

No. 740,655.

PATENTED OCT. 6, 1903.

R. H. HORN BROOK.
FEED WATER HEATER.
APPLICATION FILED MAR. 6, 1903.

NO MODEL.

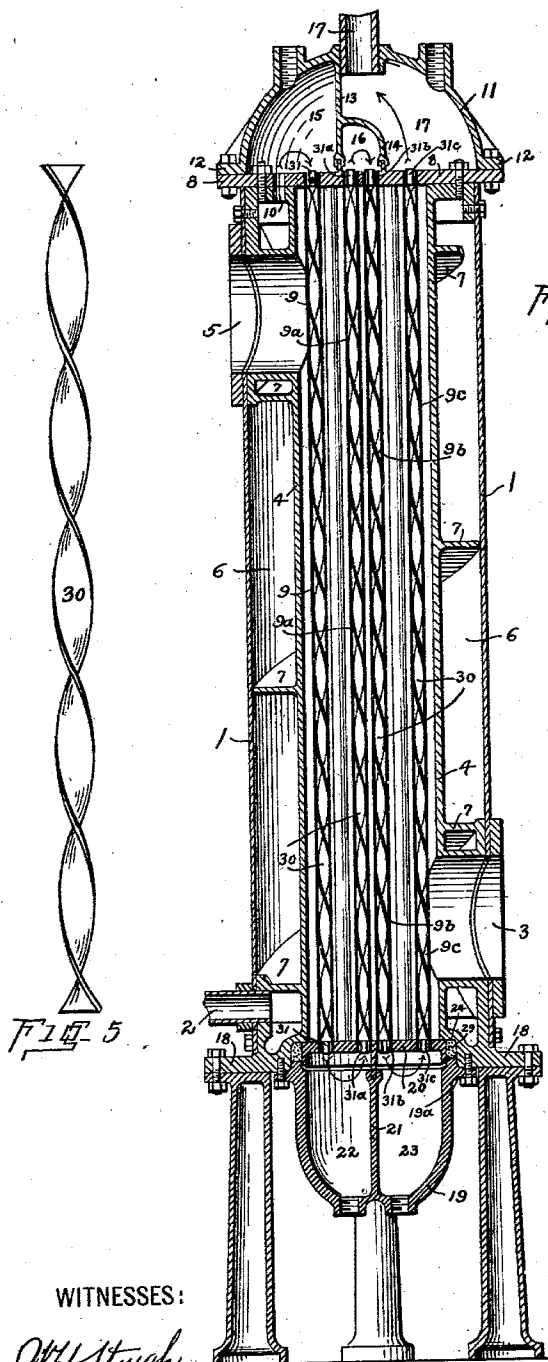


FIG. 5

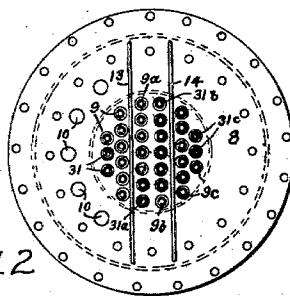


FIG. 2

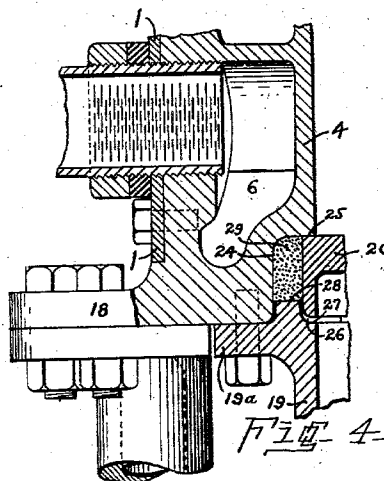


FIG. 4

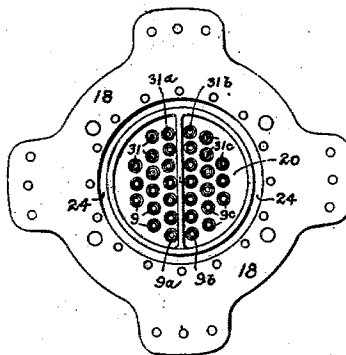


FIG. 3

WITNESSES:

W. H. Stough
Joseph Freese.

FIG. 1

INVENTOR
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RAYMOND H. HORN BROOK, OF CANTON, OHIO.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 740,655, dated October 6, 1903.

Application filed March 6, 1903. Serial No. 146,511. (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 a resident of Canton, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a specification.

My invention relates to feed-water-heaters having an outer and inner casing connected at their ends, which inner casing contains a series of longitudinal tubes connected through transverse tube-plates and opening into water-chambers at each end; and the objects of the improvements are to equalize the circulation of water in the various tubes and so direct the same that the whole heating-surface of each of the tubes is fully utilized and to provide a steam and water tight movable joint between the periphery of one tube-plate and the inner casing which will accommodate the expansion and contraction of the tubes and also resist an excessive boiler or steam pressure against the tube-plate. I attain these objects by the construction illustrated in the accompanying drawings, in which—

Figure 1 is a vertical middle section of the heater; Fig. 2, a plan of the upper tube-plate; Fig. 3, an inverted plan of the lower tube-plate; Fig. 4, a fragmentary section showing the movable joint, and Fig. 5 a separate view of the spiral deflector.

Similar numerals refer to similar parts throughout the drawings.

The outer casing 1 is preferably cylindrical in form and upright in position, through which casing the water-inlet pipe 2 enters near the lower end. In the lower part of the outer casing is connected the steam-inlet pipe 3, which pipe also communicates through and into the inner casing 4, and in the upper part of the outer casing is connected the steam-outlet pipe 5, which pipe also communicates through and into the inner casing. The inner casing 4 is also preferably cylindrical in form and is located within the outer casing, with the water-space 6 intervening, which water-space may be free and continuous or, as illustrated, may be provided with the helical partition 7, which converts the intervening water-space into a spiral passage.

The upper tube-plate 8 is connected to the

upper ends of the outer and inner casings, and through this plate are attached the upper ends of the various tubes 9, 9^a, 9^b, and 9^c. The apertures 10 are provided at one side in the upper tube-plate, which apertures furnish an outlet for the water from the spiral passage between the outer and inner casings.

The upper water-chamber 11 is attached on the upper tube-plate, preferably by the rim-flange 12, and is provided with the transverse partitions 13 and 14, which divide the chamber into the inlet-compartment 15, communicating with the apertures 10 and the tubes 9, the median compartment 16, communicating with the tubes 9^a and 9^b, and the outlet-pipe 17, communicating with the tubes 9^c. The water-outlet pipe communicates from the outlet-compartment of the upper water-chamber to the boiler or other reservoir.

The lower end of the inner casing is provided with the external annular flange 18, to which is connected the lower end of the outer casing, and the lower water-chamber 19 is attached to the lower end of the inner casing, preferably by the rim-flange 19^a. The lower tube-plate 20 is located in the lower end of the inner casing, and through this plate are attached the lower ends of the various tubes. The lower water-chamber is provided with the transverse partition 21, which divides the chamber into the first compartment 22, communicating with the tubes 9 and 9^a, and the second compartment 23, communicating with the tubes 9^b and 9^c.

The internal annular recess 24 is formed in the lower rim of the inner casing, and the periphery of the lower tube-plate projects part way into this recess, and the upper edge of the tube-plate normally rests or abuts against the shoulder 25, formed by the recess, when the tubes are contracted, and this shoulder forms a bearing to prevent a buckling of the tubes and a concomitant racking of the tube-joints by an excessive boiler-pressure on the outer sides of the tube-plates. The annular recess 26 is likewise formed in the rim of the lower water-chamber, and the periphery of the lower tube-plate projects into this recess, preferably to its outer wall, and the shoulder 27, formed by the recess, is so spaced that the lower edge of the tube-plate rests or abuts against it when the tubes are

expanded, and this shoulder forms a bearing to prevent an undue strain on the tube-joints by an excessive steam-pressure against the inner face of the tube-plate.

5 The annular tongue or gland 28 is formed on the face of the rim-flange of the lower water-chamber, which gland projects into and fills the rim-recess of the inner casing outside of the lower tube-plate, and there is thus completed an annular stuffing-box which is filled with the packing 29, and thereby makes a steam and water tight movable joint between the periphery of the lower tube-plate and the inner casing.

15 The spiral deflectors 30 are provided in the several tubes and are formed of a thin strip of sheet metal or other suitable material twisted endwise, so that each edge will form a helix fitting neatly in the tube. These spiral deflectors cause the water to flow spirally through the tubes and to bring every particle against the heated sides of the tubes, so there can be no cold current in the middle of the tubes, but all the water will be uniformly heated.

25 The bushings or ferrules 31, 31^a, 31^b, and 31^c are inserted in the ends of the several tubes and serve the double purpose of reducing the size of the aperture, according to the inside diameter of the bushing used, and of retaining the spiral deflectors in proper place. By the use of these bushings or ferrules the flow of water is equalized in the several tubes of the various series.

35 The water enters the outer casing through the inlet-pipe, and after flowing upward around the inner casing through the spiral passage it enters the inlet-compartment of the upper water-chamber through the aperture 10. The sum of the areas of these apertures preferably equals the area of the inlet-pipe to insure a steady and equal flow through all the openings and passages. The water then flows down through the tubes 9 into the first compartment of the water-chamber, and the end openings of these tubes are reduced by the bushings 31 so the sum of the areas of

these openings equals the sum of the areas of the apertures 10, thereby equalizing the flow through these tubes. The water then flows up through the tubes 9^a into the median compartment of the upper water-chamber and thence down through the tubes 9^b into the second compartment of the lower water-chamber, and the end openings of these tubes are likewise reduced by the bushings 31^a and 31^b so the sum of their areas in each series equals the standard area of the other openings. The water then flows up through the tubes 9^c into the outlet-compartment of the upper water-chamber and thence out through the outlet-pipe, and the end openings of these tubes are reduced by the bushings 31^c so the sum of their areas equals the standard area of the other openings, and the area of the outlet-pipe is preferably the same, so the flow of water is equalized and made steady and constant through each of the several tubes, passages, and openings. The water is heated in the usual manner by live or exhaust steam entering through the steam-inlet pipe, thence passing through the inner casing around and among the tubes and out the steam-outlet pipe.

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

In a heater, a casing, an annular recess in the end of the casing, a tube-plate having its periphery entered part way into the casing-recess, a water-chamber on the end of the casing, an annular recess in the end of the chamber embracing the plate, a gland on the chamber entering the casing-recess, a packing in the casing-recess, and shoulders formed by the recesses and being spaced apart to permit a movement of the plate and to alternately bear its edges.

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

RAYMOND H. HORN BROOK.

Witnesses:

O. N. MCCLINTOCK,
HUGH T. CORRIGAN.