(No Model.) 2 Sheets—Sheet 1.

C. JACOBS.

FEED WATER HEATER.

No. 472,671. Patented Apr. 12, 1892.

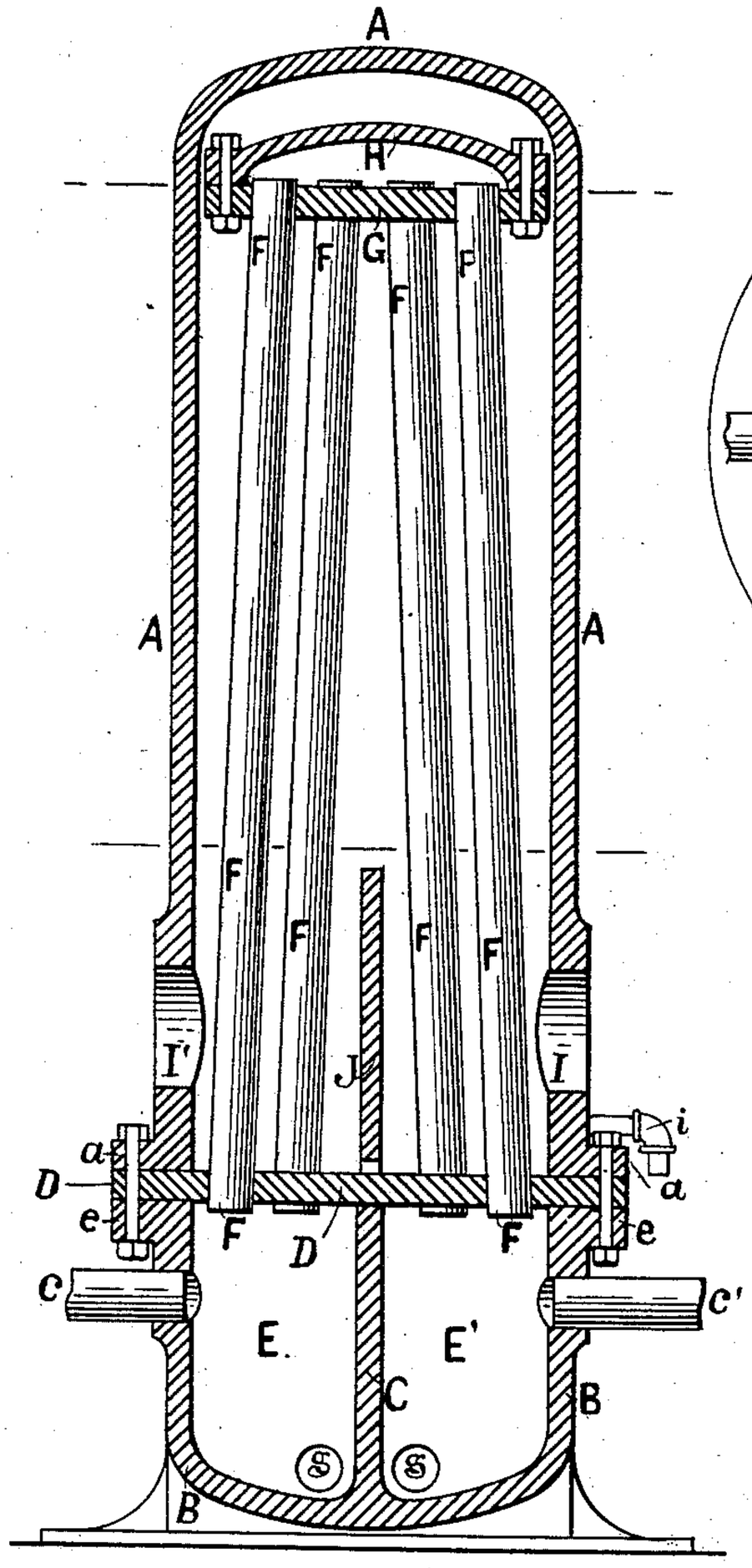

Fig. 1.

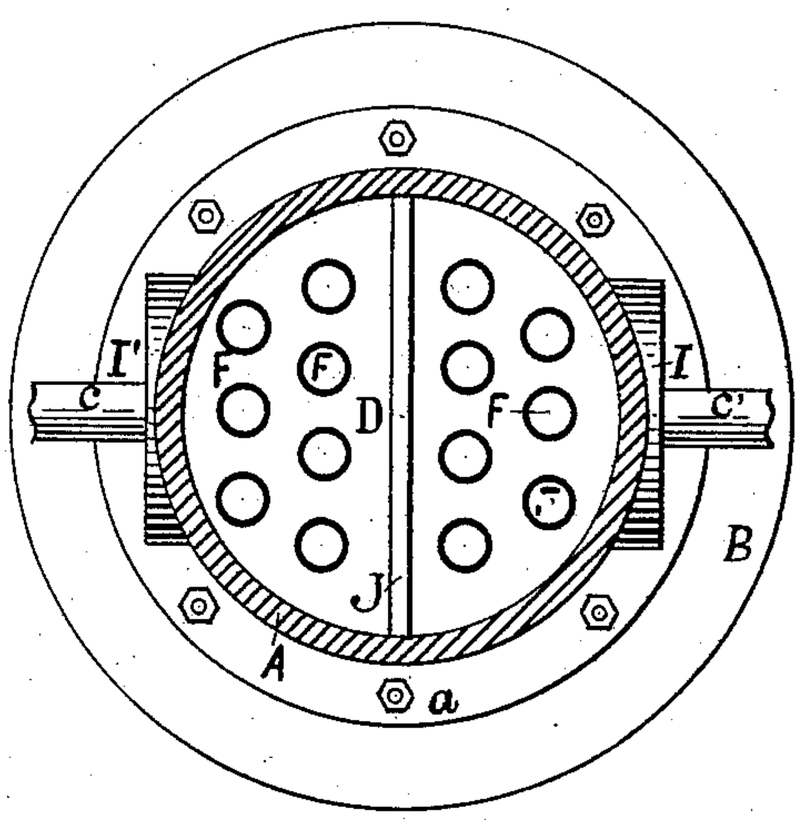

Fig. 2.

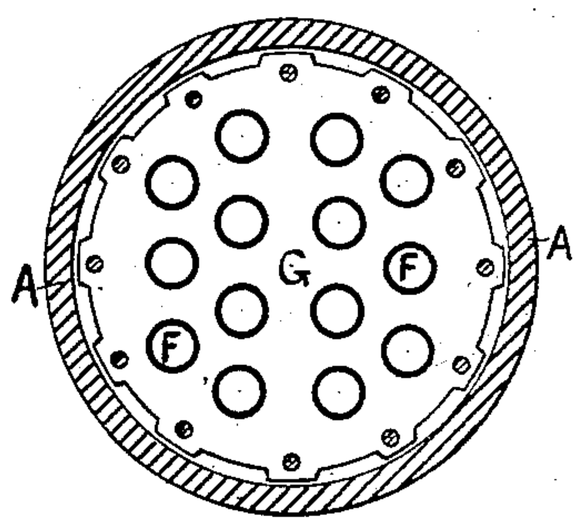

Fig. 3.

WITNESSES

William H. Parry.

E. F. Emanuel

INVENTOR

Charles Jacobs,

By Sylvenus J. Walker

Attorney

(No Model.)

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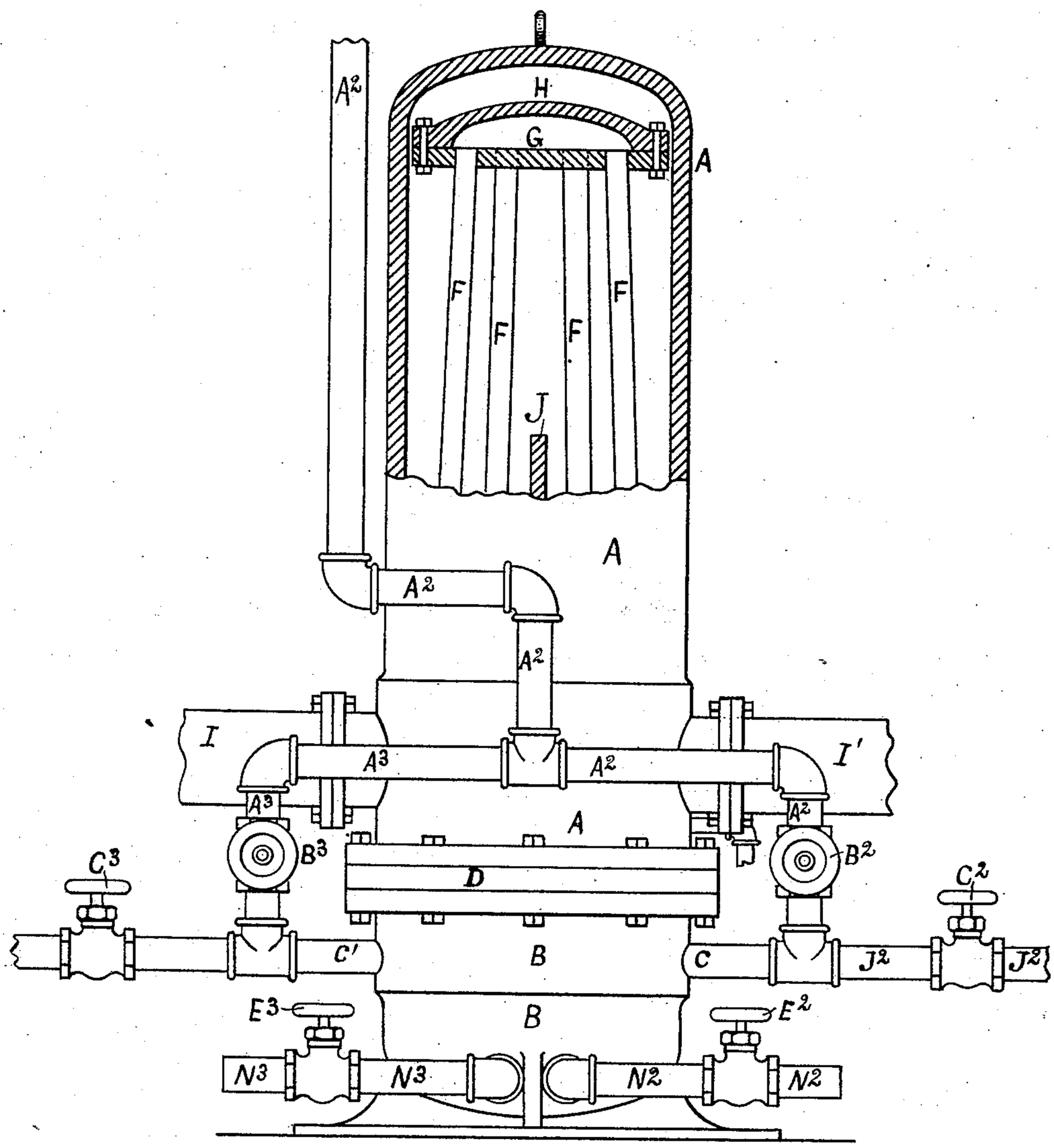

Fig. 4.

WITNESSES.
William H. Parry.
E. G. Emanuel

INVENTOR.
Charles Jacobs.
By Sylvenus Walker,
Atty

UNITED STATES PATENT OFFICE.

CHARLES JACOBS, OF HYDE PARK, MASSACHUSETTS.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 472,671, dated April 12, 1892.

Application filed June 26, 1890. Serial No. 356,802. (No model.)

To all whom it may concern:

Be it known that I, CHARLES JACOBS, of Hyde Park, in the county of Norfolk and State of Massachusetts, have invented an Improvement in Feed-Water Heaters, of which the following is a specification.

The objects of my invention are to provide a feed-water heater for heating feed-water for steam-boilers by means of exhaust-steam in order to economize fuel; and it consists in the construction, combination, and arrangement of the various parts of the heater, whereby the feed-water is caused to pass upward through the tubes in one half, thence downward through the tubes in the other half, instead of the exhaust-steam being forced to pass upward and downward through the tubes before leaving the heater, as heretofore constructed and now in general use.

In the accompanying drawings, which form a part of this specification, Figure 1 represents a vertical central sectional elevation of a feed-water heater constructed according to my invention with short deflector-plate. Fig. 2 represents a transverse section near the lower portion of the same, showing deflector-plate. Fig. 3 represents a transverse section near the top portion of the same above the tube-plate, each section being indicated on Fig. 1 by broken lines. Fig. 4 represents a side elevation of a feed-water heater constructed in accordance with my invention, showing the pipes and their valves for carrying the live steam into the heater and for blowing out the sediment therefrom.

A represents a cylindrical steam-tight casing or shell of cast iron closed at the top and having a flange *a* at the bottom, to which is bolted the base B, a flat horizontal tube-plate D intervening between the flange *e* of the said base and the flange of the said casing and the joints being suitably packed to prevent leaking, the casing A being formed in one piece. The said base B is provided with a vertical transverse partition C, which forms a joint with the under side of the said tube-plate D, thus forming two feed-water chambers E and E′, with which communicate two branch feed-water pipes *c* and *c′*, one for the entrance of the feed-water and the other for the outward passage of the heated water to the steam-boiler, as hereinafter described. The said chambers E E′ are each provided with a sediment-outlet *g*, whereby all sediment deposited from the feed-water may be easily and thoroughly removed. The horizontal tube-plate D is suitably bored to receive the lower ends of a series of seamless drawn-brass tubes F, which are firmly expanded into the said plate D, while their upper ends are similarly expanded into the upper tube-plate G, which has no contact with the said outer inclosing shell A, as heretofore. To produce a perfect circulation of the feed-water through these tubes F, the said upper tube-plate G is surrounded or inclosed by a curved or arched tube-cap H, bolted thereon and inclosing the upper ends of all the tubes, thus forming a passage for the water circulating upward through the tubes connecting with one of the said chambers E and downward through the other set of tubes connecting with the opposite chamber E′ in its passage to the boiler through the said outlet feed-water pipe C′ to discharge the hot water therefrom at a point near the inlet of the exhaust-steam through the steam-pipe I, where it enters the heater and impinges against the short vertical deflector J and fills all the interior space of the heater-shell A, the area of which is five times that of the exhaust-pipe I, thereby supplying a very large amount of heat to the feed-water tubes F before it passes from the heater-shell at its opposite side through the outlet-pipe I′. The deflector J is provided with a small hole at its connection with the upper surface of the said lower tube-plate D to allow the water of condensation to drain off through the drip-cock *i* when opened.

It will be seen and understood that by means of the feed-water tubes F, through which the feed-water passes, (instead of exhaust-steam,) that the heater will deliver to the boiler pure clean feed-water at a high temperature, as the interior of the said feed-water tubes F may be easily, quickly, and very thoroughly cleaned by means of the well-known tube-cleaners now in general use for the purpose, but which could not be effectually applied to the exterior surface of the tubes or to the interior surface of the outer casing A, as heretofore constructed, wherein the feed-water is caused to circulate outside the tubes and surrounding the same within the outside casing.

It will be seen and understood that a greater amount of heat may be imparted to and retained in the feed-water by my invention of the feed-water tubes surrounded and centrally inclosed by the exhaust-steam and the outer casing, the feed-water having to pass through the steam-chamber twice in its course, and the radiation of heat from the exterior surface of the outside case is many times greater in comparison with that of the hot-water tubes with my construction than could be obtained by the reverse or opposite construction, as heretofore.

I find from experience and actual practice in the use of both kinds of feed-water heaters of same size or capacity that with my construction of the feed-water tubes surrounded by the exhaust-steam I am enabled to effect a great saving in the amount of fuel consumed to produce the same power or maintain the same pressure of steam within the boiler for a given number of hours. Therefore it will also be evident in order to produce the best results that the exhaust-steam space within the heater should be very much in excess of that required for the feed-water and that the inlet-exhaust-steam pipe I and the outlet-exhaust-steam pipe I′ are many times larger in capacity than the said inlet feed-water pipe C and outlet feed-water pipe C′ where they connect with the said outer casing or shell A, as shown.

It is found to be important in order to produce the best results from a feed-water heater that the exhaust-steam within the same should be kept or permitted to remain in a continuous body, instead of being divided up into a series of smaller bodies, as required, in order to circulate or to pass through the series of steam-tubes, as heretofore provided in feed-water heaters.

In order to remove all sediment from the settling-chambers, above described, in the base of the said feed-water heater, I provide the same with pipes and valves, as shown in Fig. 4. These pipes and valves connect and control live steam direct from the boiler, which enters the heater when desired to blow out sediment by opening a valve (not shown) in steam-pipe A^2 and closing the valve C^2 in the feed-water pipe J^2 and opening the valve E^2 in the sediment-pipe N^2. This will permit the live steam to enter and force out all sediment from the chamber with which the said pipes connect, as shown at the right hand of Fig. 4. Now in order to blow out the sediment from the other or opposite chamber close the valve B^2 in pipe A^2 and close the valve C^3 in the pipe J^3. Then open the valve B^3 in pipe A^3, and open valve E^3 in the pipe N^3, which will permit the live steam to blow off through the chamber connected by the said pipes, as shown at the left of said Fig. 4. Now in order to remove all sediment from the vertical feed-water tubes, as above described, the said valves all being closed, admit the live steam to enter the heater, as above described, through the base by opening the said valve B^2 in pipe A^2 and the valve B^3 in pipe A^3. Then open the valve E^3 in the pipe N^3, which will permit the steam to enter the heater through the base sediment-chamber connecting with the said pipes, as shown at the right hand of Fig. 4, and then pass upward through the feed-water tubes connecting with said chamber, and thence downward through the feed-water tubes, connecting with the opposite sediment chamber, and blow off through the said connecting-pipe N^3. It will be seen and understood that the live steam may be caused to pass through the heater in the reverse direction, if desired, by opening and closing the said valves in the reverse order to the last above described.

I find from experience and practical use that by my system of carrying the exhaust-steam into the heater, as above described, that when it strikes and impinges against the said deflector it effects a further desirable result, as the said deflector thus serves as a grease or oil extractor, the same running out at the drip, thereby preventing all oil and grease from entering the said feed-water tubes and from passing into the boiler as in other feed-water heaters heretofore constructed.

What I claim is—

In a feed-water heater as above described, the combination, with the shell A, provided with the base B, having a partition C, forming two sediment-chambers E E′, provided with inlet and outlet pipes, and each having a blow-off pipe, tube-plates D and G, provided with a series of feed-water tubes F and tube-cap H, an exhaust-steam-inlet pipe I, and exhaust-steam-outlet pipe I′, of a deflector-plate J between the said exhaust-steam inlet and outlet, and an exterior series of live-steam pipes connecting with each of the said sediment-chambers and provided with valves, whereby live steam may be admitted to pass into and through each of said chambers, so as to form a double blow-off, substantially as described, as and for the purposes set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES JACOBS.

Witnesses:
H. E. LODGE,
C. B. MOORE.