

(No Model.)

T. W. DUFFY.  
FEED WATER HEATER.

No. 350,300.

Patented Oct. 5, 1886.

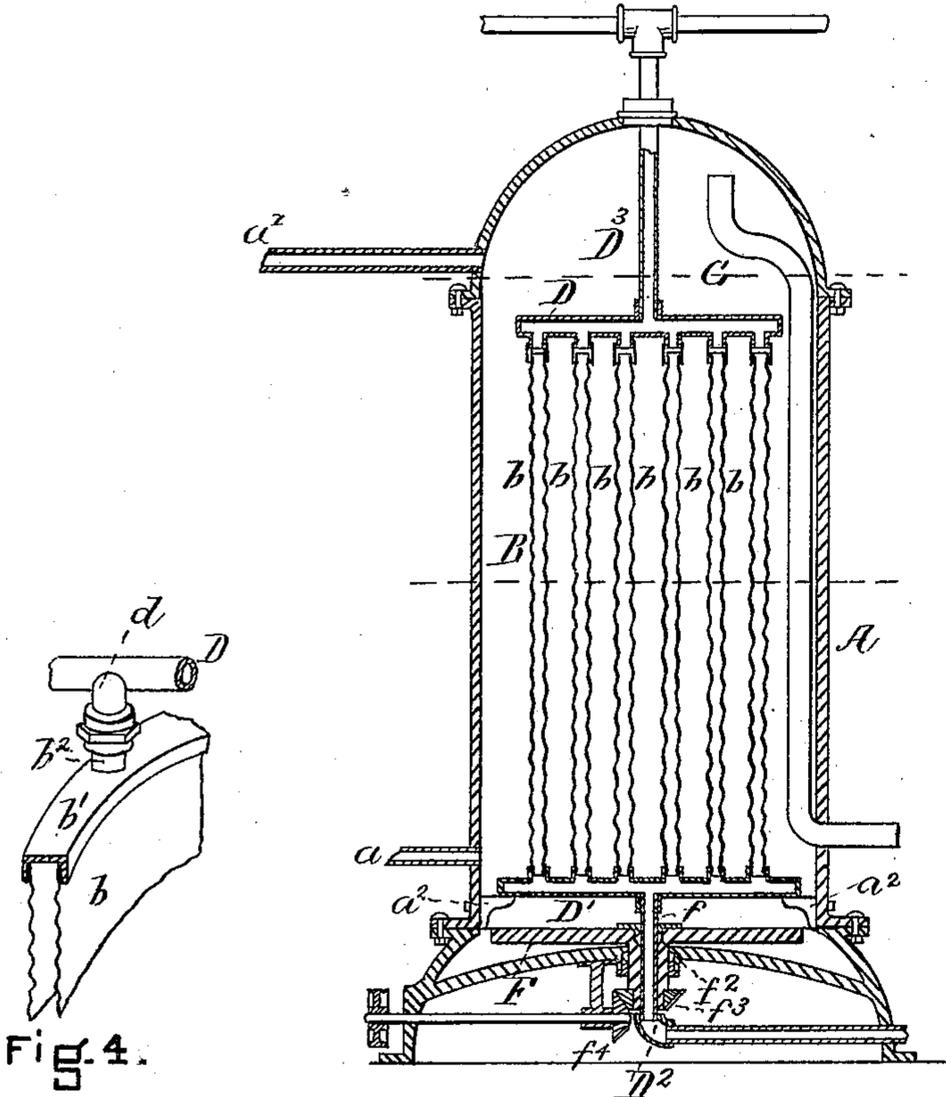


Fig. 1.

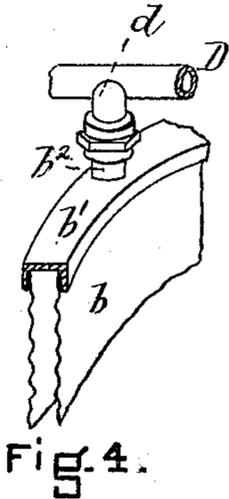


Fig. 4.

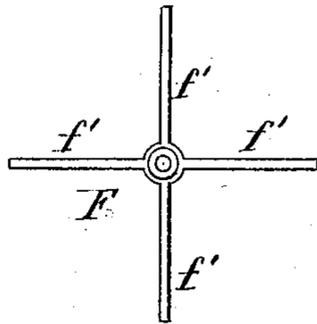


Fig. 5.

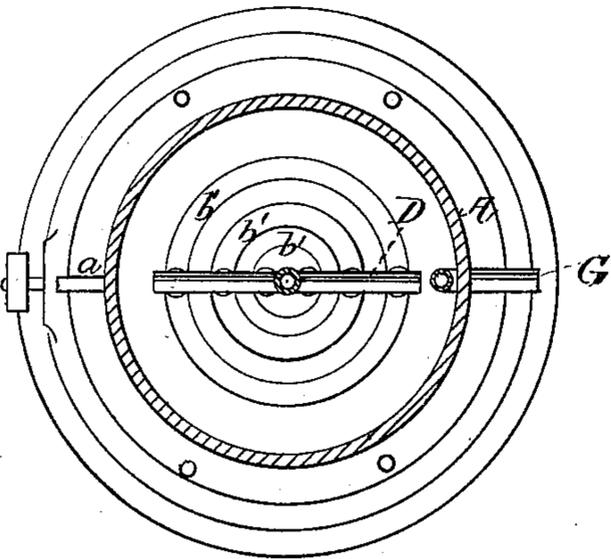


Fig. 2.

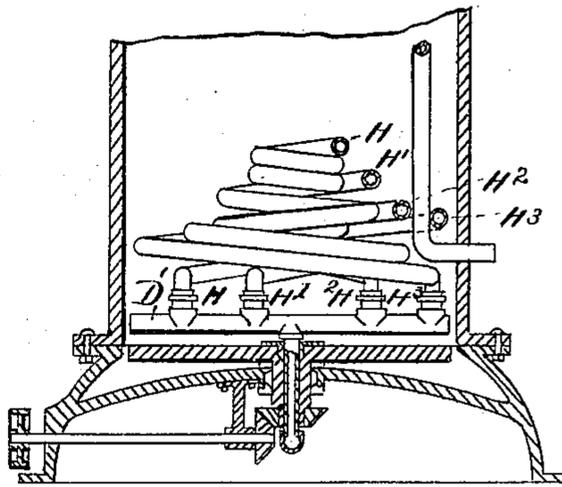


Fig. 3.

WITNESSES

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his atty.

# UNITED STATES PATENT OFFICE.

THOMAS WILLIAM DUFFY, OF BOSTON, MASSACHUSETTS, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE WAINWRIGHT MANUFACTURING COMPANY, OF PORTLAND, MAINE.

## FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 350,300, dated October 5, 1886.

Application filed February 1, 1884. Serial No. 119,535. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS WILLIAM DUFFY, of Boston, in the county of Suffolk and State of Massachusetts, a subject of Her Majesty, Queen Victoria, have invented a new and useful Improvement in Feed-Water Heaters, of which the following is a specification.

My invention relates to that class of apparatus in which heat or cold is to be transmitted to fluids by means of a heat-conducting surface, which separates the fluid to be acted upon from a fluid which acts as the medium of heat or cold. In such apparatus the heating or chilling fluid is often confined in concentric annular chambers closed by rings at both ends, these chambers being held in place by means of tube-plates, through which they each communicate, by means of suitable tubes, with a chamber connected with the source of supply or exhaust, these tube-plates being bolted into and forming a part of the outside casing.

My invention consists, chiefly, in connecting a series of chambers closed at each end, as described, by means of an inlet-pipe at one end and an outlet-pipe at the other, both of suitable diameter, and lying entirely within the casing, and so attached to and supporting this series of chambers, without the addition of the tube-plate, that the series of chambers may be removed without taking the casing to pieces.

It also consists in certain details of construction below described. Such a heater is shown and described in Letters Patent No. 314,003, granted on my application March 17, 1885.

In the drawings is shown at Figure 1 a vertical section of a feed-water heater embodying my invention. Fig. 2 is a cross-section on line  $x x$ , Fig. 1; and Fig. 3 shows a modification. Fig. 4 is a detail of chamber and ring, and Fig. 5 is a plan view of agitator.

A is the casing, provided with an inlet and outlet,  $a a'$ , for water.

B is a series of chambers formed by the cylinders  $b$ , connected in pairs by rings  $b'$ , attached thereto in some suitable way, these rings forming the top and bottom of the chambers. Each of these rings is provided with two coupling-necks,  $b^2$ .

D D' are cross-pipes, each provided with

necks  $d$ , by means of which and the necks  $b^2$  it may be connected with each of the chambers in the series B. The chambers B may be supported in the casing A by means of brackets  $a^2$ , or in any other suitable way.

F is an agitator of the shape shown. It consists of a sleeve,  $f$ , having a number of cross-arms,  $f'$ , projecting from it, so that when rotated the water in the chamber surrounding the cylinders B will be kept in motion, and any impurities kept from settling, so that they will be drawn off with the feed-water which is being heated, and may be separated from such feed-water by a filter or other like means. Such an agitator is particularly necessary where the water contains a carbonate or sulphate of lime, which is insoluble at a high temperature, and hence if drawn off with the water can be separated from it by a filter, and so damage neither the boiler nor the heater. The sleeve  $f$  passes through a stuffing-box,  $f^2$ , and is rotated about the outlet-pipe D<sup>2</sup> by means of suitable gearing and shafting,  $f^3 f^4$ .

D<sup>3</sup> is an inlet-pipe for the steam, connecting with the upper cross pipe, D.

G is an outlet-pipe for the purposes of allowing steam and any gas thrown off by the water to escape. It is intended that the water-level in the heater should be below the mouth of the pipe. This pipe should be so carried out of the heater as to allow the easy removal of the nest of cylinders B.

A heater constructed as above described may be operated as follows: Steam is allowed to circulate through the chambers B, entering by means of the pipes D<sup>3</sup> D, and passing out by means of the pipes D' D<sup>2</sup>. Water will be circulated in the chambers about the cylinder B, and any steam, &c., which may arise from the water may be conducted off by the pipe G or other opening, the circulation of the water being carried on by means of a pump, or in any other suitable way. The agitator F breaks up the water and keeps it in motion, enabling it to circulate better, and preventing any solid particles from settling and forming a deposit on any portion of the heater.

The chief advantage of this construction is in the taking apart of the apparatus for clean-

ing. To do this the top of the casing A is first removed, the joint between D<sup>3</sup> and D being broken. Then the joint D' D<sup>2</sup> is broken and the nest B lifted out of the heater. The nest  
5 is one structure, which may be tested for leaks very easily and simply without breaking a large number of joints. Moreover, in case any cylinder *b* is injured, its place may be readily supplied without taking the whole  
10 structure to pieces.

In Fig. 3 a modification of my invention is shown, in which, instead of concentric annular chambers, a set of four tubes, H H' H<sup>2</sup> H<sup>3</sup>, coiled concentrically, so as to lie one coil with-  
15 in another, as shown, are connected by the cross-pipe D at the bottom, and a corresponding pipe at the top.

The pipe G can be used as well with other forms of heaters as with that shown in the  
20 drawings, its internal diameter depending in any case upon the manner in which the heater is to be used, whether for making steam or otherwise.

Two or more series of chambers like those  
25 above described suitably connected may be used together within a large casing, if desired.

The apparatus above described is adapted for heating water; but it is obvious that with very slight changes it may be used equally well  
30 for condensing.

The cylinders *b* are best made, as shown, of corrugated metal, in order to give a large heating-surface; but plain cylinders are also avail-  
35 able. Their length should of course depend upon the height at which the water-line is expected to be maintained.

What I claim as my invention is—

1. In a heater or like apparatus, a series of concentric annular chambers closed at each end by suitable rings and connected together  
40 at each end, and with a source of supply and exhaust by a cross-pipe, D D', all as set forth.

2. In combination with an apparatus for heating water, consisting of a water-chamber provided with a suitable inlet and outlet, and  
45 suitable means of supplying heat to said water, a special educt connected with said water-heating chambers above the water-line, as set forth.

3. In combination with an apparatus for  
50 heating water, consisting of a water-chamber provided with a suitable inlet and outlet, and the special educt above the water-line, together with suitable means of supplying heat, the agitator F, whereby the mass of water may  
55 be broken and kept in a violent circulation, all as set forth.

4. In an apparatus for heating water, provided with a suitable inlet and outlet, and means for supplying heat, the combination of an  
60 agitator, whereby the mass of water may be broken up, and a special educt above the water-line, whereby any steam or gas thrown off from the water may be conveyed away, all as  
65 set forth.

In testimony whereof I have hereunto subscribed my name this 14th day of November, A. D. 1883.

THOMAS WILLIAM DUFFY.

Witnesses:

J. HENRY TAYLOR,  
GEORGE O. G. COALE.