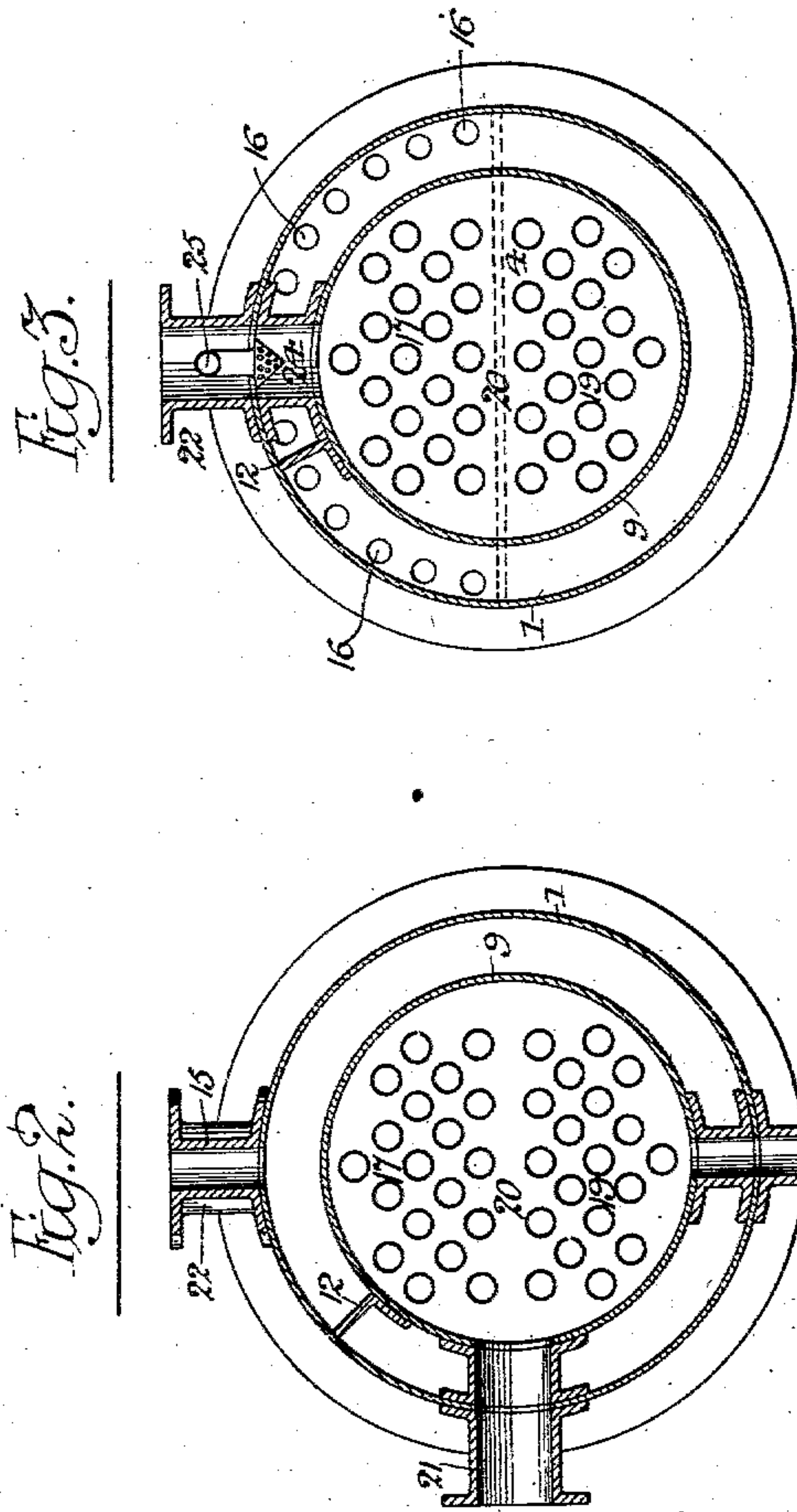
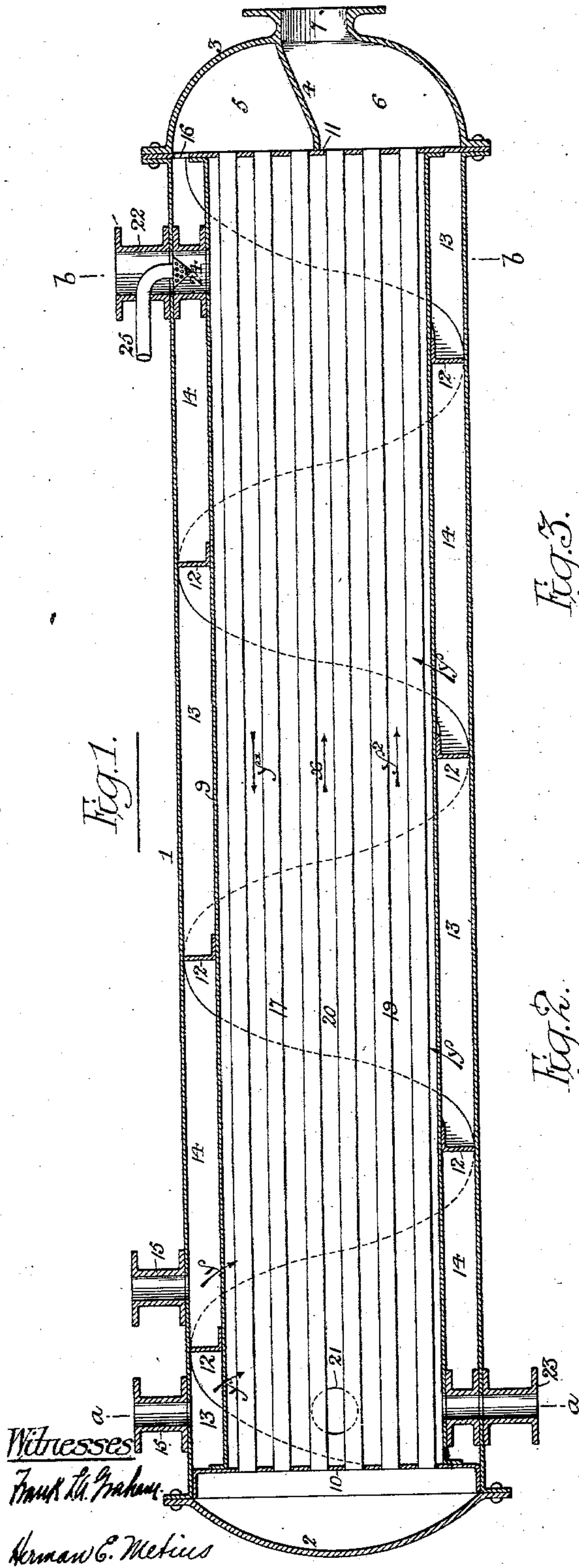


No. 704,879.

Patented July 15, 1902.

R. H. HORN BROOK.  
FEED WATER HEATER.  
(Application filed Mar. 27, 1902.)

(No Model.)



*Inventor:*  
Raymond H. Hornbrook,  
by his Attorneys:  
Howson & Howson



# UNITED STATES PATENT OFFICE.

RAYMOND H. HORN BROOK, OF CANTON, OHIO.

## FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 704,879, dated July 15, 1902.

Application filed March 27, 1902. Serial No. 100,231. (No model.)

*To all whom it may concern:*

Be it known that I, RAYMOND H. HORN-BROOK, a subject of the King of Great Britain and Ireland, and a resident of Canton, Ohio, have invented certain Improvements in Feed-Water Heaters, of which the following is a specification.

The object of my invention is to so construct a feed-water heater that a high temperature can be imparted to said feed-water by the steam used for heating purposes, and if said heating agent is exhaust-steam the latter can, if desired, be completely condensed.

In the accompanying drawings, Figure 1 is a longitudinal section of a feed-water heater and condenser constructed in accordance with my invention. Fig. 2 is a transverse section on the line *a a*, Fig. 1; and Fig. 3 is a transverse section on the line *b b*, Fig. 1.

The heater has an outer casing 1, closed at the opposite ends by convex heads 2 and 3, the latter having a transverse partition 4, whereby the space within said partition is divided into two chambers 5 and 6, the latter chamber communicating with the feed-water outlet 7 of the heater.

Within the outer cylindrical casing 1 is an inner cylindrical casing 9, which is secured at its opposite ends to a pair of tube-sheets 10 and 11, the tube-sheet 10 being flanged at the outer edge and this flange being bolted or riveted to the outer casing 1, while the outer portion of the tube-sheet 11 is confined between the flanges of the cylindrical casing 1 and its head 3. Both tube-sheets may, however, be secured to the casing in the same manner, if desired.

Between the outer and inner casings 1 and 9 of the heater intervenes an annular chamber which is provided with a helical partition 12, forming a spiral passage 14, which has near one end of the heater a feed-water-supplying branch 15, the delivery end of the passage communicating through opening 16 in the tube-sheets 11 with the chamber 5 in the head 3 of the casing. The helical partition 12 is preferably made in the form of an angle-bar, one flange of which constitutes the partition, the other flange being bolted or riveted to one of the casings of the heater, preferably to the inner casing 9, whereby the partition is thus properly secured in place.

Between the opposite tube-sheets 10 and 11 extend two sets of tubes 17 and 19, the tubes 17 communicating at one end with the chamber 5 of the head 3 and the tubes 19 communicating at the same end with the chamber 6 of said head, both sets of tubes communicating at the opposite end with the chamber in the head 2 of the casing.

The tube-chamber 20 of the heater is in communication at one end with a steam-inlet branch 21 and at the opposite end with a steam-outlet branch 22, and said tube-chamber also has an outlet branch 23 for the escape of the water of condensation. Steam entering the chamber 20 at the inlet 21 passes through said chamber in the direction of the arrow *x*, Fig. 1, in contact with the casing 9 of said chamber and with the tubes 17 and 19 and finally escapes through the outlet branch 22, the water resulting from the condensation of the steam in the chamber 20 escaping through the branch 23. The feed-water enters the chamber 14 through the branches 15 and travels in a spiral course in the direction of the arrows *y* around the heated casing 9, passing from said passage 14 into the chamber 5 of the head 3 through the openings 16 in the tube-sheet 11. From said chamber 5 the feed-water heater passes in the direction of the arrows *y'*, through the tubes 17, into the chamber within the head 2 of the casing and from the latter in the direction of the arrows *y''* through the tubes 19 and into the chamber 6 of the head 3, from which it escapes through the outlet branch 7. The water is thus exposed three times to the heating action of the steam—first, when it is circulating around the casing 9 of the heating-chamber; secondly, when passing through the tubes 17, and, lastly, when passing through the tubes 19. Hence the water is heated to a high temperature by the steam, and the heating capacity of the apparatus in proportion to its size is very great. At the same time there is a corresponding condensation of the steam employed, and if the heating agent is exhaust-steam from an engine or pump I may, if desired, effect complete condensation of the same by introducing into the discharge branch 22 of the heater a rose or sprayer 24, communicating with a water-supply pipe 25, the water-jets thus supplied completing the condensation of the steam, which, with the



added supply of water, escapes through the drainage-outlet 23, this drainage, if desired, being conveyed to a storage-tank to be added to the water-supply for the heater, or, if desired, being conveyed to the supply branches 15 or either of them.

The securing of the angular partition 12 to the inner casing 9 of the heater serves to stiffen and strengthen the same and enables it to resist either bursting or collapse. Hence I am enabled to use comparatively thin metal for said inner casing 9, with corresponding freer transmission of heat from the steam within the casing to the water surrounding the same.

In the use of my improved heater the conditions above described may be reversed—that is to say, the feed-water may circulate through the chamber 20, and the steam may take the course prescribed for the water; but the use of the heater in the manner before set forth is preferred.

I am aware that it has heretofore been proposed to construct feed-water heaters with steam-chambers containing two sets of tubes communicating with the chambered heads, so that the water is caused to flow first in one direction through one set of tubes and then in the opposite direction through the other set, and I am aware also that feed-water has been compelled to flow through spiral passages and that water jets or sprays have been introduced into the steam-inlet passages of feed-water heaters. Hence I do not lay claim to either of these things; but

I claim as my invention and desire to secure by Letters Patent—

1. The combination, in a feed-water heater, of an outer casing having chambered heads, an inner casing containing a chamber having inlet and outlet and closed at its opposite ends by tube-sheets whereby said internal chamber is separated from the chambered heads of the casing, tubes connecting said sheets and passing through the chamber within the inner casing, and means whereby fluid is caused to flow through the chamber between the inner and outer casings and between the tube-sheets of the heater and through the tubes of the same, substantially as specified.

2. The combination in a feed-water heater, of the outer casing having chambered heads, one of which chambers is divided into two parts, an inner casing containing a chamber with inlet and outlet, tube-sheets closing the opposite ends of said inner casing, and separating the chamber within the same from the

chambers within the heads of the outer casing, tubes extending through said internal chamber and connecting the opposite tube-sheets, both sets of tube-sheets communicating with the chamber in one of the heads, and each set of tubes communicating with its respective chamber in the other head, one of the latter chambers being in communication with the annular space between the inner and outer casings and between the tube-sheets of the heater, and the other being in communication with the supply or discharge branch, substantially as specified.

3. The combination in a feed-water heater, of an outer casing having chambered heads, an inner casing containing a chamber with inlet and outlet, tube-sheets closing the opposite ends of said casing, and separating the same from the heads of the outer casing, tubes connecting said tube-sheets, a helical partition whereby the annular chamber between the inner and outer casings is formed into a spiral passage, and communication between said passage and one of the chambered heads of the outer casing, substantially as specified.

4. The combination in a feed-water heater, of inner and outer casings, with a helical partition forming the annular chamber between said casings into a spiral passage, said partition consisting of an angular bar having one of its flanges secured to one of the casings, the other flange forming the partition, substantially as specified.

5. The combination in a feed-water heater, of inner and outer casings, with a helical partition forming the annular chamber between said casings into a spiral passage, said partition consisting of an angular bar having one of its flanges secured to the inner casing, substantially as specified.

6. The combination of a feed-water heater having steam and water passages therein, and a water-distributor located in the contracted steam-outlet branch whereby it provides for a condensation of the steam independently of that effected by contact of said steam with the casings of the passages through which the water flows, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RAYMOND H. HORNBROOK.

Witnesses:

A. S. GRIFFIN,  
H. F. AKE.