

No. 627,167.

Patented June 20, 1899.

T. WILLEBRAND.  
FEED WATER HEATER AND PURIFIER.

(Application filed Feb. 25, 1897.)

(No Model.)

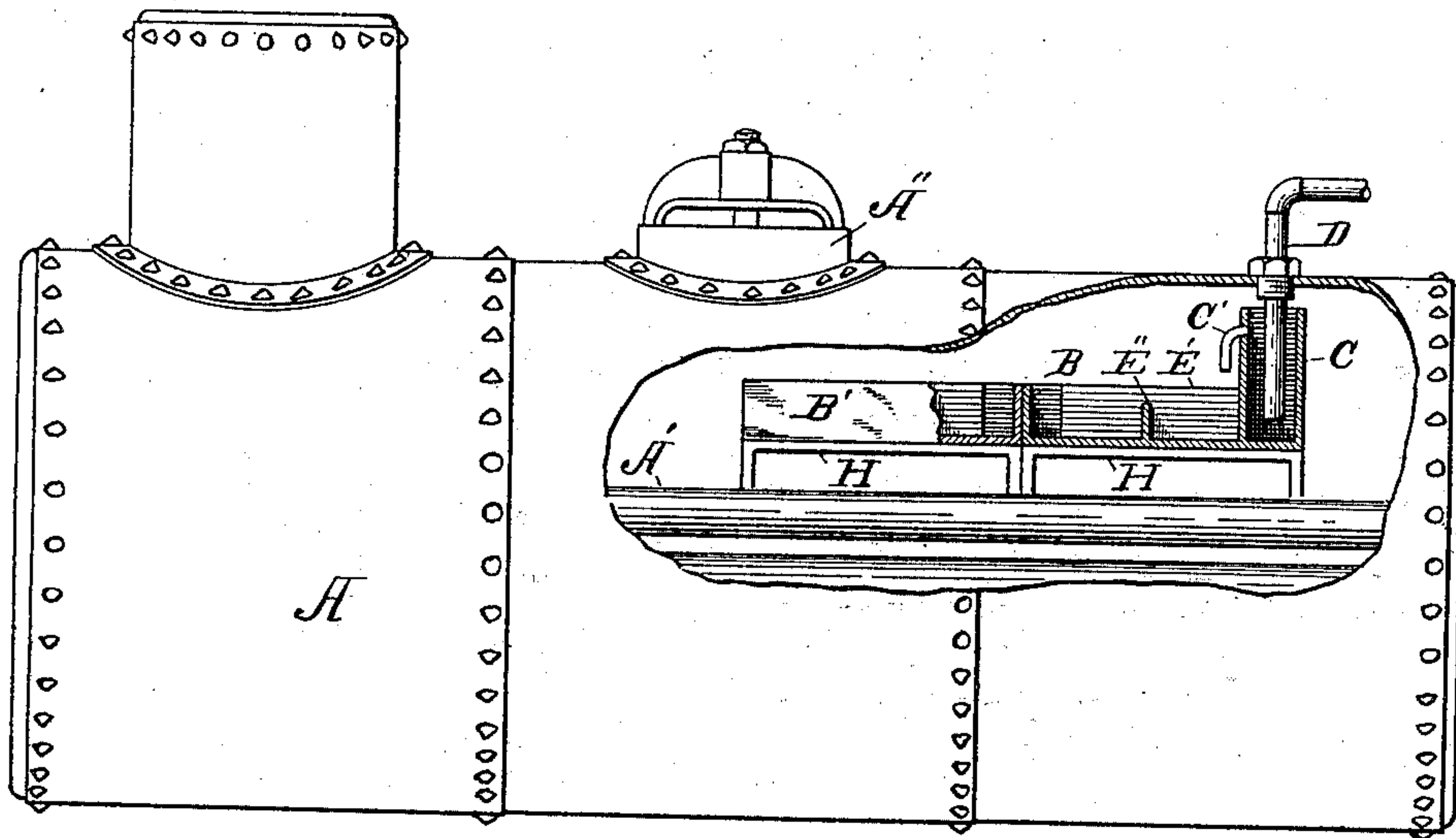


Fig. 1

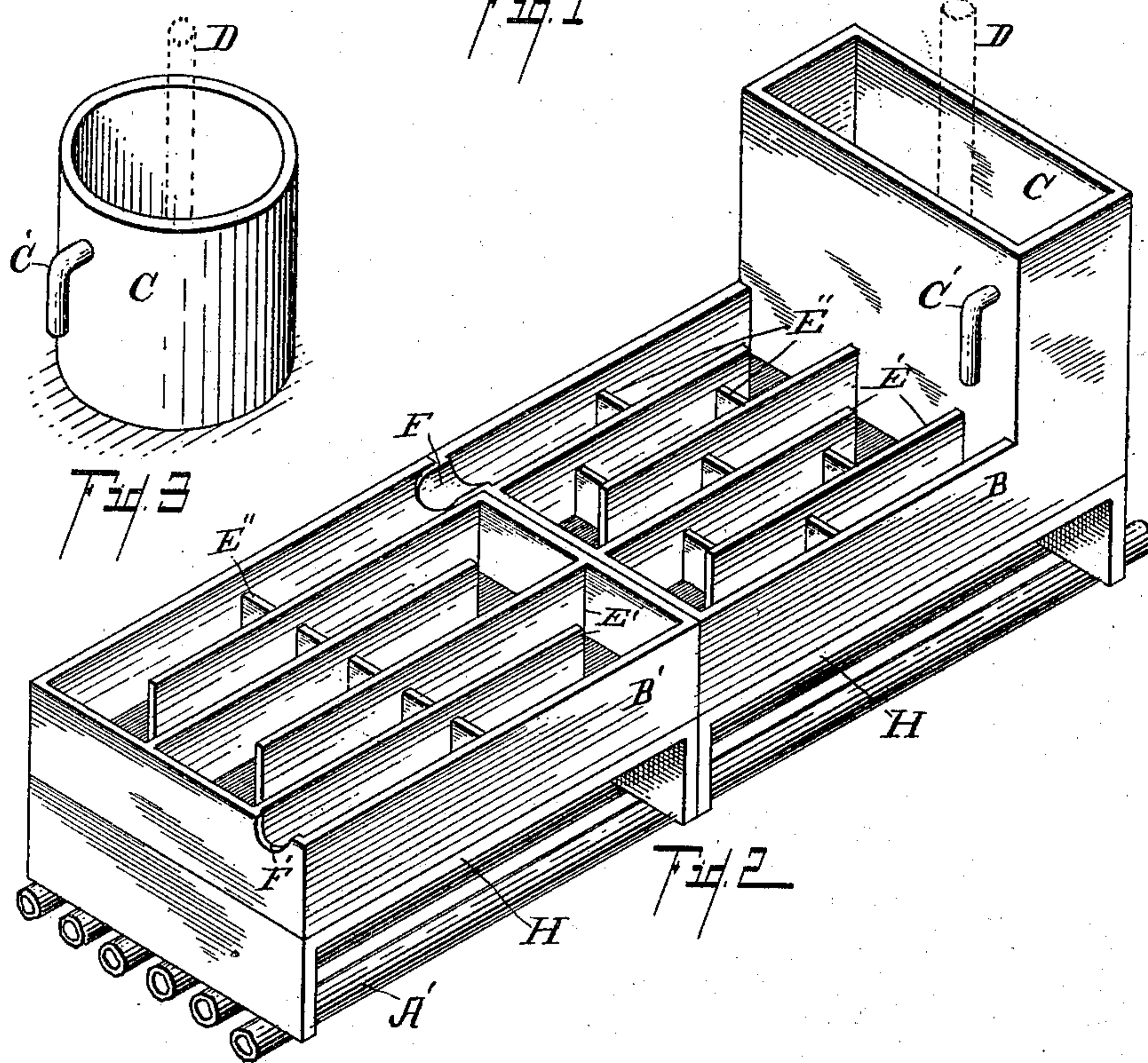


Fig. 2

Fig. 2

Witnesses.

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# UNITED STATES PATENT OFFICE.

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## FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 627,167, dated June 20, 1899.

Application filed February 25, 1897. Serial No. 625,016. (No model.)

*To all whom it may concern:*

Be it known that I, THEODOR WILLEBRAND, a citizen of the United States, residing at the city of Grand Rapids, in the county of Kent and State of Michigan, have invented certain new and useful Improvements in Feed-Water Heaters and Purifiers, of which the following is a specification.

My invention relates to improvements in internal feed-water heaters and purifiers for use in steam-boilers.

It has long been known that when water is first thoroughly heated in a boiler is the time when the lime and other incrusting materials are deposited. It is necessary, however, that the water be thoroughly heated to practically the full temperature of the water in the boiler to secure a complete deposit. Numerous devices have been produced for accomplishing this desired result which have been more or less successful. In all of these after the deposits have been made it has been necessary to clean the parts inside the boiler. So far as is known to me from a thorough investigation no means has ever been provided for making the deposition of incrusting material complete before the water comes in contact with the tubes and more or less of the deposit has been distributed over the entire interior of the boiler, forming a scale or an objectionable impurity or deposit in the body of the boiler.

The objects of my invention are therefore, first, to provide an internal feed-water heater and purifier for boilers which can be easily removed from the boiler to be cleaned, and, second, to provide an internal feed-water heater and purifier in which the water shall be thoroughly heated and all incrusting matter and other objectionable impurities deposited and collected before the said water passes to the boiler below.

A further object is to provide a means whereby the water can be introduced into the boiler without agitating the contents of the purifier.

Other objects will appear in the detailed description.

I accomplish these objects of my invention by the devices and means described in the following specification.

The invention is clearly defined and pointed

out in the claims. The structure is fully illustrated in the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a side elevation of a horizontal boiler containing one of my improved internal feed-water heaters and purifiers, portions being broken away to show details of construction and the relative position of parts. Fig. 2 is an enlarged detail perspective view of my improved internal feed-water heater and purifier shown supported by the tubes of the boiler. Fig. 3 is a detailed view of a slight modification of a part thereof shown separate.

Similar letters of reference refer to similar parts throughout the several views.

Referring to the lettered parts of the drawings, A represents the boiler, A' the boiler-tubes within, and A'' the manhole. Within the boiler and resting upon the tubes A' are two bases H H, of cast-iron. On these is supported my improved feed-water heater and purifier, which is made up of two sections B B'. The section B' has a receptacle C toward one end. The delivery-pipe D extends down to near the bottom of this receptacle C. An overflow-spout C' projects out from near the top of the same into the remaining portion B of the section. The remaining portion B is formed like a pan, with dividing partial partitions E', extending alternately from opposite ends or sides and interlapping to form a long continuous passage, except for subpartition E'' therein. A spout F is at the opposite end of the passage leading into the section B', which is of a similar construction to the partition B. Short transverse partitions E'' E'' extend between the partitions E' and between the partitions E' and the side walls and reach nearly to the top or the water-level between the partitions E' and between the partitions and side walls and serve to divide the space into distinct and separated compartments to retard the flow of the water to allow it to be thoroughly heated and to secure a precipitation of all incrusting materials and other objectionable impurities within it and prevent the washing of the same out of the purifier. At intervals the manhole of the boiler is opened and these sections B B' are withdrawn from the boiler, and the incrusting materials



can be thus easily removed, as it will be deposited in the troughs or the compartments of the sections above described. These sections might be cleaned by a person entering the boiler for the purpose instead of removing the sections from the boiler.

The device could of course all be made of one section where the boilers are small. Where the boilers are very large, it will be necessary to make the same of more than two sections. In that case the receptacle C should be made a separate part, as indicated in Fig. 3. It should then project down to the boiler-tubes to heat the water as rapidly as possible. The bases H are not an absolute necessity, but serve to hold the purifier-sections above the tubes, and so that the top of the purifier is in the steam-space above the water-line. This could be accomplished by a suitable bridging, or the same could be set on the flues, if deep enough so the top of the purifier would extend above the water-line. It is only required that the top of the purifier be above the water-line of the boiler, and if this be true it may be anywhere in the boiler. In the styles of boilers where no tubes or flues are in position to support the device any suitable bridging or support can be provided. The receptacle and sections can be made of any suitable material. Sheet metal answers the purpose very well. I am aware that wood can be used for the purpose.

It is desirable that the pipe D extend from the top of the boiler down toward the bottom of the receptacle C to relieve direct back steam-pressure on the pipe and pump. The pipe, however, could be inserted into the boiler at any convenient point and deliver into the receptacle and still answer the purpose very well. The pipe D might deliver directly into the pan and be quite effective; but in that case great care would be necessary to prevent slopping over, and the water of the pan would be agitated to a considerable extent, which would of course cause sediment to be washed over. I desire to say in this connection that the heating-pans should present a comparatively broad surface to the action of the steam to insure quick and thorough heating of the water.

In the operation of my improved feed-water heater and purifier water is delivered through the pipe D into the receptacle C, the comparatively cold water introduced descending to the bottom of the receptacle and allowing the sediment to accumulate there. When the water overflows through pipe C' into the first compartment of the heater, it being cooler than the water already in the same, it will descend to the bottom and cause the warmer water to overflow over the partition E' into the next compartment, where, it being cooler than the water in that compartment, it will descend to the bottom and raise the warmer water and pass the warmer water to the next compartment, and so on successively. This will effectually prevent the cold water from chill-

ing all the water in the heater by passing the more-heated water forward, and in this way the water finally discharged from the heater at the notch F' will be as fully and thoroughly heated as the water in the boiler, and all incrusting material and other objectionable impurities in the water will consequently have been precipitated and retained in the heater. The partitions also serve the purpose of holding the water perfectly quiet, and hence prevent agitation when the pump is in operation, which permits the very fine sediment to collect and settle in the bottom of the separated compartments. In this connection I desire to state that my improved feed-water heater and purifier is perfectly effective for use in connection with any pump delivering cold water. I prefer, however, to use the same in connection with a first-class outside feed-water heater and purifier, because it will then only need to collect a comparatively small residue of the sediment which the outside heaters and purifiers all leave in the water which passes through the same, and by so utilizing my improved feed-water heater and purifier in connection with the outside feed-water heater and purifier the interval of time between the openings of the boiler to remove the sediment from my purifier is much prolonged.

In use it will be found that much of the water will be evaporated from the purifier and heater before it reaches the end of the tortuous passages or troughs and passes out at the depression F'. This secures complete precipitation of the incrusting material.

The device is also of great advantage when the water accidentally becomes low in the boiler, because it will allow it to enter on the purifier and become gradually heated before it strikes the superheated portions of the boiler. This, it will be readily understood, avoids much of the danger of an explosion.

Having thus described my improved feed-water heater and purifier, I desire to state that from my above description it will be noted that it is capable of great variation in its details without departing from my invention. Any structure presenting a series of separated compartments lying in substantially the same horizontal plane overflowing from one to the other supported in the position described will accomplish the purpose. The exact construction shown, however, possesses certain advantages over any other, and I desire to protect it specifically by patent as well as broadly.

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

1. In an internal feed-water heater the combination of the bases H, H, to rest upon the tubes of the boiler; the sections or trays B, B', formed into a long continuous trough by the partial partitions E', E'; subpartitions E'' E'', extending between the partitions E', to retard the passage of the water through the troughs; a receptacle C, to form a connection



therewith with a delivery-pipe from toward the top thereof and a supply-pipe D, leading down toward the bottom of the receptacle all coacting to heat the water in the purifier to precipitate all incrusting materials substantially as described for the purpose specified.

2. In an internal feed-water heater the combination of the sections B, B', formed into a long continuous trough by the partial partitions E', E'; subpartitions E'' E'' extending between the partitions E', to retard the passage of the water through the troughs; a receptacle C, to form a connection therewith with a delivery-pipe from toward the top thereof and a supply-pipe D, leading down toward the bottom of the receptacle all coacting to heat the water in the purifier to precipitate all incrusting materials substantially as described for the purpose specified.

3. An internal feed-water heater consisting of a box-like casing with alternate partitions extending from opposite sides nearly across the same to form a tortuous trough-like passage, subpartitions between the alternate partitions of lesser height to retard the passage of the water in combination with a supply-pipe delivering the feed-water into one end of the same to allow it to pass through the passage to become thoroughly heated to precipitate all incrusting material as specified.

4. An internal feed-water heater consisting of a suitable casing forming a long trough-like passage for the water, in combination with partitions at intervals in the passage

lower than the walls thereof, means of delivering water thereto so that it may pass through the trough by the force of gravity as specified.

5. An internal feed-water heater and purifier consisting of a series of compartments arranged in substantially the same horizontal plane and adapted to deliver from one to the other successively by the force of gravity; means for supporting the same in the steam-space of a boiler; a supply-passage leading thereto, all coacting together so that the feed-water shall pass slowly through the same to become thoroughly heated to precipitate incrustating material for the purpose specified.

6. An internal feed-water heater and purifier consisting of a suitable casing open at the top divided into a series of separated compartments by suitable partitions, adapted to deliver from one to the other successively, by overflowing so that the water passes only by the force of gravity; suitable means of supporting the same in the steam-space; and a supply-passage leading thereto, all coacting so that the feed-water shall pass slowly through the same to become thoroughly heated to precipitate incrustating materials, for the purpose specified.

In witness whereof I have hereunto set my hand and seal in the presence of two witnesses.

THEODOR WILLEBRAND. [L.S.]

Witnesses:

L. P. EDDY,  
SELIG STERN.