

(No Model.)

2 Sheets—Sheet 1.

J. M. KELLER.

FEED WATER HEATER AND CONDENSER.

No. 570,435.

Patented Oct. 27, 1896.

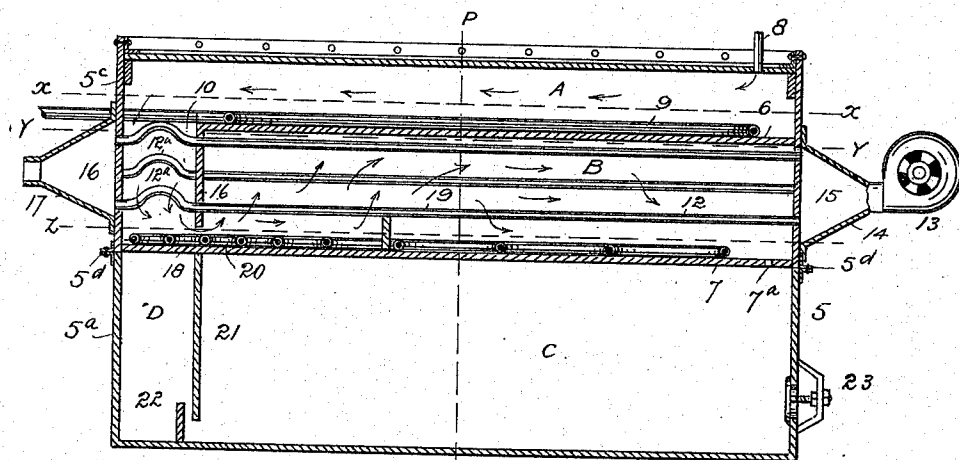


FIG. 1. P

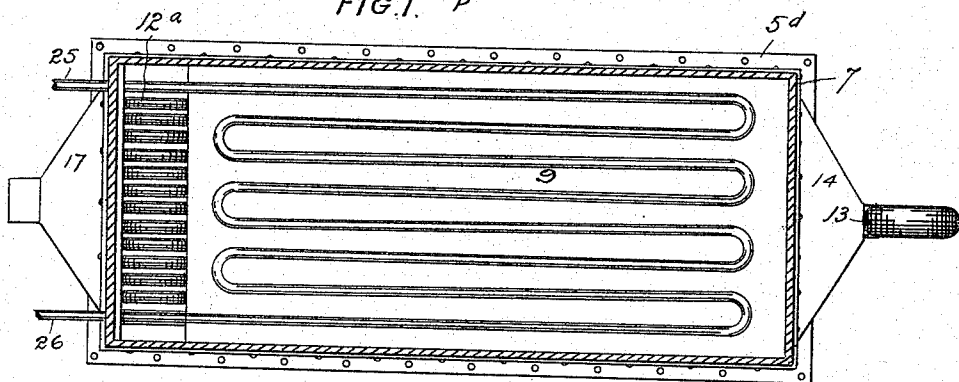


FIG. 2

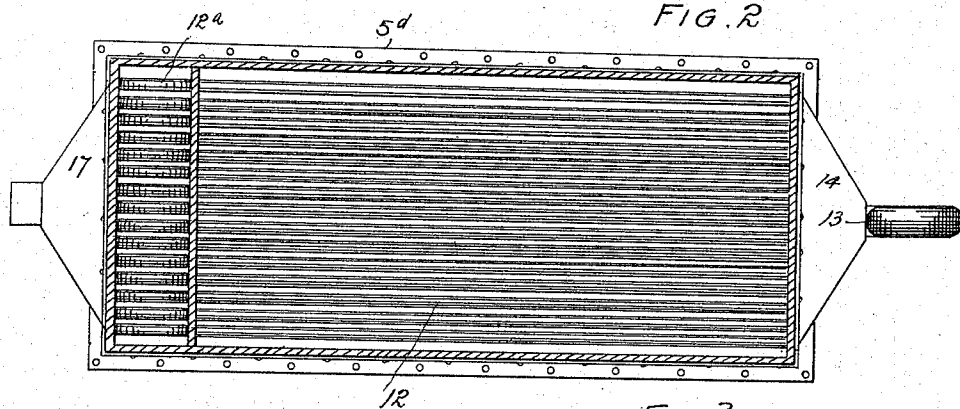


FIG. 3.

Witnesses  
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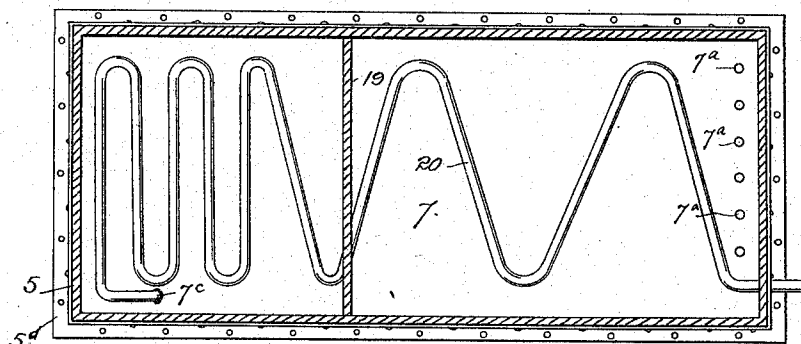


FIG. 4.

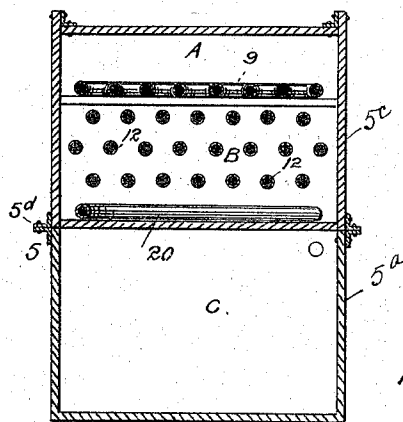


FIG. 5.

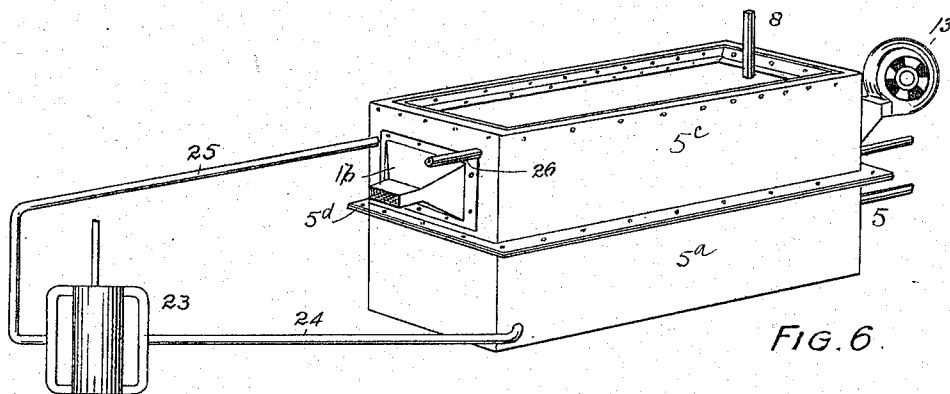


FIG. 6.

Witnesses  
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# UNITED STATES PATENT OFFICE.

JAMES M. KELLER, OF DENVER, COLORADO, ASSIGNOR OF ONE-HALF TO  
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## FEED-WATER HEATER AND CONDENSER.

SPECIFICATION forming part of Letters Patent No. 570,435, dated October 27, 1896.

Application filed October 25, 1895. Serial No. 566,923. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES M. KELLER, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in a Combined Feed-Water Heater and Condenser; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in feed-water heaters in which the feed-water is purified and the exhaust-steam from the engine condensed.

My improvement consists of the features hereinafter described and claimed, all of which will be fully understood by reference to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a central vertical longitudinal section taken through the apparatus. Figs. 2, 3, and 4 are horizontal sections taken on the lines  $x x$ ,  $y y$ , and  $z z$ , respectively. Fig. 5 is a vertical section taken on the line  $P P$ , Fig. 1. Fig. 6 is a perspective view of the apparatus shown in connection with a pump for transferring the purified feed-water and the water of condensation to the superheated pipes located in the uppermost chamber.

Similar reference-characters indicate corresponding parts in the views.

Let the numeral 5 designate the casing of the apparatus, formed in two sections 5<sup>a</sup> and 5<sup>b</sup>, suitably connected, as shown at 5<sup>d</sup>. The space inclosed by this casing is divided by horizontal plates 6 and 7 into three compartments A, B, and C. The compartment A, which is uppermost, receives the exhaust-steam from the engine through an inlet-pipe 8. In the bottom of the chamber, and resting on the partition-plate 7, is located a coil of pipe 9, whose function will be fully explained hereinafter. The plate 6 does not entirely separate the compartments A and B, an opening 10 being left at the extremity

remote from the inlet-pipe 8. The exhaust-steam, after traversing the entire length of the chamber A in contact with the pipe-coil 9, passes downward through the opening 10 into the condensing-chamber B next below, in which are located the air-pipes 12, through which a blast of cold air is continually passed through the instrumentality of a fan 13, attached to a casing 14, made fast to the end of the section 5<sup>b</sup> of the casing 5. The pipes 12 are open-ended, and communicate at one extremity with the blast-chamber 15, inclosed by the casing 14. Near their opposite extremities the pipes 12 pass through a depending head-plate 16<sup>a</sup>, attached to the horizontal plate 6. Between the head-plate 16<sup>a</sup> and the end of the casing a bend 12<sup>a</sup> is formed in each pipe 12. These bent extremities of the pipes open into a chamber 16, inclosed by a casing 17, attached to the end of the casing 5<sup>b</sup> remote from the blast-chamber. The air which has been heated by passing through the pipes 12 may be taken from the chamber 16 and utilized for warming purposes.

There is an opening 18 between the head 16<sup>a</sup> and the plate 7 to allow the steam to circulate through the entire chamber B. Attached to the plate 7 and projecting upwardly therefrom is a short vertical cut-off plate 19, which causes the steam to rise in the chamber B, its function being to diffuse the steam among the cold-air pipes 12 and facilitate condensation. The object of the bends 12<sup>a</sup> in the pipes 12 is to offer some resistance to the passage of air through the pipes and also to increase the condensing surface with which the exhaust-steam is brought in contact. By reason of the bends the air is heated to a greater degree than would be the case if it passed through the pipes in straight lines or in an uninterrupted flow.

The exhaust-steam being condensed in chamber B, the water passes through one or more apertures 7<sup>a</sup>, formed in the plate 7 at the extremity of the chamber B remote from the opening 10, through which the steam enters the chamber. The course of the exhaust-steam is indicated by the arrows. (See Fig. 1.) The water of condensation, passing through the apertures 7<sup>a</sup>, enters the water-chamber C and mingles with the feed-water,

which is introduced via the pipe-coil 20, located in the chamber B on the floor-plate 7. This feed-water enters at one extremity of the chamber B, and after traversing the pipe to the opposite extremity of the chamber is discharged through an opening 7<sup>c</sup> in the floor-plate into the water-chamber C.

Near one extremity of the chamber C is located a depending plate 21, attached to the floor-plate 7 and reaching nearly to the bottom of the chamber C, forming a small compartment D, communicating with the compartment C. Attached to the bottom of the casing and projecting upwardly into the compartment D at a short distance from the plate 21 is a short plate 22, whose upper extremity reaches a short distance above the lower extremity of the plate 21.

The water is taken out of the compartment D near the bottom, and is entirely free from oil and other impurities. The impurities in the feed-water settle in chamber C, and may be removed via the hand-hole 23. The two plates 21 and 22 form a trap against the entrance of oil and other impurities to the compartment D.

The water of condensation, together with the purified feed-water, is taken from the compartment D and transferred to the pipe-coil 9 in the chamber A through the instrumentality of any suitable pumping apparatus, conventionally shown at 23 in the drawings, (see Fig. 6,) and the pipes or conduits 24 and 25. The water while passing through the pipes in the uppermost chamber is superheated before it passes to the boiler, since the pipe-coil 9 is in direct contact with the hot exhaust-steam when it first enters the apparatus via the inlet-pipe 8, as heretofore explained. After traversing the entire pipe-coil 9 the superheated water passes to the boiler via a pipe 26, connected with the coil 9.

Having thus described my invention, what I claim is—

1. In an apparatus of the character described, the combination of the casing with horizontal plates dividing the space inclosed by the casing, into three compartments, namely, the steam-chamber A, the condensing-chamber B and the water-chamber C, the chamber A being uppermost and provided with an inlet for the exhaust-steam which enters chamber A before passing to the condensing-chamber, the superheated pipe-coil located in the chamber A, the air-pipes located in the chamber B, means for forcing the air through said pipes, the apparatus being provided with a passage-way for the exhaust-steam from chamber A to chamber B, and an outlet for the water of condensation to allow it to pass from chamber B to chamber C; and means for transferring the water from chamber C and forcing it through the superheated pipe-coil in the chamber A prior to its passage to the boiler.

2. In an apparatus of the character de-

scribed, the combination of the casing, the horizontal, or approximately horizontal, plates dividing the space inclosed by the casing, into three horizontal compartments A, B and C, the apparatus being provided with an inlet for the exhaust-steam to chamber A, an outlet for the exhaust-steam from chamber A to chamber B, and an outlet for the water of condensation from chamber B to chamber C; the superheated pipe-coil located in chamber A, the open-ended condensing-pipes located in chamber B, means for forcing cold air through said pipes, the feed-water pipe-coil also located in chamber B, and means for transferring the water from chamber C and forcing it through the superheated coil in chamber A before it passes to the boiler.

3. In an apparatus of the character described, the combination of the casing, the horizontal, or approximately horizontal, partition-plates dividing the space inclosed by the casing, into three compartments, A, B and C, the apparatus being provided with a passage-way for the exhaust-steam from chamber A to chamber B, and a passage-way for the water of condensation from chamber B to chamber C; the superheated pipe located in chamber A, the air-pipes located in chamber B, said pipes having bends near their exit extremities, means for forcing cold air through said pipes, and means for transferring the water from chamber C and forcing it through the superheated pipe in chamber A.

4. In an apparatus of the character described, the combination of the casing, the horizontal, or approximately horizontal, plates dividing the space inclosed by the casing, into three compartments A, B, and C, the chamber A being uppermost and adapted to receive the exhaust-steam from the engine, the apparatus being provided with a passage-way for the exhaust-steam from chamber A to chamber B, and a passage-way for the water from chamber B to chamber C; the superheated coil located in chamber A; the open-ended cold-air pipes located in chamber B, means for forcing air through said pipes, the feed-water pipe-coil also located in chamber B, the oil-trap comprising a depending plate located near the extremity of the chamber C, but not reaching to the bottom of said chamber, and a short upwardly-projecting plate attached to the bottom of said chamber and extending a short distance above the lower extremity of the depending plate; and means for transferring the water from chamber C to the superheated pipe in chamber A and forcing it therethrough.

5. In an apparatus of the character described, the combination of the casing having a compartment A, a steam-pipe entering said compartment, a condensing-compartment B in communication with the compartment A, a compartment C located below, and being in communication with the compartment B, pipes passing through the compartment B,

means for forcing air through said pipes, the  
pipe-coil located in the chamber A, and means  
for pumping liquid from the chamber C  
through said pipe-coil which is superheated  
5 by direct contact with the steam which first  
enters the compartment A and passes thence  
to the condensing-compartment B.

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

JAMES M. KELLER.

Witnesses:

CHAS. E. DAWSON,  
A. J. O'BRIEN.