

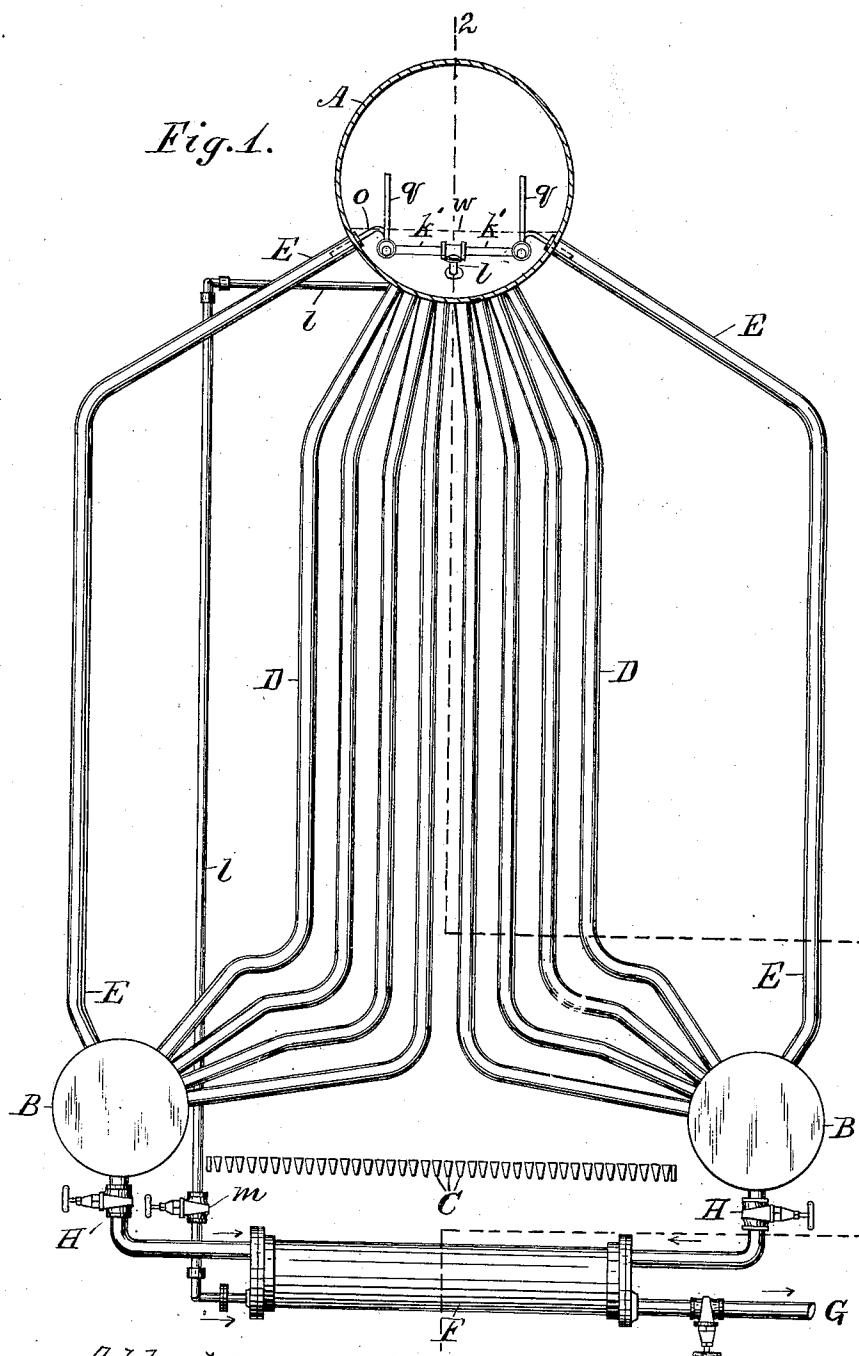
(No Model.)

2 Sheets—Sheet 1.

J. J. HOGAN.
INTERNAL FEED WATER HEATER.

No. 565,986.

Patented Aug. 18, 1896.



Attest:
L. Lee
Edw. G. Kinsey.

Inventor
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Thomas S. Crane, Atty.

(No Model.)

2 Sheets—Sheet 2.

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Fig. 2.

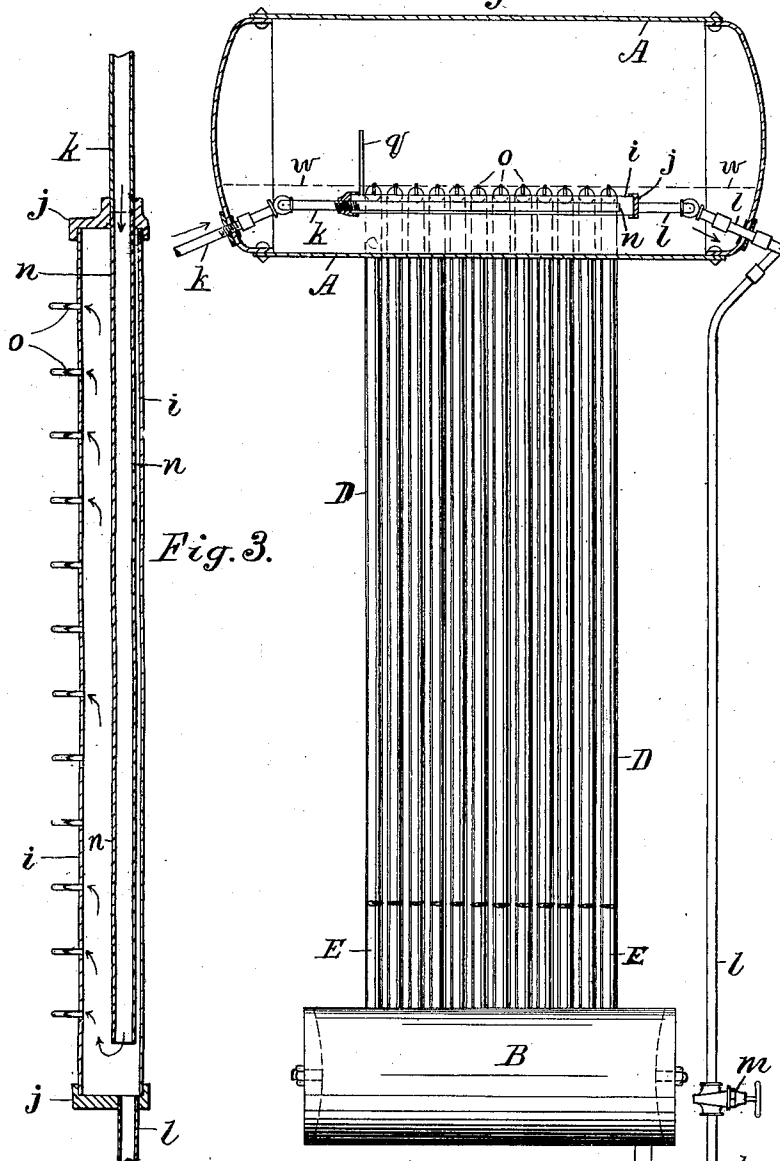
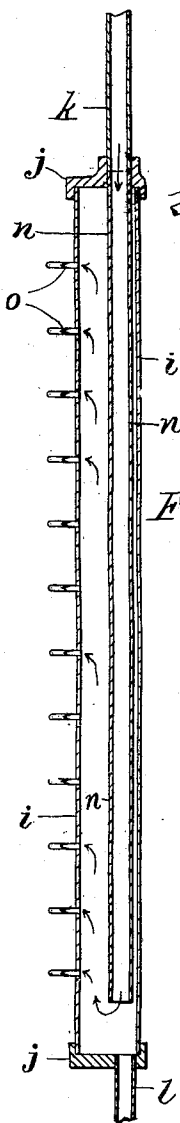


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN J. HOGAN, OF MIDDLETOWN, NEW YORK.

INTERNAL FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 565,986, dated August 18, 1896.

Application filed September 13, 1895. Serial No. 562,407. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. HOGAN, a citizen of the United States, residing at Middletown, Orange county, New York State, have invented certain new and useful Improvements in Internal Feed-Water Inductors, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is to furnish a more efficient and simple means of heating the feed-water delivered to a tubular steam-boiler, and preferably to deliver the feed-water into the descending current of the boiler, so as to be heated by the waste heat of the boiler fluid before it enters the rising current, in contact with the hotter surfaces.

The invention is especially applicable to boilers having a horizontal steam-drum at the top and a water-drum arranged at a lower level and connected with the steam-drum by ascending and descending water-tubes.

The invention consists, primarily, of a feed-water-heater shell immersed in and heated by the moving circulation-current of the boiler. Such circulation-current is most effectively maintained by connecting a steam-and-water drum at the top of the boiler with a water-drum at the bottom by means of ascending and descending water-tubes; and the invention consists, partly, in the combination, with the heater-shell extended within the steam-and-water drum below the water-line, of a series of discharge-pipes extended from the top of the shell to the mouths of the descending pipes to mingle the feed-water with the current of boiler fluid descending therein.

The invention also includes other details of construction, as hereinafter set forth.

The invention will be understood by reference to the annexed drawings, in which—

Figure 1 is an elevation of the drums and tubes in such a water-tube boiler with the steam-drum in section. Fig. 2 is a vertical section upon line 2 2 in Fig. 1. Fig. 3 is a longitudinal section of the heater, and Fig. 4 is a cross-section of the same. Figs. 3 and 4 are drawn upon a larger scale than Fig. 2.

A designates the steam-drum, and B B water-drums arranged below the same at opposite sides of a grate C. The ascending

tubes D connect the water-drums with the bottom of the steam-drum, and the descending tubes E connect the water-drums with the sides of the steam-drum adjacent to the water-line.

F is a mud-drum provided with a blow-off G and connected with the bottoms of the water-drums by pipes having cocks H.

The water-heater consists of a tubular shell *i*, closed at the ends by caps *j*. The boiler when in operation is filled with water up above the tops of the descending tubes E, and the drum A therefore serves as a steam-and-water drum. The shell is shown immersed in the boiler fluid just below the water-line *w* and one of the caps connected with the feed-water pipe *k*, which is extended through the head A' of the steam-drum. The contact of the shell with the boiler fluid heats it to a high temperature, and the feed-water within such shell is thus heated very effectively. The other cap is connected by pipe *l* and cock *m* with the mud-drum F.

A heating-pipe *n* is connected with the feed-water pipe *k* and extended within the shell close to its bottom nearly to the opposite cap. A series of small outlet-apertures is formed in the top of the shell, their combined area being no greater than that of the feed-water pipe, twelve of such outlets, a quarter-inch diameter each, being shown to cooperate with a one-inch feed-water pipe. As the water delivered by the pipe within the shell is unable to escape through the apertures nearest to the mouth of such pipe, it is forced toward the apertures at the farther end of the shell, and is thus brought into contact with a large part of the shell's surface before it is discharged into the boiler fluid. By extending the heating-pipe *n* through the length of the shell the cold water flowing through such heating-pipe is warmed before it enters the shell by conduction from the water within the shell, which is already partially heated by the heat conducted through the shell itself. The heat is thus conducted to the water most effectively and thoroughly before the water is discharged from the heater.

A series of discharge-pipes *o* is projected from the apertures in the top of the shell and bent downwardly to extend into the mouths of the descending tubes E. The water rises

in the ascending tubes D, owing to their superior heat, and, after it has discharged its steam into the drum A, descends to the water-drums B through the tubes E, and in its passage from the mouths of the tubes D to the mouths of the tubes E the highly-heated current flows over the water-heater, which is arranged within the steam-drum between the mouths of the said pipes. Two such water-heaters are shown in Fig. 1 arranged at opposite sides of the center line and connected with the feed-pipe by branch pipes *k'*. I sometimes extend the mouths of the water-tubes D upward through the water above the water-line *w*; but the heated fluid in either construction flows around the shell of the water-heater on its passage to the descending tubes E. As a very high temperature prevails in the steam-drum, steam is liable to be generated within the shell of the water-heater, and I therefore extend a vent-pipe *q* from the top of the water-heater to a point above the water-line to discharge any steam that may be generated therein. As the temperature of the feed-water is greatly raised within the heater, a sediment is precipitated therein, which is drawn off from time to time by the pipe *l* and cock *m* to the mud-drum F, in which the sediment from the water-drums B is also accumulated and discharged, when necessary, through the pipe G. In thus blowing off the sediment from the heater the outlet-pipe G from the mud-drum is slightly opened to diminish the pressure therein, thus inducing a current of steam into the heater-shell *i* through the vent-pipe *q*, which forces the entire contents of the heater through the pipe L into the mud-drum.

Without the steam vent-pipe *q* a water-current would be induced within the heater (when thus connected with the mud-drum) through the water-pipes *o*; but the action of the water-current would not be so rapid as that of the steam and would not tend to scour out the interior of the water-heater so effectively. The vent-pipe *q* also furnishes a means of scouring out the mud-drum with steam, when required, as the entire contents of the mud-drum would be blown out rapidly by the steam operating through the pipe *q* whenever the outlet-pipe G from the mud-drum is fully opened.

The boiler-settings are not shown in the drawings, as they form no part of the present invention, which relates solely to the construction of the water-heater and its connections and its arrangement within the steam-drum, where it is exposed to the heated steam and water.

The shell of the heater is shown (see Fig. 3) formed of wrought-metal pipe with caps screwed upon its ends; but the heater may be formed in one piece, of cast-iron, if preferred, and the pipe *n* inserted through one of the ends. The pipe *n* is placed within the lower side of the heater-shell *i* to permit the free passage of the water to the outlet-pipes

o, but may be placed in the center of the shell without departing from my invention.

The outlet-pipes *o* are shown projected from the top of the shell, but may be projected from the side, if preferred, and where a heater is used having the constructive features which I have described in a steam-drum having no descending tubes E the water may be discharged from the outlets of the heater-shell directly into the boiler fluid, the outlets in such case being made very small to diffuse the feed-water in a sort of spray within the boiler fluid.

By mingling the feed-water first with the descending current of boiler fluid the water is heated by the waste heat of the fluid and is thus raised within a few degrees of the boiler temperature without diminishing the heat of the ascending fluid.

In one important respect my invention differs from other water-heaters, in its arrangement within the moving circulation-current of the boiler between the mouths of the ascending and descending water tubes, which produce such a moving current in the upper drum where the steam is disengaged from the water.

One form of water-tube boiler is shown in the drawings to illustrate my invention; but it is obvious that the arrangement of the tubes in relation to the steam-drum is immaterial, provided the drum is connected with ascending and descending water-tubes which produce a circulation or moving-water current therein. The insertion of a water-heater shell within the drum below the water-line secures, under such conditions, the utmost possible rapidity in the conduction of heat to the feed-water, while the moving current of water carries the feed-water, when mingled therewith, into the cooler parts of the boiler, where it is least liable to injure the heated boiler plates or tubes.

Having thus set forth the nature of my invention, what I claim herein is—

1. In a tubular steam-boiler, a steam-drum having ascending and descending water-tubes connected therewith, a tubular feed-water heater extended within the drum below the water-line, a feed-water pipe delivering water within such heater, and a series of discharge-pipes extended from the top of the heater to mingle the heated feed-water with the boiler fluid, substantially as herein set forth.

2. In a tubular steam-boiler, a steam-drum having ascending and descending water-tubes connected therewith, a tubular feed-water heater extended within the drum below the water-line, a feed-water pipe delivering water within such heater, a series of discharge-pipes for mingling the feed-water with the boiler fluid, and a vent-pipe projected from the top of the heater above the water-line within the steam-drum, as and for the purpose set forth.

3. In a tubular steam-boiler, a steam-drum

having ascending water-tubes connected with its lower side and a row of descending water-tubes connected to it near the water-line, a tubular feed-water heater extended within the drum below the water-line, a feed-pipe delivering water within such heater and minute discharge-pipes extended from the heater into the mouths of the descending water-tubes to deliver the feed-water therein, substantially as herein set forth.

4. A tubular steam-boiler having a steam-drum with a water-drum arranged at a lower level and connected therewith by ascending and descending water-tubes, a mud-drum connected with such water-drum, a feed-water heater having a tubular shell extended within the drum below the water-line, a feed-water pipe delivering water within such heater, and a series of discharge-pipes for mingling the heated water with the boiler fluid, and a connection from the shell of the heater to the mud-drum to discharge the mud therefrom, substantially as herein set forth.

5. A tubular steam-boiler having a steam-

drum with a water-heater arranged at a lower level and connected therewith by ascending and descending water-tubes, a mud-drum connected with such water-drum and provided with an outlet-pipe G, a feed-water heater having a tubular shell extended within the steam-drum below the water-line, a feed-water pipe delivering water within such heater, and discharge-pipes for mingling the heated feed-water with the boiler fluid, a connection from the shell of the heater to the mud-drum to discharge the mud therefrom, and a vent-pipe, as g, projected from the heater above the water-line within the steam-drum to admit steam for blowing off the water-heater and the mud-drum, substantially as herein set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN J. HOGAN.

Witnesses:

L. LEE,

EDW. F. KINSEY.