig. 4.

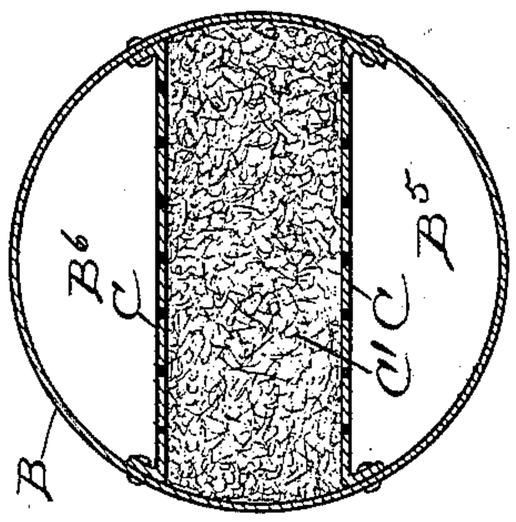

Fig. 3.

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UNITED STATES PATENT OFFICE.

COLE STICKLE, OF SALEM, NEW YORK, ASSIGNOR TO CELIA A. STICKLE, OF BENNINGTON, VERMONT.

PURIFYING FEED-WATER FOR BOILERS.

SPECIFICATION forming part of Letters Patent No. 646,885, dated April 3, 1900.

Application filed August 6, 1898. Renewed February 21, 1900. Serial No. 6,119. (No model.)

To all whom it may concern:

Be it known that I, COLE STICKLE, a citizen of the United States, residing at Salem, county of Washington, and State of New York, have invented certain new and useful Improvements in Purifying Feed-Water for Boilers, of which the following is a specification.

The invention relates to such improvements; and it consists of the novel construction and combination of parts hereinafter described and subsequently claimed.

Reference may be had to the accompanying drawings and the letters of reference marked thereon, which form a part of this specification.

Similar letters refer to similar parts in the several figures.

Figure 1 of the drawings is a top plan view of my improved apparatus. Fig. 2 is a front elevation of the same. Fig. 3 is a central vertical longitudinal section of the purifying-cylinder, showing a different arrangement of connecting-pipes from that shown in Figs. 1 and 2. Fig. 4 is a cross-sectional view of the cylinder, taken through the filter-chamber.

My invention relates to improvements in apparatus for heating and purifying feed-water for boilers and upon the apparatus shown and described in United States Letters Patent No. 526,330, issued to me September 18, 1894, for improvements in purifying feed-water for steam-boilers.

My present invention relates more particularly to the apparatus for heating and purifying the water and cleansing the heating and purifying apparatus.

In treating the water by my improved apparatus the supply to the boiler is continuous and is produced by a pump or any other known means capable of forcing the water into the boiler against the back pressure of steam therein, and the water so forced into the boiler is on its way thereto heated approximately to boiler-temperature while passing through the feed-pipe or one or more coils in said pipe and is then deposited in the lower part of a filter and forced upwardly through the filter slowly into a chamber at the top of the filter, whence it passes into the boiler.

The general construction of the purifying-cylinder is the same in all the figures of the drawings, the construction shown in Fig. 3 differing from that in Figs. 1 and 2 only in the arrangement of the connecting-pipes and valves.

Referring to the arrangement shown in Figs. 1 and 2, A represents a steam-boiler, which may be of any known form, and A', A^2, A^3, A^4, A^5, and A^6 represent the feed-pipe for conveying feed-water thereto.

B represents a heating and purifying cylinder wherein the water is treated on its way to the boiler. The cylinder comprises a cylindrical shell provided with the convexed ends B' and B^2 and the transverse concavo-convex diaphragm B^3, intermediately of the ends, dividing the cylinder into two chambers, B^4 being the heating-chamber and the other chamber being the filtering-chamber, which is subdivided into the lower chamber B^5 and the upper chamber B^6 by the horizontal filter-diaphragm, which extends longitudinally of the chamber from the end wall B^2 to the transverse diaphragm B^3. (See Fig. 3.)

The heating-chamber is provided with an inlet B^7 and an outlet B^8, whereby said chamber is adapted to be connected with a supply of heated fluid and a circulation of such fluid maintained through the chamber. The supply of heated fluid can be derived from the exhaust from the engine or from any convenient source.

Within the heating-chamber is located a heating-coil A^2, which forms a part of the feed-pipe, being connected at one end with the main branch A' of such pipe and at the other end with the branch A^3 of such pipe, which leads from the heating-coil interiorly of the boiler and connects with one or more heating coils or loops A^4 at one end, the other end of such coils or loops being connected with the return branch pipe A^5, leading back to the cylinder and entering the same in communication with the lower filtering-chamber B^5.

The filter-diaphragm comprises a pair of perforated plates C C and a mass of finely-divided coke or other filtering material inclosed between such plates, as shown at C'.

The upper filter-chamber B^6 is in commu-

nication with the outlet branch pipe A^6, which communicates with the interior of the boiler.

The operation of the apparatus is as follows, it being understood that all valves in the pipes above referred to by letter are open and that valves in such pipes as have not yet been referred to are closed: Water is forced into the pipe A′ under pressure sufficient to overcome the back pressure from the boiler and passes through the coil A^2, where it is partly heated to the desired degree, thence through the pipe A^3 to the coils or loops A^4 within the boiler, where the water in the coils is heated approximately to the temperature of the water in the boiler. Then it passes through the return-pipe A^5 and is deposited in the comparatively-large body of water in the lower filter-chamber B^5, which by the same process has been previously heated approximately to boiler-temperature, which body of water is forced slowly upwardly through the filter into the upper chamber B^6 and then passes into the boiler to feed the same. As set forth in my said prior patent, the tendency of water to deposit its impurities increases with its temperature and is favored by suddenly arresting the velocity of the water, as by depositing a comparatively-small stream into a comparatively-large body of water. It will thus be seen that the free impurities, which were carried along by the velocity of the water while confined in the small feed-pipes, are permitted to settle by gravity to the bottom of the lower chamber B^5 when deposited therein, and as the water, by reason of the large area of the filter-diaphragm, passes very slowly upward through the filter I am able to utilize the full effect of gravity in separating the impurities from the water in its passage through the filter.

As shown in Fig. 2, the purifying-cylinder is located on a lower plane than the boiler, and the general course of the water from the point where it is deposited in the bottom of the filter-chamber is upward, so that any free impurities in order to enter the boiler must not only pass through the filter, but must overcome the force of gravity.

The impurities which are freed from water by heat are usually of a soft nature and tend to adhere to surfaces with which they come in contact and to harden thereon in layers, which hardened matter can be removed only with great difficulty. If, however, the deposit is not given time to harden, its removal can be accomplished with little trouble. Taking advantage of this fact, I provide my improved apparatus with means for removing such deposit frequently, while yet soft, from the interior of the various small pipes and coils of the feeding system. Outside of the heating-coils the feed-pipe is provided with a check-valve A^7, which may be of any known form adapted to resist and control the back pressure from the boiler, and between this check-valve and the heating-coils I provide an outlet A^8, leading from the feed-pipe and controlled by a valve A^9. It will be readily seen that by opening the valve A^9 a reverse current will be established from the boiler back through the various chambers, pipes, and coils and out through the outlet A^8, whereby soft impurities adhering to the inner surfaces of the various pipes and coils will be forced therefrom and out through such outlet, thereby cleansing the apparatus.

In order to secure a more direct connection between the boiler and the several heating coils and pipes, whereby the several coils and pipes can be separately cleansed by the back-flow from the boiler and whereby certain parts of the apparatus can be cleansed and renewed without interrupting the supply of feed-water to the boiler, I provide each of the pipes above referred to by letter with a controlling-valve, as the valve F in pipe A^3, the valve F′ in pipe A^5, the valve F^2 also in pipe A^5, and the valve F^3 in pipe A^6, all of which valves are normally open to permit free flow of the feed-water and one or more of said valves being closed from time to time, as required, in cleansing the apparatus, and I provide direct valve-controlled pipe connections between the several sections of the feed-pipe, as the horizontal and vertical pipe F^4, connecting the pipes A^3 and A^5 and controlled by the valve F^5, and the horizontal and vertical pipe F^6, connecting the pipes A^5 and A^6 and controlled by the valve F^7. These two pipes F^4 and F^6 both connect with the pipe A^5 intermediately of the two valves F′ and F^2 in such pipe. I also provide the pipe A^5, near its connection with the filter-chamber, with a blow-off outlet F^8, controlled by a valve F^9, and the pipe A^6, near its connection with the boiler, with a blow-off outlet F^{10}, controlled by a valve F^{12}, which comprise the means for blowing out the boiler when desired.

The respective valves and outlets being located in substantially the positions shown in the drawings in Figs. 1 and 2, the cleansing operations are as follows: The valves F^{12}, F^7, and F^2 being closed and valves F^3 and F^9 being opened, impurities can be blown out from the filter through the outlet F^8. The valves F^{12}, F^3, F^2, and F^5 being closed and valves F^7, F′, F, and A^9 being opened, the coils A^4 and A^2 can be cleansed, the impurities being blown off through the outlet A^8, and by opening the valve F^5 and closing the valves F and F′ the coil A^2 can be blown out independently of the coil A^4. By closing the valves F^3 and F^2 the filter-chamber is entirely cut off from the other parts of the apparatus, and access can be had thereto through the manhole K for the purpose of renewing the filtering material without interfering with the supply of water to the boiler.

The cleansing operation reduces the pressure in the boiler but little and may be repeated daily or several times daily if very impure water is used.

In the construction shown in Figs. 3 and 4 the cylinder and its diaphragms and coil are the same as in Figs. 1 and 2, and said Figs. 3 and 4 may be referred to in connection with the above description for a complete understanding of the construction of the same. As shown in Fig. 3, however, the construction is adapted to heat the feed-water to approximately boiler-temperature independently of the coils A^4. (Shown in Fig. 1 and contained within the boiler.) To do this, it is necessary to supply the heating-chamber B^4 with a highly-heated fluid, as steam or superheated water from the boiler, which passes through the inlet-pipe B^7 and outlet-pipe B^8 and quickly heats the feed-water, which is forced from the feed-pipe A′ through the coil A^2, located in said heating-chamber. The water is thus heated approximately to boiler-temperature before it leaves the coil, whence it passes directly into the lower filter-chamber through the pipe D, then passing upwardly through the filter and out through the pipe D′ to the boiler to feed the same. The pipes D and D′ are connected by a pipe D^2, provided with a valve D^3, and the pipe D is provided with a similar valve D^4 near its connection with the filter-chamber. The valve D^3 is normally closed and the valve D^4 open; but when it is desired to cleanse the heating-coil the valve D^3 is opened and the valve D^4 closed, leaving the pipes D and D′ in communication with each other only through the pipe D^2, and the valve A^9 in the outlet-pipe A^8, which leads from the feed-pipe between the heating-coil and check-valve A^7, is opened, permitting the back pressure from the boiler to force out all free impurities from the pipes.

As one or both sides of the transverse diaphragm B^3 is subjected to boiler-pressure, I make such diaphragm concavo-convex in form, in order to secure strength sufficient to resist such pressure.

The end wall B^2 of the cylinder is provided with a manhole, as at K, which communicates with the space between the filter-plates C C and permits the filter to be renovated by renewing the supply of filtering material. The heating-chamber B′ is also provided with a manhole, as at K^4, to permit access to the coil within such chamber and facilitate the insertion and removal of the coil. Each of said manholes is closed by a suitable cover.

The filter-chamber may, if desired, be provided with a safety-valve V, as shown in Fig. 3.

When desired, the supply of feed-water to the heating and filtering apparatus may be stopped during the cleansing operations, and by opening and closing, respectively, the proper valves the several parts of the apparatus can be temporarily cut off from communication with the boiler to permit such parts to be emptied of their liquid contents, after which the communication with the boiler can be reëstablished to blow out the emptied parts in the manner above described, thus utilizing the full value of the inertia of the backflow from the boiler to remove accumulations of sediment and impurities.

The pressure and temperature of the filtering-chamber being approximately that of the boiler varies with the pressure and temperature of the boiler and frequently changes, not only absolutely, but relatively to the pressure and temperature of the heating-chamber B^4, so that the temperature of the cylinder B and the concavo-convex diaphragm B^3 is continually changing according to the changes of boiler-pressure.

If the diaphragm B^3 were made plane instead of concavo-convex, its union with the cylinder would be strained or ruptured by the varying expansion and contraction of the parts, thereby causing a leak from the filter-chamber into the heating-chamber. The yielding nature of the concavo-convex diaphragm, which is formed of plate metal similar to that of the shell of the cylinder, compensates for the changes in contraction and expansion and leaves the joint intact and uninjured.

I make no claim in this application to the form of filter shown and described herein, as the same is shown, described, and claimed in an application filed by me December 2, 1899, Serial No. 738,967, as a division of the present application.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a feed-water heater and purifier, a heating and purifying cylinder having two end chambers and comprising a cylindrical shell continuous throughout its length, and a transverse concavo-convex diaphragm located within the cylinder and having its peripheral edge secured to the interior surface of the continuous shell, in combination with water-heating mechanism located in one of said chambers, steam and water inlets and outlets and filtering mechanism in the other of said chambers, substantially as described.

2. In a feed-water heater and purifier, the combination with a continuous cylindrical shell having convexed ends, of a closed transverse concavo-convex diaphragm located within the cylinder intermediately of said ends and having its peripheral edge secured to the continuous cylindrical shell, whereby the interior of the shell is divided into two chambers; water-heating mechanism located in one of said chambers; filtering mechanism in the other of said chambers; and means located exteriorly of the cylinder for conducting the heated water from the heating-chamber to the filtering-chamber, and thence to the boiler, and steam and water inlets and outlets substantially as described.

In testimony whereof I have hereunto set my hand this 22d day of July, 1898.

COLE STICKLE.

Witnesses:
FRANK C. CURTIS,
A. G. GOLDTHWAIT.