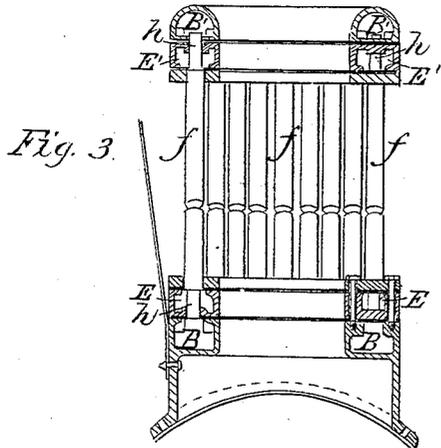
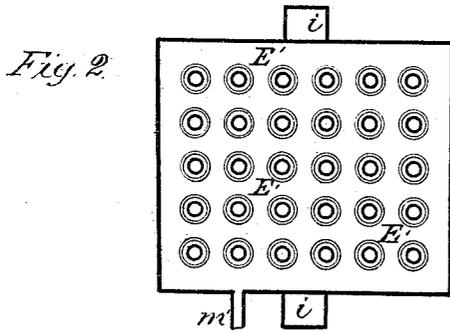
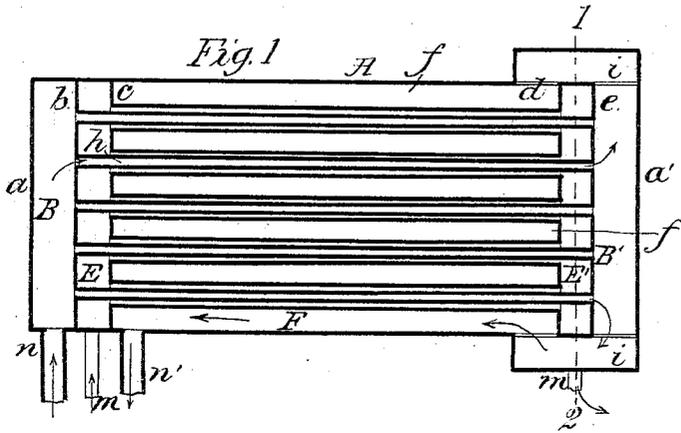


H. Sabin,
Steam-Boiler Condenser.

No 83,796.

Patented Nov. 3, 1868.



Witnesses:
Wm. A. Steel
John Parker

Inventor:
H. Sabin
By his Atty
J. H. Howson

United States Patent Office.

HIBBARD SABIN, OF PHILADELPHIA, PENNSYLVANIA.

Letters Patent No. 83,796, dated November 3, 1868.

IMPROVED WATER-HEATER.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, HIBBARD SABIN, of Philadelphia, Pennsylvania, have invented an Improved Water-Heater; and I do hereby declare the following to be a full, clear, and exact description of the same.

My invention consists of a heater, composed of a casing, separated into compartments, and provided with a series of external and internal tubes, and with inlets and outlets for steam and water, all substantially as described hereafter, so as to utilize nearly all the available heat in the steam.

My invention further consists of a modification of the heater, for use in locomotives, in the manner described hereafter.

In order to enable others skilled in the art to make and apply my invention, I will now proceed to describe its construction and operation, reference being had to the accompanying drawing, which forms a part of this specification, and in which—

Figure 1 is a longitudinal section of my improved water-heater;

Figure 2, a transverse section on the line 1-2, fig. 1; and

Figure 3 represents my invention applied to the smoke-stack of a locomotive.

On reference to figs. 1 and 2, A is the outer casing of the heater, which, in the present instance, is of the square form shown, this casing being closed at its opposite ends, *a a'*, and having, near the former end, internal partitions, *b* and *c*, and near the end *a'*, partitions *d* and *e*, so that the casing is separated by these partitions into the compartments B, B', E, E', and F.

A series of tubes, *f*, extends from the partition *c* to the partition *d*, and forms communications between the compartments E and E'.

Through each of the pipes *f* passes a smaller pipe, *h*, all of the latter extending from the partition *b* to the partition *e*, and forming communications between the compartments B and B'.

Hollow projections, *i i*, are arranged at one end of the heater, so as to form communications between the middle compartment F and end-compartment B'.

The feed-water is admitted through the pipe *m* to the compartment E, passes thence, through the spaces between the external tubes *f* and internal tubes *h*, to the compartment E', and leaves the latter through the pipes *m*.

Exhaust or other steam enters the compartment B through the pipe *n*, passes thence, through the internal tubes *h*, into the compartment B'; thence, through the passages *i i*, returns through the middle compartment F, and escapes through the pipe *n*.

It will be seen that as both the inner and outer tubes, *f* and *h*, are exposed to the steam, the water, in taking its course through the annular spaces between these tubes, is exposed to two heating-surfaces, in contact with which the entire volume of steam is caused to pass, first within the inner tubes, and then round the outer tubes, nearly all the available heat in the steam being thus imparted to the water.

In fig. 3, the outer casing, A, is dispensed with, and the tubes are arranged vertically in a circle, the inner tubes *h* forming communications between the lower and upper chambers B, and the outer tubes forming communications between the annular chambers E and E', the whole being placed within the chimney of a locomotive, the chimney, in this instance, being a substitute for an outer casing.

I do not claim the combination of inner and outer tubes, forming annular water-spaces, and internal and outer passages for the steam; but

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

The arrangement of chambers or passages B, B', E, E', F, and *i*, in respect to internal and external tubes *h* and *f*, so that the steam shall pass first within and then around the tubes, as described.

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

HIBBARD SABIN.

Witnesses:

JOHN WHITE,
C. B. PRICE.