

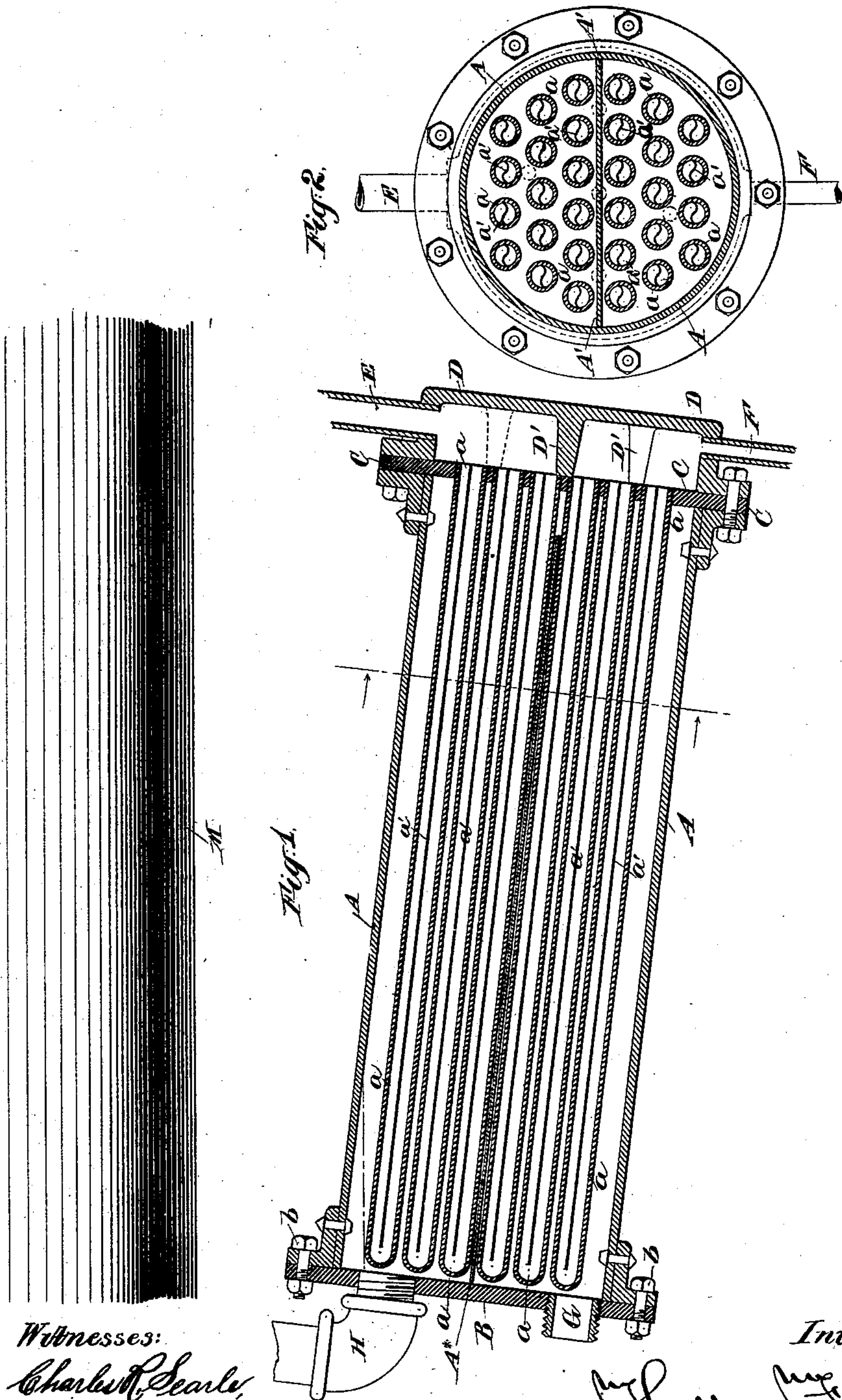
(No Model.)

T. FAIRBANKS.

WATER HEATER.

No. 361,003.

Patented Apr. 12, 1887.



Witnesses:

Charles H. Searle,

Marion Ellison.

Inventor:

Thaddeus Fairbanks  
by his attorney  
Shuman Drew Stetson



# UNITED STATES PATENT OFFICE.

THADDEUS FAIRBANKS, OF ST. JOHNSBURY, VERMONT, ASSIGNOR TO THE  
FEED WATER HEATER COMPANY, OF SAME PLACE.

## WATER-HEATER.

SPECIFICATION forming part of Letters Patent No. 361,003, dated April 12, 1887.

Application filed October 16, 1885. Renewed February 25, 1887. Serial No. 228,905. (No model.)

*To all whom it may concern:*

Be it known that I, THADDEUS FAIRBANKS, of St. Johnsbury, in the county of Caledonia and State of Vermont, have invented certain new and useful Improvements in Water-Heaters; and I do hereby declare that the following is a full and exact description thereof.

I will describe the invention as applied to a locomotive for heating the feed-water, although it may be understood that the same may be applied in other situations—as in steam-navigation and in manufactories, and for heating water for other purposes.

I have discovered that steam will circulate in pipes with closed ends, surrounded by the water to be heated, if the pipes are placed a little inclined and connected with a liberal passage or chamber, through which the steam is discharged. By causing the water on its way from the pump to the boiler to circulate once forward and backward through a properly-inclined cylinder thickly filled with such tubes, and making the connection of the exit-pipe a little below the extreme top, so as to retain a quantity of air to serve as a cushion, I produce a very compact and efficient heater, capable of allowing the discharge of any quantity of exhaust-steam without appreciable back-pressure, efficiently heating any quantity of feed-water, and avoiding all concussions.

The accompanying drawings form a part of this specification, and represent what I consider the best means of carrying out the invention.

Figure 1 is a central vertical longitudinal section, and Fig. 2 a vertical transverse section.

Similar letters of reference indicate corresponding parts in both the figures where they occur.

A is a cylinder, of boiler-iron, mounted in an inclined position under the boiler M; and B, an end plate, secured by removable bolts *b*. A series of pipes, *a*, are tightly and strongly set in a plate, C, bolted or riveted to the opposite end of A. These pipes extend nearly to the opposite end of the cylinder A. A case, D, inclosing a sufficient chamber, is secured by bolts in the position shown, and receives steam through a pipe, E, discharging it with the water of condensation through a pipe, F. Any

required portion of the exhaust-steam from an engine (not represented) may be led in through the pipe E. A trap (not shown) may aid to discharge the water of condensation resulting from the cooling of the steam by the feed-water surrounding the pipes *a*; but I esteem it preferable to discharge a small continuous current of steam.

A partition, A\*, extending from one end nearly to the other, divides the interior of the cylinder A into two parallel chambers or channels, each traversed by the thickly-set tubes *a*. They are connected by a liberal opening. Feed-water under a strong pressure from a feed-pump or injector (not represented) is received through a pipe, G, and, circulating between the pipes *a* on one side of the partition A\*, flows across the partition and back between the pipes *a* on the other side. It flows out through the pipe H, and is admitted into the boiler through an ordinary check-valve. (Not represented.)

A partition, *a'*, is inserted in each pipe *a*, extending nearly the whole length. I find that the exhaust-steam in the casing D is by this arrangement induced to circulate actively in the several pipes *a*, the current of steam moving upward and forward above the partition *a'*, and downward and backward below it.

The partitions *a'* are corrugated longitudinally, so that the cross-section of each presents the form of the letter S. They may be of thin sheet metal of a size to a little more than extend across the interiors of the several pipes *a* in their natural form, and on being forced in will be firmly retained by their elasticity.

The construction may be easily separated for cleaning or repairs.

I attach importance to my provision for supporting the plate C. The pressure of the feed-water is frequently considerably in excess of that of the steam in the boiler, especially at certain points in each stroke when there is no air in the apparatus to relieve the parts from concussion. The plate C is exposed to this strain, and is weakened by the junction of the tubes *a*. I support the plates C by extending a number of spurs inward from the outer casing, B, fitting their ends fairly and firmly against C, as indicated by D'.



I attach importance to the inclined position of the parts and to the provisions in connection therewith for allowing the exhaust-steam to move freely through the chamber D, while  
 5 the partitions  $a'$  in the inclined pipes  $a$  facilitate the circulation of the steam through the pipes without obstructing its flow. The partition  $A^*$  extending nearly the whole length of the casing, and the water-connections being near  
 10 together at the opposite end with the partial partition  $A^*$  standing between them in the casing, insures that the feed-water shall traverse the entire space within the casing and be subjected to the heat of all the tubes.

15 The inclination of the casing and the junction of the water-connection H at a point considerably below the top leaves a space within the casing above the junction of the pipe H, in which air may be retained and serve as an  
 20 air-chamber. This is important in reducing the concussions, particularly when the locomotive is running at a high speed, and the feed is partially shut off so that the pump or pumps deliver intermittently.

25 Modifications may be made in the forms and proportions without departing from the principle or sacrificing the advantages of the invention. The proportion of the height to the diameter may be varied. The number of the

pipes  $a$  may be increased or diminished. Other  
 30 means than those shown may be employed for closing the ends of the cylinder A. It is important to secure strength with tightness and facility of access when required.

I claim as my invention—

1. In a water-heater, the cylinder A and tubes  
 35  $a$ , with their partial partitions  $a'$  inclined, as shown, in combination with the steam-connections E F, freely communicating with each other, and with the tubes  $a$  through the cham-  
 40 ber D, and with water-connections G H, and partial partitions  $A^*$ , all arranged for joint operation, substantially as herein specified.

2. In a feed-water heater, the removable case  
 45 D, having spurs  $D'$ , in combination with the cylinder A, removable tube-plate C, inclined tubes  $a$ , having partitions  $a'$ , steam-connections E F, and water-connections G H, all arranged  
 50 for joint operation, substantially as herein specified.

In testimony whereof I have hereunto set my hand, at St. Johnsbury, Vermont, this 5th day of October, 1885, in the presence of two subscribing witnesses.

THADDEUS FAIRBANKS.

Witnesses:

HENRY FAIRBANKS,  
 ROBERT FAIRBANKS.