No. 730,285. PATENTED JUNE 9, 1903.

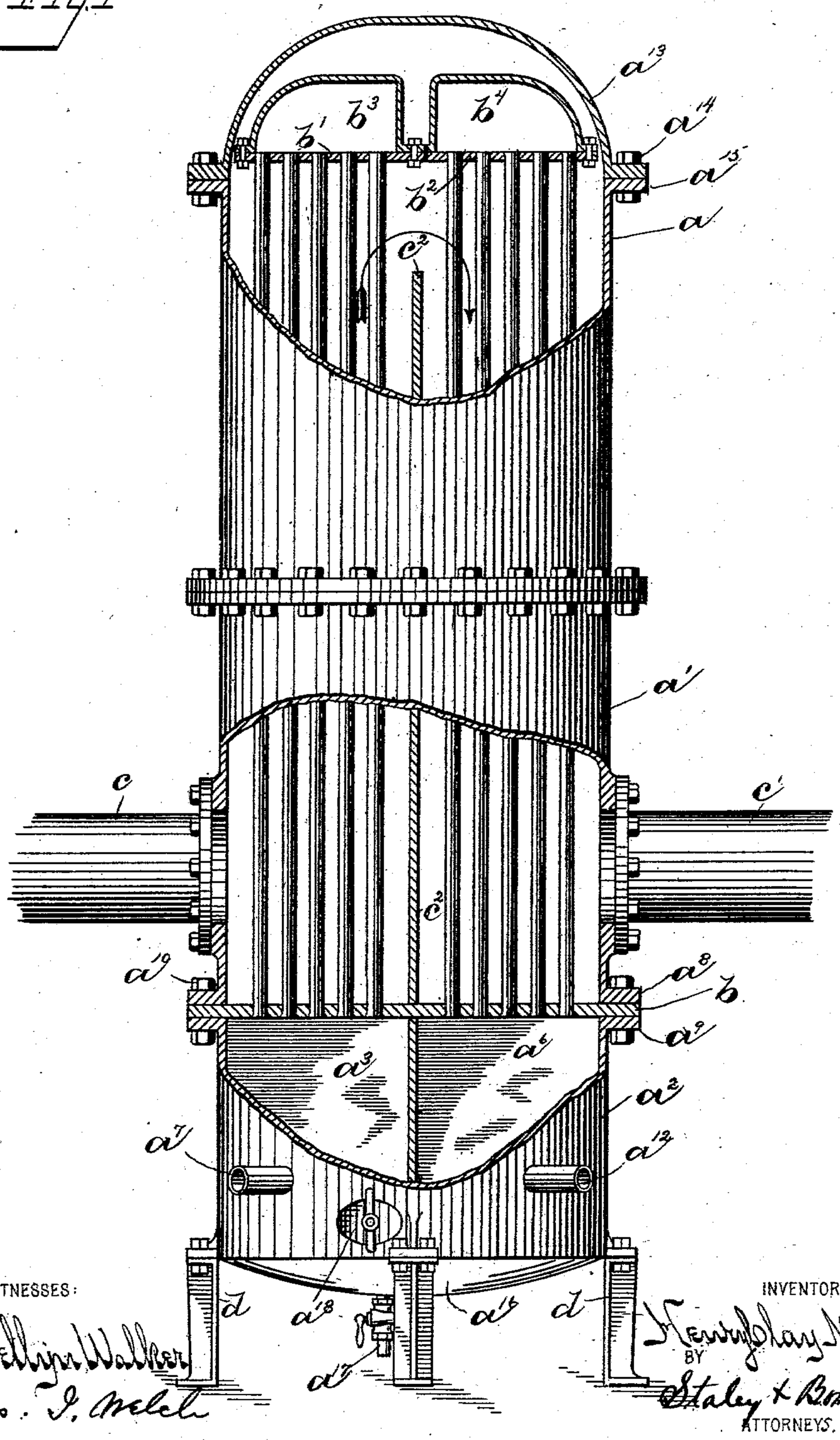
H. C. MOORE.

FEED WATER HEATER AND CONDENSER.

APPLICATION FILED AUG. 2, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1



WITNESSES:

J. Llewellyn Walker

Chas. F. Mebel

INVENTOR

Henry Clay Moore

BY

Staley & Bowman

ATTORNEYS.

No. 730,285. PATENTED JUNE 9, 1903.

H. C. MOORE.

FEED WATER HEATER AND CONDENSER.

APPLICATION FILED AUG. 2, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig 2

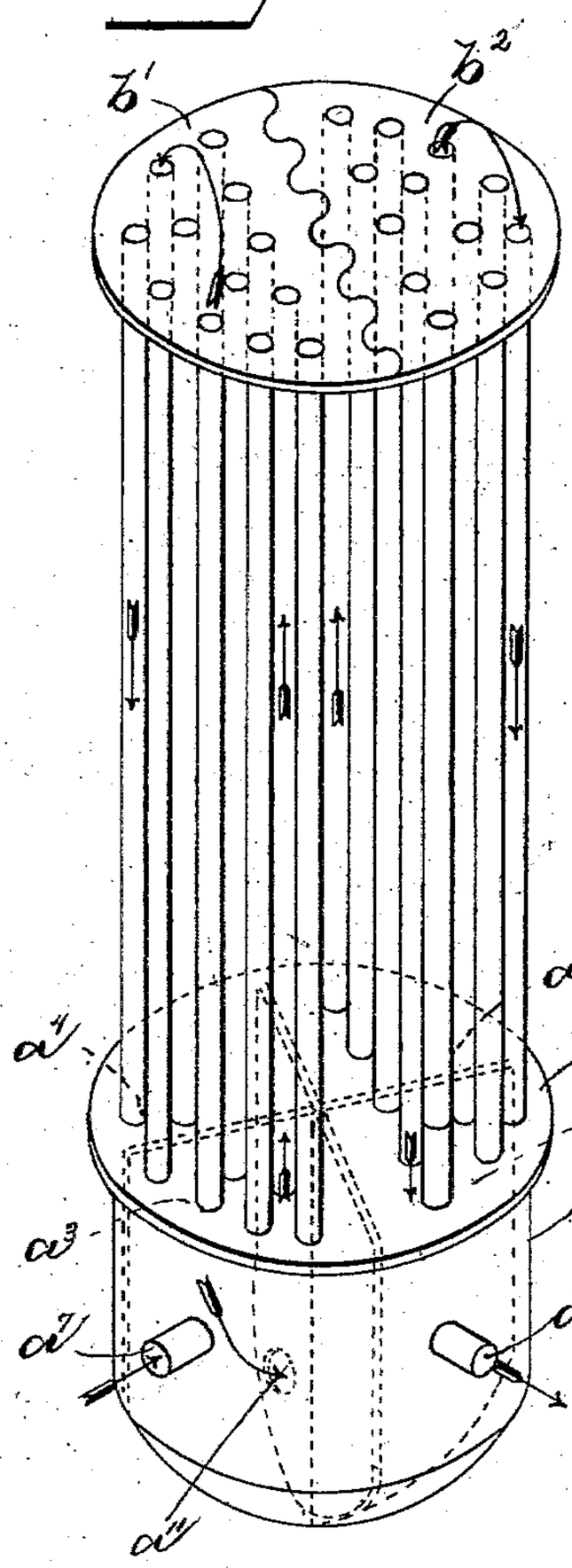


Fig. 3

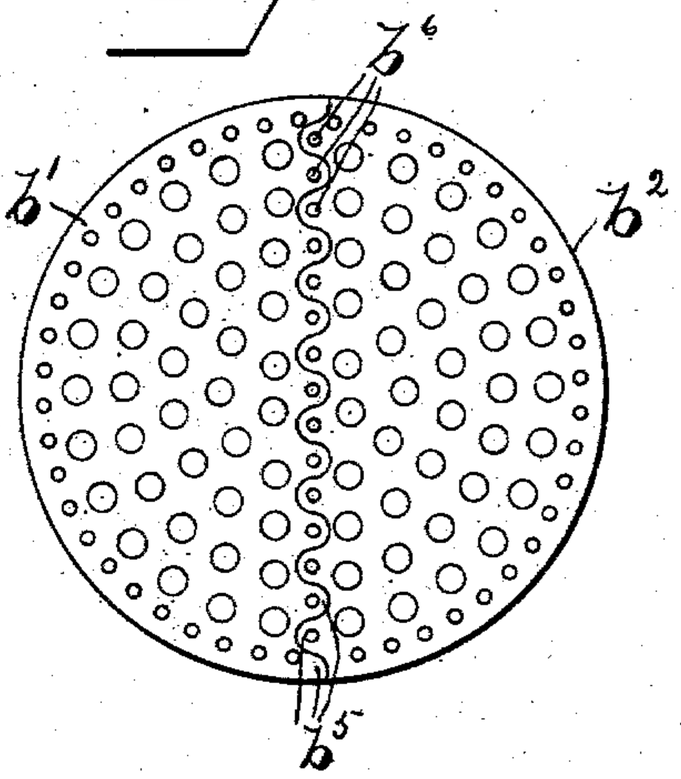


Fig. 5

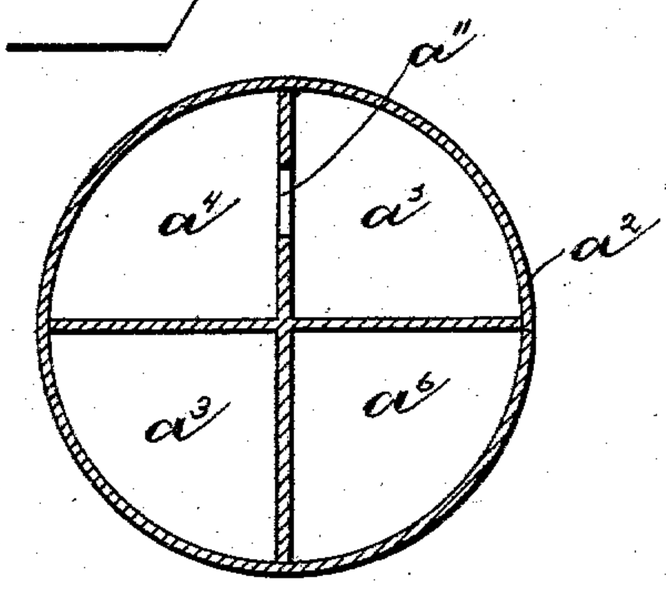
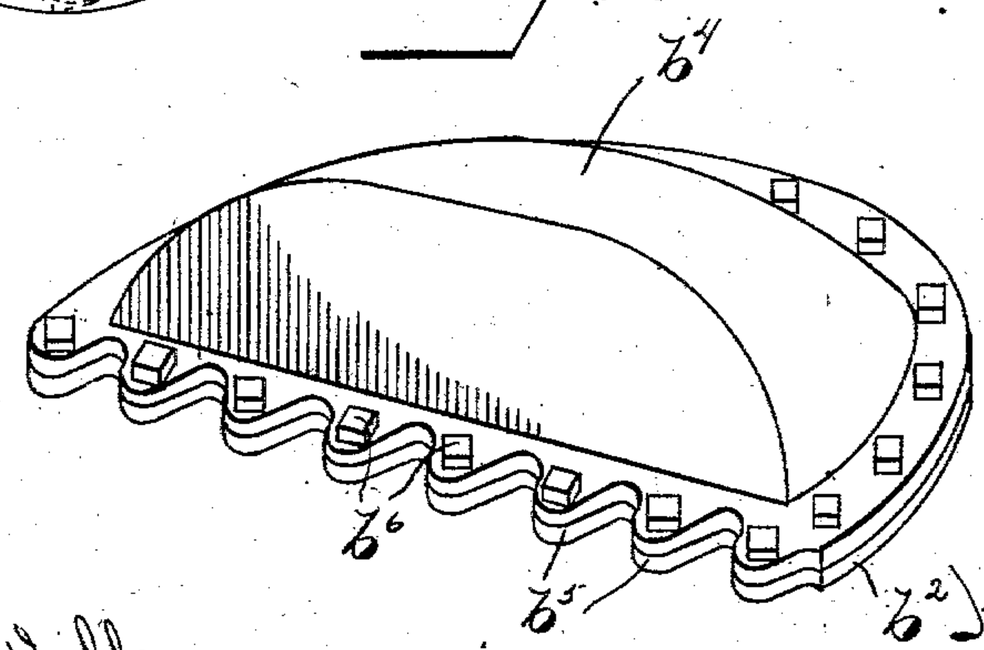


Fig. 4



WITNESSES:

J. Llewellyn Walker

Chas. D. Welch

INVENTOR

Henry Clay Moore

BY

Staley & Borman

ATTORNEYS.

No. 730,285. Patented June 9, 1903.

UNITED STATES PATENT OFFICE.

HENRY CLAY MOORE, OF ATLANTA, GEORGIA.

FEED-WATER HEATER AND CONDENSER.

SPECIFICATION forming part of Letters Patent No. 730,285, dated June 9, 1903.

Application filed August 2, 1902. Serial No. 118,058. (No model.)

To all whom it may concern:

Be it known that I, HENRY CLAY MOORE, a citizen of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented certain new and useful Improvements in Feed-Water Heaters and Condensers, of which the following is a specification.

My invention relates to feed-water heaters and condensers; and the object of my invention is to simplify the construction and arrange the parts so as to give ready access for cleaning and repairs and secure the highest possible efficiency.

A further object of my invention is to provide a construction to compensate for the unequal expansion and contraction of the several sets of feed-water or condenser tubes, and thereby prevent the loosening and breaking of the tube-joints in the heads.

My invention consists of the constructions and combinations hereinafter described, and set forth in the claims.

In the accompanying drawings, which form a part of the specification, Figure 1 is a side view of a heater or condenser with the shell partly broken away to show a construction embodying my invention. Fig. 2 is a view of the tubes with the upper and lower heads and the lower chambers, the arrows indicating the flow of the feed or condenser water. Fig. 3 is a plan view of the upper heads. Fig. 4 shows one of the caps on the upper heads, and Fig. 5 is a sectional view of the lower chambers.

Like parts are represented by similar letters of reference in the several views.

In the drawings, a, a', and a^2 represent a shell or casing, which I preferably make of cast-iron in sections and bolt together, as shown. This construction admits of greater facility in casting, and the parts may be readily assembled or taken apart for any purpose, as may be required. The lower section a^2 I divide by vertical walls into four chambers a^3, a^4, a^5, and a^6, the initial chamber a^3 receiving the feed-water or condenser-water supply through an inlet a^7. Between flanges a^8 and a^9 of the sections a' and a^2 I securely attach a tube-head b by bolts a^{10}, said head forming the upper wall of said chambers, in which I secure the lower ends of upwardly-extending tubes to carry the feed or condenser water.

The upper tube-head, to which I attach the upper ends of the tubes, I bifurcate or form into two separate parts b' and b^2, and I provide caps for each of these parts having water-chambers b^3 and b^4 therein, said caps being secured to said head preferably by bolts, as shown in Fig. 4.

The feed or condenser water being admitted through the inlet a^7, its course is from the chamber a^3 through the set of tubes leading from said chamber to the upper chamber b^3, thence from said chamber to the lower chamber a^4, thence through an opening a^{11} into the chamber a^5, thence through the tubes leading from said chamber to the upper chamber b^4, thence through the tubes leading from said chamber to the lower chamber a^6, from which it is discharged through an outlet a^{12}, the course of the feed or condenser water as described being clearly indicated by the arrows in Fig. 2.

The feed or condenser water as it passes through the several sets of tubes, as stated, acquires a higher and higher temperature until the variation in the temperature between the tubes leading from the chambers a^3 and a^4 and those leading from the chambers a^5 and a^6 becomes so great as to break the joints of the tubes in a single or integrally-formed upper head. The lower head being fixed in the outer shell or casing and the upper head being independent thereof, the longitudinal expansion and contraction of the tubes are very considerable, and the difference in the degree of heat in the tubes upon one side and those on the other causes a severe strain, which loosens and breaks the joints in a single or integrally-formed upper head. This has been a serious problem, causing great annoyance, trouble, and expense, which I have solved by providing the bifurcated tube-sections and separated upper heads, as described. This construction also enables me to build the heater or condenser circular in form, which of course in any steam-pressure reservoir is preferable over an oblong or other shape, and to economize space I preferably form these upper heads and their caps on their abutting sides with a series of lugs b^5, through which bolts b^6 extend to secure the caps to the heads, this

construction giving ample strength and at the same time permitting the lugs of one part to extend between the lugs of the other part, whereby the parts may be brought closer together.

I further provide a removable head or cover a^{13} for the shell or casing, which I preferably secure by bolts a^{14} to a flange a^{15} of the shell.

The steam I introduce at one end of the tube-chamber, preferably in the lower end, as shown at c, and discharge at the same end, as shown at c', and to properly distribute the heat I provide a partition c^2, extending from near the upper head to the lower head and between the tubes leading from the respective upper heads, thus causing the steam to pass upwardly upon one side and downwardly on the other side of said partition the length of the tube-chamber.

I further preferably provide legs d, on which the heater is mounted, and I preferably dish the lower head a^{16} of the casing, and at the lowest point in the chambers a^3, a^4, a^5, and a^6, where the sediment from the heater or condenser will settle, I provide blow-off cocks, such as shown at a^{17}, to clean said chambers, and I further provide hand-holes in each of said chambers, such as shown at a^{18}.

It will be seen that by the bifurcated or separated upper heads I have provided means to compensate for the unequal expansion and contraction of the tubes on their respective sides, as described; that I have further provided a removable covering for the casing, as well as removable caps for the upper tube-heads, whereby easy access is given to said heads and tubes; that by making the shell in sections I obtain facility in casting, and the sections may be taken apart for any purpose, as required, and that by dishing the lower head and providing blow-off cocks at the lowest point in each of the lower chambers sediment may be more easily blown out.

It is obvious that my invention may be employed with equal advantage in a heater or condenser, like constructions in one case heating feed-water and in the other reducing the temperature of or condensing steam.

Having thus described my invention, I claim—

1. In a device such as described, the combination with the outer shell or casing, of tube-heads and two or more series of tubes connecting said heads for the circulation of water, one of said heads being adapted to permit a variation in the relative position of the several series of tubes to relieve the strain on the tube ends caused by difference in temperature.

2. In a device such as described, the combination with the outer shell or casing, of tube-heads and two or more sets of tubes connecting said heads for the circulation of water, one of said heads attached to said shell and the other independent thereof, the last-named head being adapted to permit a variation in the relative position of the several series of tubes to relieve the strain on the tube ends caused by difference in temperature.

3. In a device such as described, the combination with an outer shell or casing, circular in form, made in section and secured together, of a tube-head removably secured between two of said sections, another tube-head independent of said shell, two or more series of tubes connecting said heads for the circulation of water, said last-named head being adapted to permit a variation in the relative position of the several series of tubes to relieve the strain on the tube ends caused by the difference in temperature.

4. In a device such as described, the combination with an outer shell or casing and a tube-head secured to said casing, of another tube-head independent of said casing separated into two independent portions, and tubes for the circulation of the water leading from each of said portions to said first-named head, substantially as specified.

5. In a device such as described, the combination with an outer shell or casing made in section and secured together, and a tube-head removably secured between two of said sections, of another tube-head comprising two separate portions independent of each other and of said casing, and tubes for the circulation of the water leading from each portion of said head to said first-named head, substantially as specified.

6. In a device such as described, the combination with an outer shell or casing made in sections and secured together, and a tube-head removably secured between two of said sections, of another tube-head comprising two separate portions independent of each other and of said casing, tubes for the circulation of the water leading from each portion of said head to said first-named head, and caps for each portion of said separated head forming chambers over each of said portions, substantially as specified.

7. In a device such as described, the combination with an outer shell or casing made in sections and secured together, and a tube-head removably secured between two of said sections, of another tube-head comprising two separate portions independent of each other and of said casing, tubes for the circulation of the water leading from each portion of said head to said first-named head, and removable caps for each portion of said separated head forming chambers over each of said portions, the abutting sides of each of said portions and their caps having interengaging lugs thereon, and bolts through said lugs to secure said caps to said head, substantially as specified.

8. In a device such as described, the combination with an outer shell or casing made in sections and secured together, a removable cover therefor, a tube-head removably secured between two of said sections, and four lower chambers below said head, of another tube-head comprising two separate portions inde-

pendent of each other and of said casing, removable caps forming upper chambers over each of said portions, tubes connecting each of said upper chambers with two of said lower chambers, an opening between two of said lower chambers, a water-inlet to one of said lower chambers and an outlet from another, a steam inlet and outlet to said casing between said tube-heads and near one of said heads, and a partition extending from said last-named head to a point removed from the other tube-head, substantially as specified.

9. In a device such as described, the combination with an outer shell or casing made in sections and secured together, a removable cover therefor, a tube-head removably secured between two of said sections, and four lower chambers below said head, of another tube-head comprising two separate portions independent of each other and of said casing, removable caps forming upper chambers over each of said portions, tubes, connecting each of said upper chambers with two of said lower chambers, an opening between two of said lower chambers, a water-inlet to one of said lower chambers and an outlet from another, a steam inlet and outlet to said casing between said tube-heads and near one of said heads, and a partition extending from said last-named head to a point removed from the other tube-head, a dish-shaped bottom to said casing forming the bottom of said lower chambers, and blow-off cocks in the lowest portion of the bottom of each of said chambers, substantially as specified.

In testimony whereof I have hereunto set my hand this 29th day of July, A. D. 1902.

HENRY CLAY MOORE.

Witnesses:
JACK E. BRANTLEY,
W. C. CARMICAL.