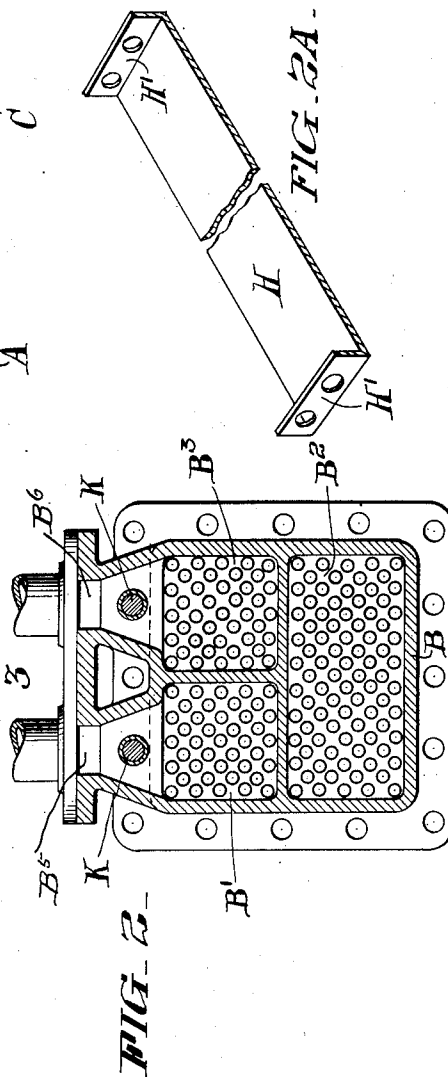
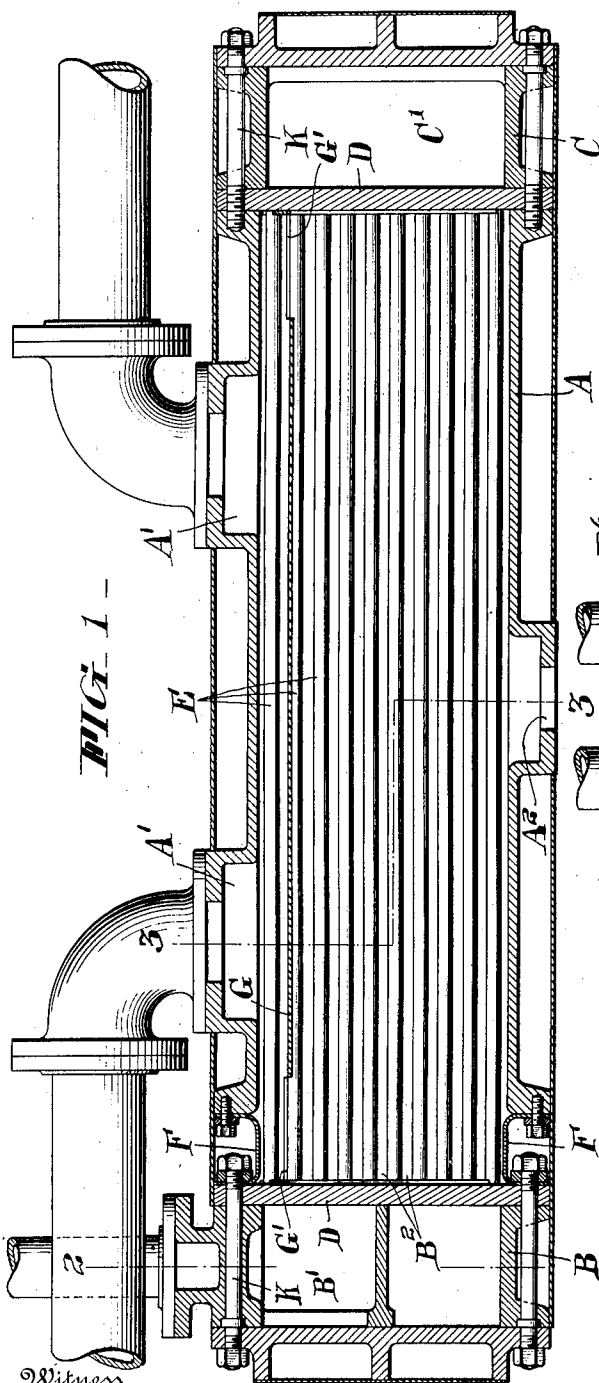


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FEED WATER HEATER.  
APPLICATION FILED SEPT. 25, 1916.

1,350,320.

Patented Aug. 24, 1920.

2 SHEETS—SHEET 1.



Witness  
Daniel Webster Jr.

Inventor  
Luther D. Lovekin  
By Francis T. Chambers  
his Attorney

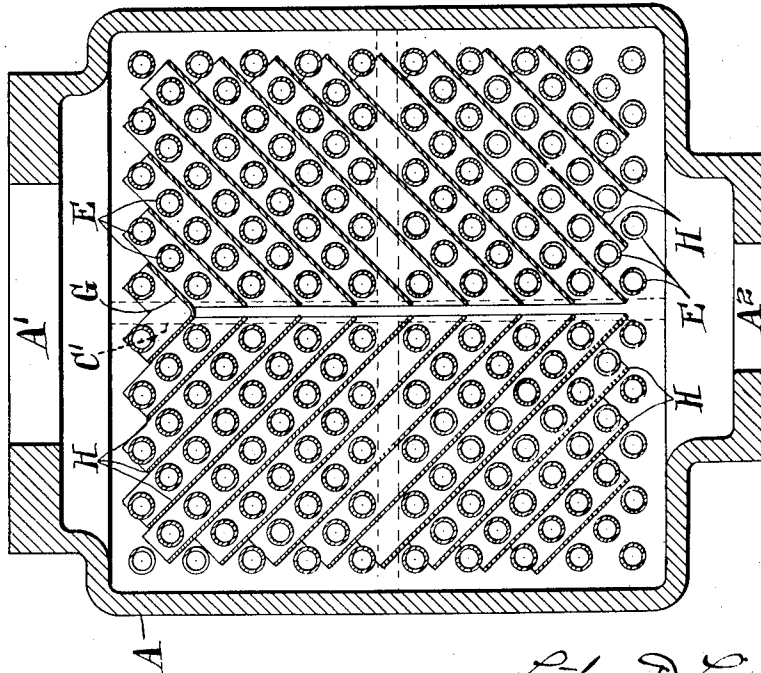
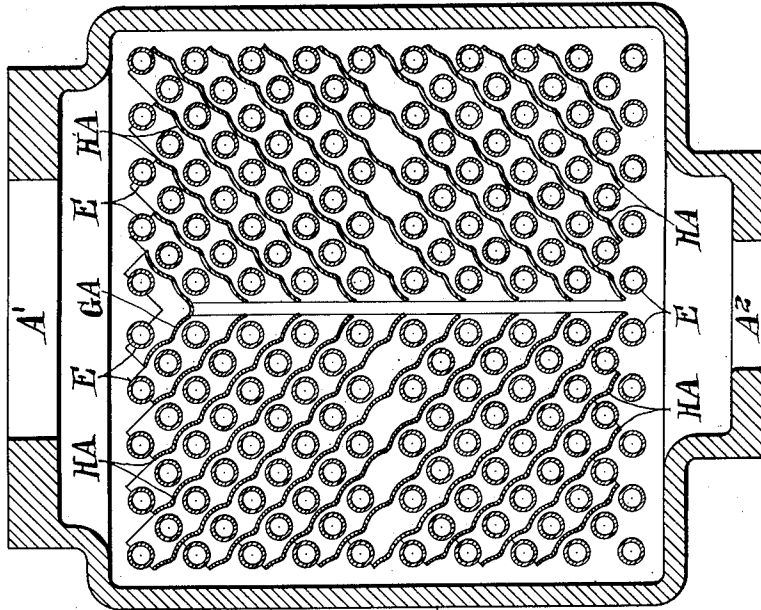
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Inventor

Luther D. Loucks

Witness

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his Attorney

Attorney

# UNITED STATES PATENT OFFICE.

LUTHER D. LOVEKIN, OF PHILADELPHIA, PENNSYLVANIA.

## FEED-WATER HEATER.

1,350,320.

Specification of Letters Patent.

Patented Aug. 24, 1920.

Application filed September 25, 1916. Serial No. 122,046.

*To all whom it may concern:*

Be it known that I, LUTHER D. LOVEKIN, a citizen of the United States, and a resident of the city and county of Philadelphia, State of Pennsylvania, have invented a certain new and useful Improvements in Feed-Water Heaters, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My present invention relates to heat interchanging apparatus of the surface condenser type in which heat is transferred to a colder fluid flowing through a group of spaced apart tubes from a condensable vapor, as steam, in contact with the outer walls of the tubes, and the general object of the invention is to provide simple and effective apparatus of the type characterized by its efficiency and relatively high capacity per unit of bulk. More specifically the object of my invention is to provide apparatus of the type referred to with a novel arrangement of baffles in the vapor space traversed by the tubes which will insure a desirable distribution of the vapor through the vapor space and which will divert the liquid of condensation forming on and dripping off upper tubes away from lower tubes. This adds to the effectiveness of the apparatus since a liquid coat or film on a tube exerts a heat insulating effect which increases with the thickness of the coat or film and correspondingly reduces the coefficient of heat transmission through the tube wall.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, and the advantages possessed by it, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described preferred embodiments of my invention.

Of the drawings:

Figure 1 is a sectional elevation of a preferred embodiment of my invention;

Fig. 2 is a section taken on the line 2—2 of Fig. 1;

Fig. 2<sup>A</sup> is a perspective view partly broken away, of one of the baffle plates;

Fig. 3 is an enlarged section taken on the broken line 3—3 of Fig. 1; and

Fig. 4 is an enlarged section taken similarly to Fig. 3 illustrating a modification.

In the drawings and referring first to the construction shown in Figs. 1, 2 and 3, A represents the casing body of apparatus of the surface condenser type especially devised for use on, and as a part of a locomotive for using the exhaust steam from the locomotive to heat the feed water for the locomotive. To the ends of the casing body A are secured chambered end members B and C. As shown, the end member C is directly secured by bolts K to the adjacent end of the casing body A, the corresponding tube sheet D being clamped at its margin between the casing body and the end member C. The end member B is connected by bolts K to the adjacent tube sheet D which, with the end member B, is connected to the adjacent end of the casing body A by the flexible casing portion F which forms an expandable joint to take care of the relative expansion of the casing body A and the tubes E which are rigidly connected at their ends into the tube sheets D. The tubes E are approximately horizontally disposed. As shown, the steam space within the casing body A traversed by the tubes E is provided with two steam inlets A' at its upper edge and a bottom outlet A<sup>2</sup> for water of condensation. The end member B is formed with an inlet chamber B' and an outlet chamber B<sup>2</sup> and a third chamber B<sup>3</sup>. The space in the end member C is divided into two equal portions by the vertical diaphragm C'.

The feed water to be heated entering the chamber B' through the inlet B<sup>5</sup> passes through the tubes E opening into that chamber to the chamber in the end member C at the left of the partition C' as viewed in Fig. 3, and returns from that chamber to the chamber B<sup>2</sup> through the tubes E opening to both of said chambers. The water passes from the chamber B<sup>2</sup> to the chamber in the end member C at the right of the partition C' through the tubes E connecting the two chambers last referred to. Thence the water returns to the chamber B<sup>3</sup> through the tubes E connected thereto, and leaves the apparatus through the outlet port B<sup>4</sup>. The water

being heated thus passes back and forth between the two end members four times. It will be understood, however, that it is immaterial to the present invention whether the chambered end members be divided and provided with external connections to insure one or any desirable plurality of passages of the water being heated from one end of the apparatus to the other.

10 The tubes E are arranged in diagonal rows running from the upper edge to the outer vertical edges of the assembled body of tubes toward the vertical central plane of the tube receiving space. A trough shaped member or baffle G with oppositely inclined sides, is arranged below the central pair of tubes E at the upper edge of the mass of tubes. This trough is formed at one or both ends with a discharge opening G' for water of condensation collecting in the trough. Interposed between each adjacent pair of diagonal rows of tubes E below the member G are plate like baffles H which terminate at their lower edges either adjacent the vertical central plane of the body of tubes or, in the case of the lower baffles, at the lower edge of the mass of tubes. The baffle plates are secured in place in any suitable manner.

With the described arrangement each of the baffle plates H receives the water of condensation forming on and dripping off the tubes E in the diagonal row immediately above the baffle plate and conducts this water either to the center of the tube mass or, in the case of the lower baffle plates, to the lower edge of the tube body. In either event the baffles effectually protect the tubes beneath them against the drip of the water of condensation formed on the tubes above them.

40 At the same time the baffles insure a very desirable distribution of the steam through the intertube space as they provide a large number of separate steam passages leading inwardly and downwardly from the upper and side edges of the steam space. This minimizes any tendency to the creation of air pockets and undesirable eddies in the active condensing portion of the steam space. The trough shaped baffle G effectively pre-

vents the rush of an unduly large portion of the steam into the upper central portion of intertube space.

The baffle plates H are advantageously secured in place by forming each plate with outturned flange portions H' at its ends, as shown in Fig. 2A. Apertures are formed in the flange portions H' to receive the tubes E lying immediately above the baffle. The baffles G and HA may be secured in place in the same manner.

The baffles may sometimes be corrugated with advantage, as are the baffle plates HA shown in Fig. 4, as this makes it possible to get the necessary stiffness with thinner baffles than would otherwise be required, and this turn permits of a closer tube spacing.

While in accordance with the provisions of the statutes I have illustrated and described the best forms of my invention now known to me, it will be apparent to those skilled in the art that changes can be made in the form of my invention without departing from its spirit, and that some features of my invention can be used without a corresponding use of other features.

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

Heat exchange apparatus comprising in combination a casing inclosing a vapor chamber with an upper inlet for the vapor and a lower outlet for the liquid of condensation, a group of horizontally disposed tubes traversing said chamber and arranged in rows diagonally inclined downwardly and toward a central vertical plane of the intertube space, correspondingly inclined baffle plates arranged between the rows of tubes to provide diagonal vapor and water of condensation paths leading inwardly and downwardly from the upper and side edges of the intertube space, and a central downwardly extending escape passage for liquid of condensation, and a trough shaped baffle extending along and partially closing the upper end of said passage.

LUTHER D. LOVEKIN.