

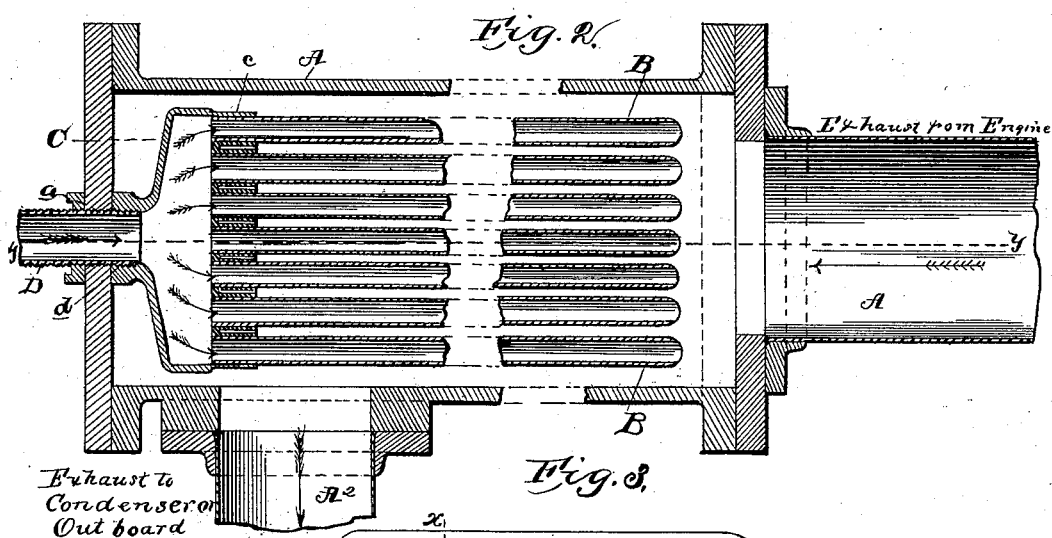
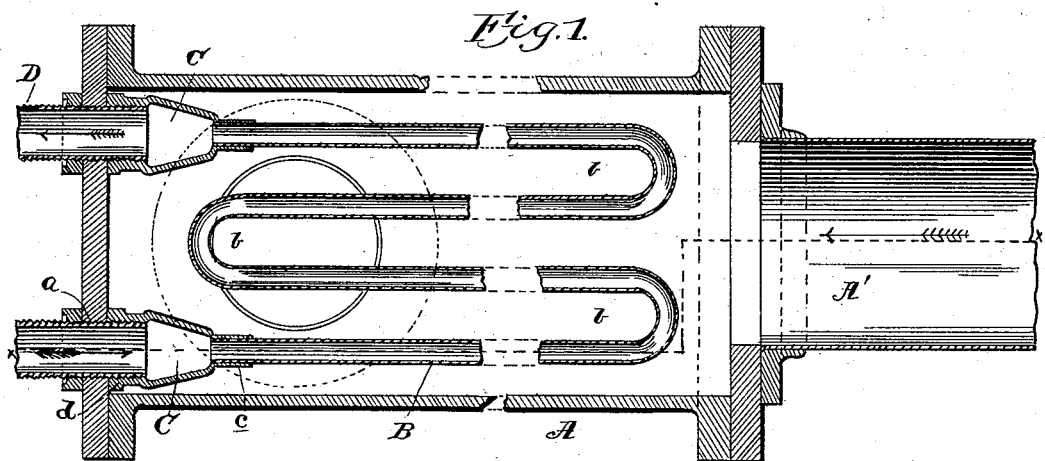
(No Model.)

T. CLARKE & W. S. FLYNN.

FEED WATER HEATER.

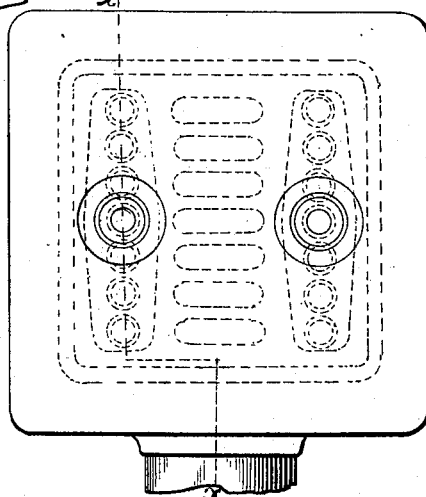
No. 347,228.

Patented Aug. 10, 1886.



Exhaust to  
Condenser  
Out board

*Fig. 3.*



Witnesses  
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# UNITED STATES PATENT OFFICE.

THOMAS CLARKE AND WILLIAM S. FLYNN, OF JERSEY CITY, NEW JERSEY.

## FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 347,228, dated August 10, 1886.

Application filed May 17, 1886. Serial No. 202,441. (No model.)

*To all whom it may concern:*

Be it known that we, THOMAS CLARKE and WILLIAM S. FLYNN, citizens of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Feed-Water Heaters; and we do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to devices for heating feed-water by the utilization of exhaust-steam or other media possessing caloric which would otherwise be spent to no purpose.

It consists in the novel features more particularly referred to hereinafter, and claimed and shown in the annexed drawings, in which—

Figure 1 is a sectional view on the line Y Y of Fig. 2, the middle portion being broken away. Fig. 2 is a sectional view on the lines X X of Figs. 1 and 3, the middle portion being likewise broken away. Fig. 3 is an end view showing the relative positions and outlines of the inclosed parts by dotted lines.

For the sake of illustration, the device is shown having its middle portion broken away; and it consists of a case, A, having an inlet and exit at opposite ends, a series of tubes, each bent in return-folds, and castings forming a common junction for the opposite ends of the series. The case may be of any desired length and any shape, in cross-section, the rectangular form shown being preferred, as it permits the tubes B to be arranged in a series, the one above the other, without any excessive space intervening between the inner walls and the tubes which would allow the heating media to escape before it could part with its caloric. The ports A' A<sup>2</sup> are formed at opposite ends of the case, the one through one end or head, the other through a side near the opposite end, preferably the under side. The one is used as the inlet, the other as the exit. The heating medium, which may be exhaust-steam, waste products of combustion, hot air, &c., in its passage is compelled to traverse the entire length of the case and come

in contact with the tubes, which, by reason of the extended surface, causes it to part with nearly all of its caloric, which is transferred to and raises the temperature of the water passing through the series of tubes. The tubes B are each bent in a series of return-folds, *b*, the ends of which terminate on the same side to enter the rear sides of hollow castings C, located at the end of the case opposite to the port A'. The front of the castings are provided with single openings *d*, which register with corresponding openings, *a*, in the head or end of the case. Pipes D, screwed into the openings *a* and *d*, which are threaded, hold the castings in place and form the ingress and egress of the feed-water. The bore of the tubes is very small, and they are arranged so that a space surrounds each tube on every side throughout their entire length. They form, as it were, numerous branches extending from the castings. The rear sides of the castings have a series of tubular projections *c* cast therewith, into which the ends of the tubes are inserted and secured by brazing, swaging, or other means whereby a tight joint is formed. By reason of the series of return folds formed in the tubes an extended surface is presented, and the contraction and expansion of the tubes will be taken up by the bends or folds, thus relieving the joints from any undue strain. Water entering by one of the pipes D is separated by one of the castings into a number of small streams corresponding with the number of tubes through which it flows, and is again reunited by the other casting, and makes its exit by a solid stream by way of the other pipe, D. During its passage the water is heated, and may be used for feed-water or other desired purpose.

We are aware that a feed-water heater for locomotives has been devised, consisting of a case having within a manifold provided with an inlet, a series of tubes leading from said manifold and terminating in a return-bend, a second like series leading from the return-bend and parallel with the first series, said second series terminating in a second bend, a third series of tubes leading from said second bend and terminating in a third bend and terminating in a second manifold having an exit, said series of tubes alternately extending

in opposite directions, and each tube being substantially parallel with the other.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

The herein shown and described feed-water heater, comprising the following elements in combination: the case provided with an inlet and exit located at opposite ends, two independent hollow castings located within the case at one end, each having a single port on its front side and a series of tubular projections integral therewith on the rear side, pipes passed through the head of the case into the ports of the hollow castings for securing them

in place, and a series of tubes arranged in a pile the one above the other, each tube being bent in a number of return folds, having the limbs of each fold parallel, as shown, and their ends inserted in the tubular projections, by which a tight joint is effected between the tubes and the castings and the tubes are supported, substantially as shown.

In testimony whereof we affix our signatures in presence of two witnesses.

THOMAS CLARKE.

WILLIAM S. FLYNN.

Witnesses:

OTTO CROUSE,

B. J. DOWNER.