No. 649,116. Patented May 8, 1900.

C. STICKEL.

FEED WATER PURIFIER FOR BOILERS.

(Application filed Dec. 2, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

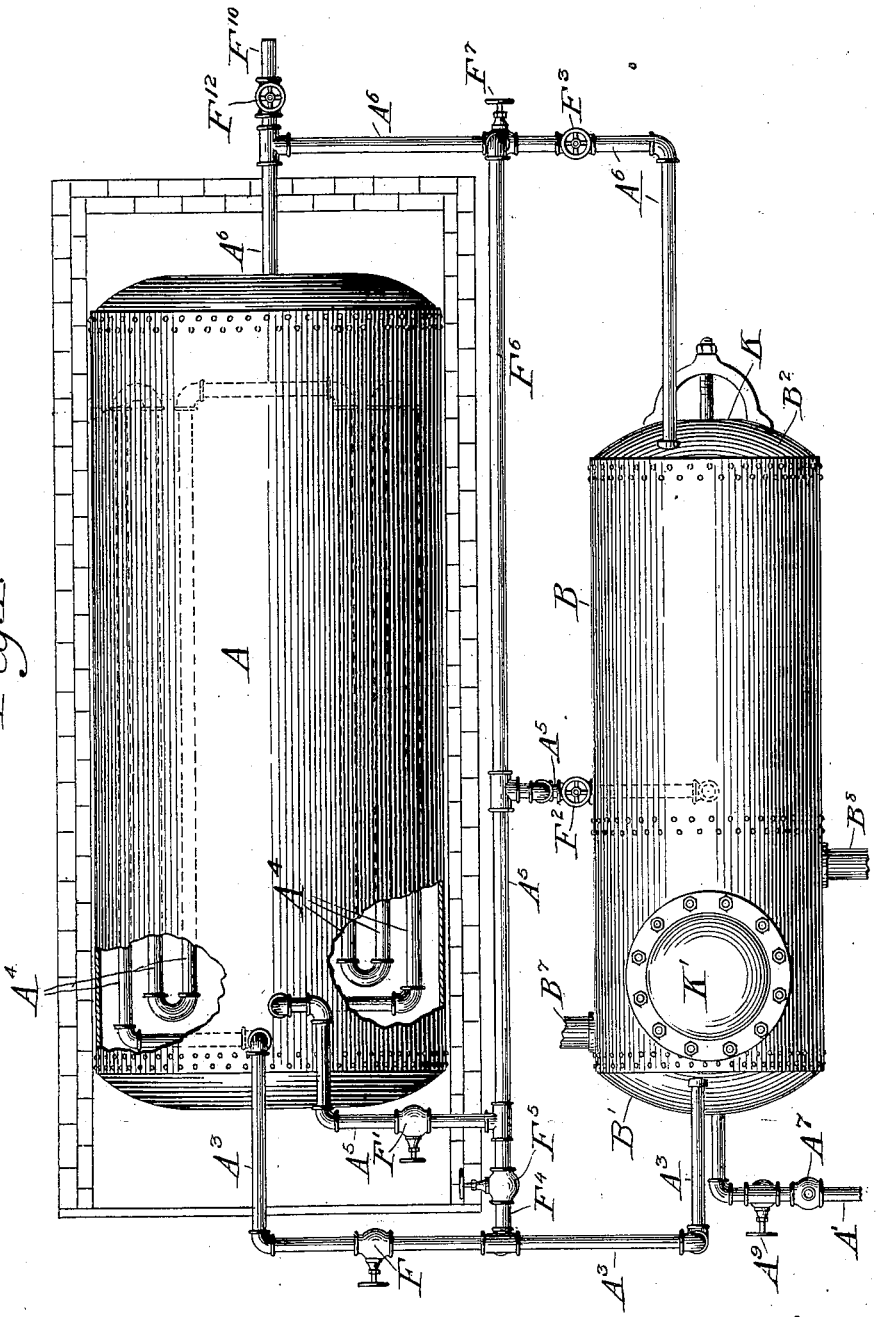

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Fig. 2.

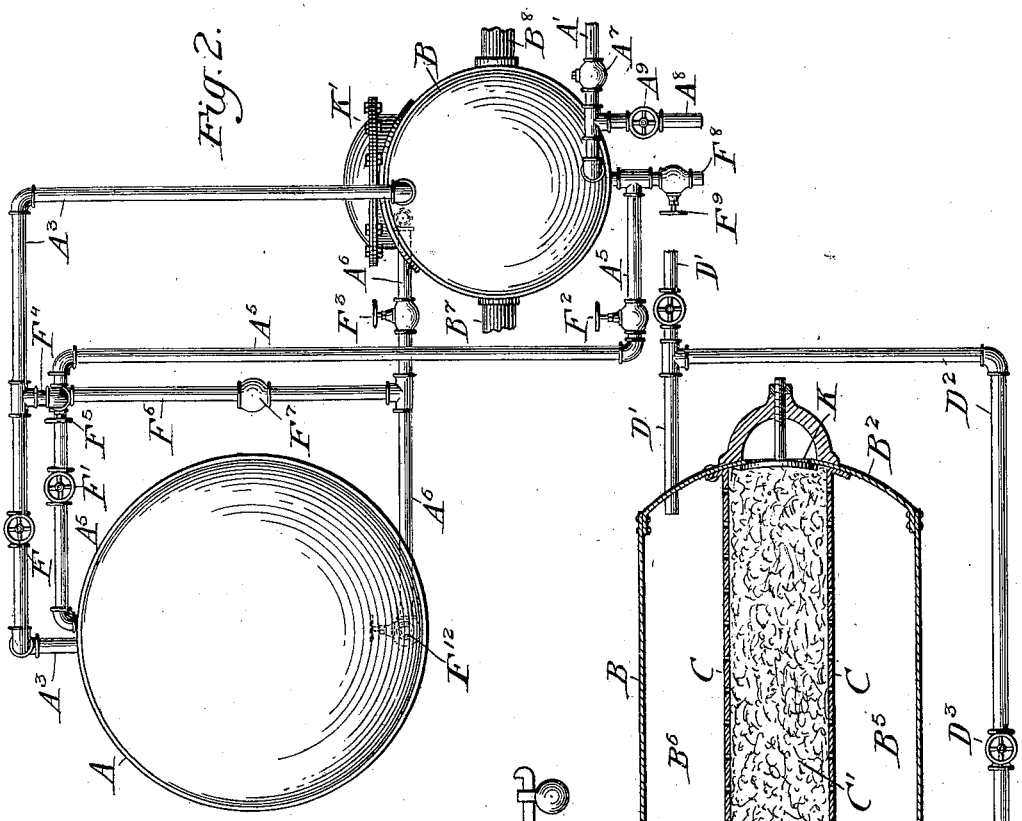


Fig. 4.

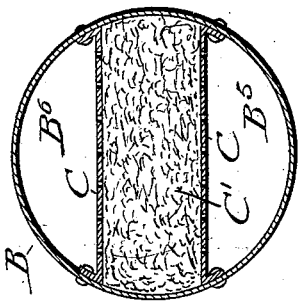
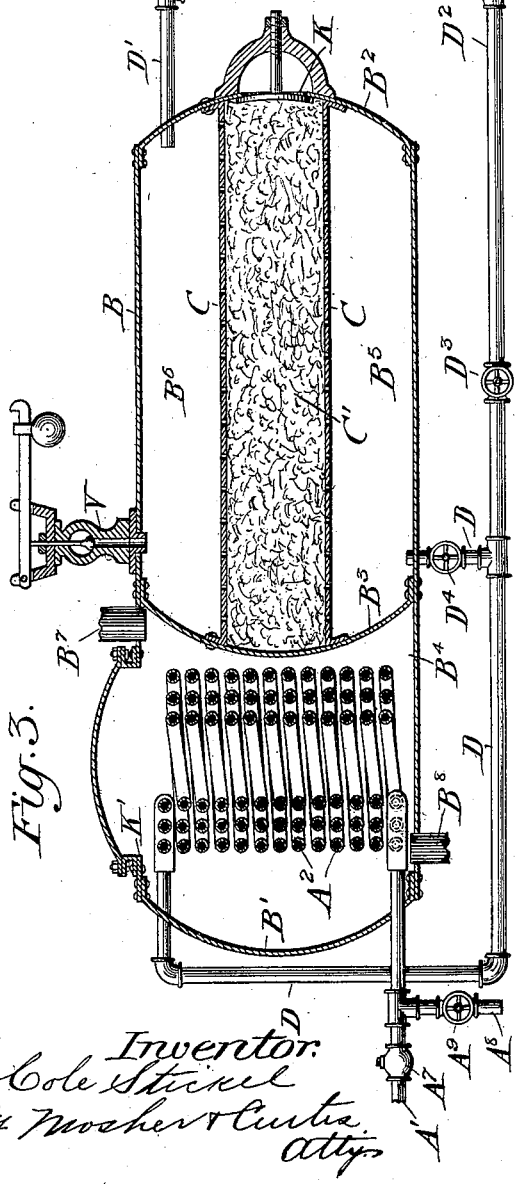


Fig. 3.



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UNITED STATES PATENT OFFICE.

COLE STICKEL, OF BENNINGTON, VERMONT.

FEED-WATER PURIFIER FOR BOILERS.

SPECIFICATION forming part of Letters Patent No. 649,116, dated May 8, 1900.

Original application filed August 6, 1898, Serial No. 687,951. Divided and this application filed December 2, 1899. Serial No. 738,967. (No model.)

To all whom it may concern:

Be it known that I, COLE STICKEL, a citizen of the United States, residing at Bennington, county of Bennington, and State of Vermont, have invented certain new and useful Improvements in Feed-Water Purifiers 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 reference characters marked thereon, which form a part of this specification.

Similar characters 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, 1898, for improvements in purifying feed-water for steam-boilers.

This application is a division of the application filed by me August 6, 1898, Serial No. 687,951.

My present invention relates more particularly to the filtering apparatus for extracting the solid impurities from the heated water.

In treating the water by my improved apparatus the supply to the boiler is preferably 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 figures of the drawings, the combination 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.

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 end of one or more heating coils or loops A^4, located within the boiler, the other ends 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 communication 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.

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 backflow 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}.

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.

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 opposite sides of the transverse diaphragm B^3 may be subjected to differential 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^4 is also provided with a manhole, as at K′, 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.

By having the perforated plates C C, which, with the inclosed filtering material, form the filter-diaphragm, extend longitudinally of the cylinder B and to the end wall B^2 of the cylinder I am able to make the filter-diaphragm more conveniently accessible for renewing the filtering material. The cylinder can be horizontally disposed, as shown, which brings the entire filter-diaphragm on a comparatively-low level and below the level of the boiler, so that the direction of the feed-water delivered thereto is upward, and the filtering-chamber is in a conveniently-accessible position for renewing the filtering material. The end B^2 of the cylinder is provided with the manhole K, through which the filtering material can be easily withdrawn by a hoe or other implement and other material easily inserted.

A very important object accomplished by extending the filtering-diaphragm longitudinally of the cylinder, which is horizontally disposed, is the economical and advantageous division of the filter-chamber into subdivisions best adapted to perform their various functions. The diaphragm itself occupying the middle part of the cylinder, with its plane-surfaced top and bottom plates extended horizontally lengthwise of the cylinder and its side walls formed by the cylinder-walls also extending on straight horizontal lines to the outlet or manhole, not only facilitates the easy renewal of the filtering material, but devotes more than half the capacity of the cylinder to the storage of such material, and at the same time provides a lower settling-reservoir B^5 beneath such diaphragm, which has a maximum depth of about one-third the diameter of the cylinder, and an upper reservoir B^6 of about the same depth.

When a filtering-diaphragm is placed between two settling-reservoirs, it is desirable that the diaphragm should have a large area exposed to such reservoirs and that the reservoirs should have depth as well as area, whereby the fluid to be purified entering near the middle of the bottom of the lower reservoir will travel a long distance to reach the filter-surface, and having reached such surface and been distributed over a large area will travel slowly through the filtering material.

By disposing the cylinder horizontally and the filter-diaphragm horizontally and longitudinally of the cylinder, as shown, the surface area of the filtering material adjacent to the inclosing reservoirs is limited only by the length of the cylinder, which may be safely extended indefinitely without requiring material reinforcement of its shell, while to obtain the same enlarged area with a transverse filter-diaphragm would be practically impossible and unsafe without materially strengthening the whole shell of the cylinder, the diameter of which would necessarily be increased. When the cylinder is thus horizontally disposed with its horizontal filter-diaphragm, the length of the cylinder and said diaphragm may be extended indefinitely without materially interfering with the operation of renewing the supply of filtering material through the end manhole, as above described.

The plates of the filter-diaphragm are preferably not only secured along their side edges to the side walls of the cylinder, as shown in Fig. 4, but are also secured at their opposite ends to a cylinder end and said concavo-convex diaphragm, respectively, as shown in Fig. 3.

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

1. In a feed-water heater and purifier, the combination with a horizontally-disposed cylinder; of a filter-diaphragm horizontally disposed within the cylinder, whereby is formed a comparatively-deep depositing-reservoir beneath said diaphragm and a like reservoir above said diaphragm; means for heating the feed-water; and means for depositing the heated feed-water into the bottom of the lower depositing-reservoir, and withdrawing the same from the top of the upper depositing-reservoir, substantially as described.

2. In a feed-water heater and purifier, the combination with a boiler; of a cylinder horizontally disposed below the level of the boiler having ends and a transverse diaphragm separating the interior of the cylinder into two chambers; heating mechanism in one of said chambers; a pair of perforated filter-diaphragms extending in planes parallel with each other and with the axis of the cylinder,

longitudinally of the other of said chambers from said transverse diaphragm to one of the cylinder ends, and secured along their side edges to the side wall of said chamber, and at their opposite ends to said cylinder end and the transverse diaphragm respectively, said cylinder end having an aperture communicating directly with the space inclosed between said filter-diaphragms and detachable mechanism for closing said end aperture, substantially as described.

In testimony whereof I have hereunto set my hand this 28th day of November, 1899.

COLE STICKEL.

Witnesses:
HARRY T. CUSHMAN,
E. H. HOLDEN.