G. W. STORER.

Feed-Water Heater.

No. 213,003. Patented Mar. 4, 1879.

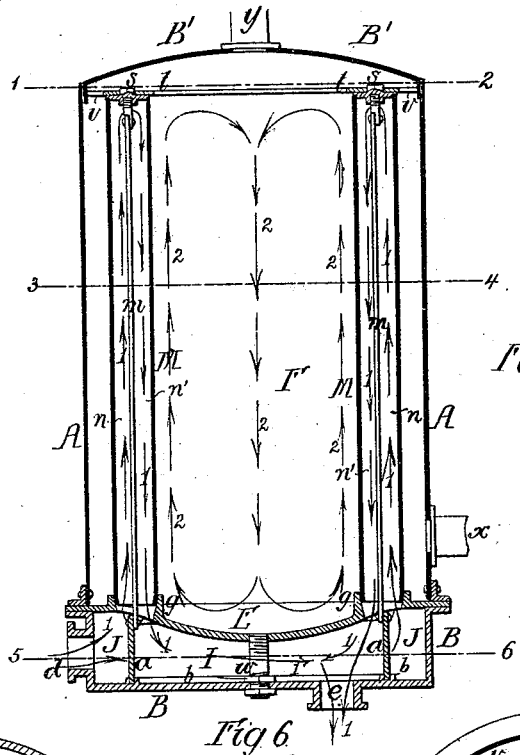

Fig. 1

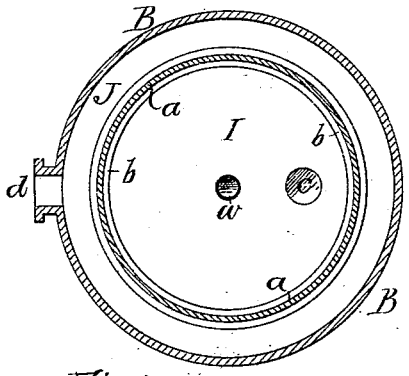

Fig. 4

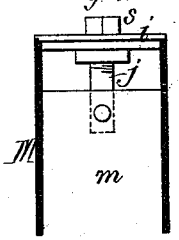

Fig. 6

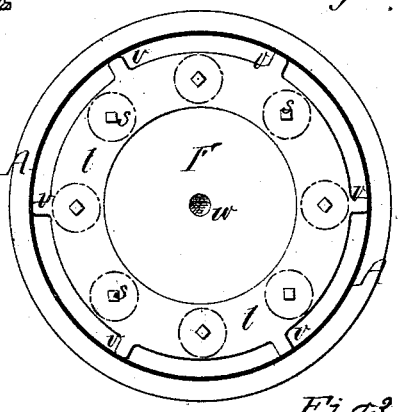

Fig. 2.

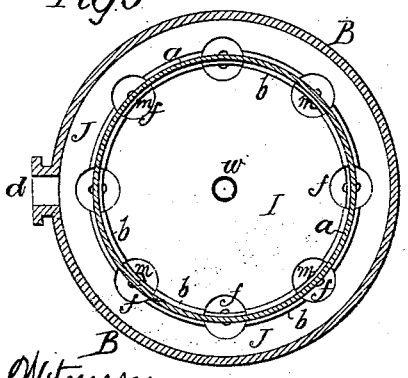

Fig. 5

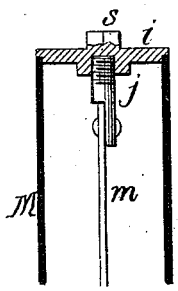

Fig. 7

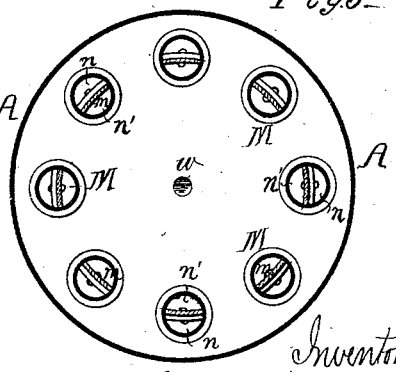

Fig. 3.

Witnesses

Harry Smith

Inventor

George W. Storer

by his Attorneys

Houston and Co

# UNITED STATES PATENT OFFICE.

GEORGE W. STORER, OF PHILADELPHIA, PENNSYLVANIA.

## IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **213,003**, dated March 4, 1879; application filed January 18, 1879.

*To all whom it may concern:*

Be it known that I, GEORGE W. STORER, of Philadelphia, Pennsylvania, have invented a new and useful Improvement in Feed-Water Heaters, of which the following is a specification:

My invention relates to improvements in that class of water-heaters in which the water is caused to circulate in contact with steam-heated tubes; and the main objects of my invention are to insure a thorough circulation of the water in the heater, and to provide a ready means of securing the tubes in place and effecting a circulation of steam within the same, further objects of my invention being general simplicity and economy in construction. These objects I attain in the following manner, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical section of my improved feed-water heater; Figs. 2, 3, and 4, sectional plans on the lines 1 2, 3 4, and 5 6, Fig. 1, respectively; Fig. 5, an inverted plan view on the line 5 6; and Figs. 6 and 7, enlarged views of part of Fig. 1.

A is the body or casing of the heater; B′, the concavo-convex top of the same, and B the hollow base, the casing A and top B′ of the heater being preferably made of wrought-iron plates riveted together, and the base B of cast-iron. E is a dished plate or partition, the edge of which is bolted between a flange on the base B and an angle-iron ring secured to the lower edge of the casing A, the partition serving to separate the chamber F within the casing A from the space within the hollow base B. The latter space is divided into a central chamber, I, and an annular chamber, J, by means of an annular vertical partition, *a*, which fits at the top in grooves in the under side of the partition E and below in grooves in the bottom of the base B.

In the partition E are formed a number of openings, *f*, arranged in a circle near the outer edge of the partition E, and each opening is surrounded on the upper side of the partition by a flange, *g*, the inner face of which is inclined, so as to form a tapering socket for the lower end of a pipe, M. These pipes M extend upward within the casing A to any desired height, and are closed at the top by caps *i*, each of which is rabbeted at the edge, so as to fit snugly to the upper edge of the pipe, the latter being properly trued for this purpose. (See Fig. 6.)

In the under side of each cap *i* is formed a central threaded opening, to which is adapted a screw-stud, *j*, secured to the upper end of the plate *m*, the latter being of the same width as the internal diameter of the tube M, and extending downward to a point below the lower end of the said tube, where it is firmly secured, by riveting or otherwise, to the upper edge of the annular partition *a* in the base.

The plates *m* thus serve not only as a means of insuring the firm clamping of the tubes M between the caps *i* and the tapered sockets *g*, but also as partitions by means of which each tube is divided into two passages, *n n′*, the former communicating at the bottom with the annular chamber J, and the passage *n′* communicating with the central chamber I of the base, and both passages communicating with each other at the upper end above the top of the partition *m*.

Each of the caps *i* has on the top a square projection, *s*, the projections of all of the caps being adapted to openings in a ring, *t*, which rests on the caps, and has lugs *v* bearing against the interior of the casing A, the ring thus serving to prevent lateral vibration of the upper ends of the tubes.

Live or exhaust steam entering the annular chamber J through the branch *d* takes an upward course through the passages *n* in the several tubes M, and descends through the passages *n′*, as shown by the arrows 1, the steam and water of condensation escaping from the chamber I through the branch *e*. If desired, the steam may enter the heater at *e*, traverse the passages of the tubes, and escape through the branch *d*.

Water enters the chamber F within the casing A through a pipe, *x*, and is withdrawn therefrom through a pipe, *y*.

As the heating-tubes M are arranged in a circle near the outer portion of the chamber F, a circulation of the water in said chamber is constantly maintained in the direction of the arrows 2, the water rising at the outer portion of the chamber, where it is directly

heated by the tubes, and descending at the center of the chamber, where no direct heat is applied; hence the water, by its constant circulation in intimate contact with the steam-heated tubes, soon acquires the desired degree of heat.

Sediment is withdrawn from the bottom of the chamber F through the pipe *w* at the center of the base B.

The above-described feed-water heater is composed of comparatively few and simple parts, which can be readily put together, and are not liable to injury by rough handling during transportation.

By maintaining a constant flow of comparatively cold water through the chamber F the device may be adapted for use as a condenser, or the water may be caused to flow through the tube M and the steam passed through the chamber F.

I claim as my invention—

1. The combination, in a feed-water heater, of the base B, having two chambers, I and J, with the casing A and its tubes M, each of the latter having its interior divided into two passages, *n n'*, by a partition, *m*, all substantially as specified.

2. The combination of the casing A, inclosing a chamber, F, with the heating-pipes M, arranged around the outer portion of the chamber, so as to leave a clear space at and near the center of the same, as set forth.

3. The combination of the tubes M and the caps *i* with the plates *m*, having screw-studs *j*, as specified.

4. The combination of the partition E, having tapered sockets *g*, the pipes M, the plates *m*, and the partition *a*, to which said plates are secured, as set forth.

5. The combination of the base B and its partition *a*, the partition E, having openings *f* and tapered sockets *g*, the pipes M, adapted at their lower ends to the sockets, and the plates *m*, secured at their lower ends to the partition *a*, and having at the upper ends screw-stems *j*, adapted to the caps *i* at the tops of the tubes, as set forth.

6. The combination of the casing A, the tube-caps *i*, having projections *s*, and the ring *t*, having lugs *v*, as set forth.

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

GEORGE W. STORER.

Witnesses:
WM. JOHN COOPER,
HARRY SMITH.