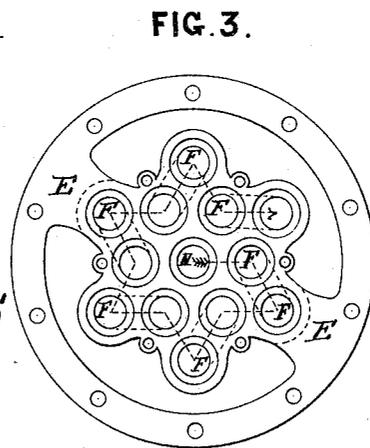
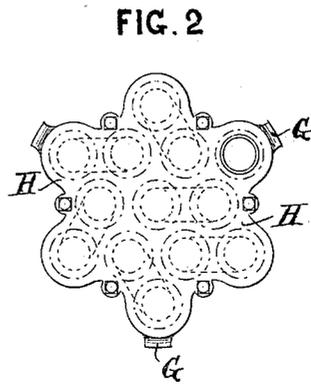
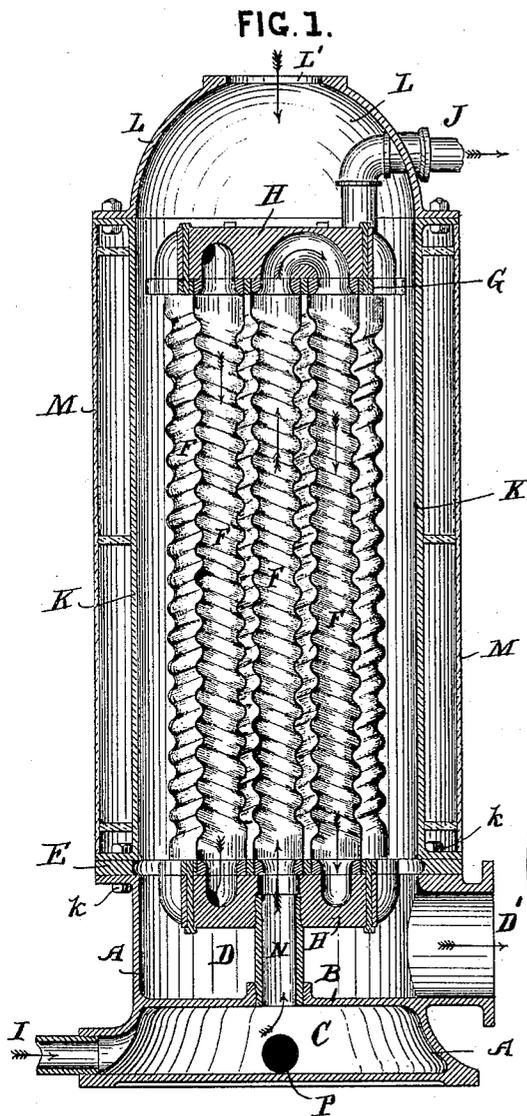


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FEED WATER HEATER.

No. 395,347.

Patented Jan. 1, 1889.



Witnesses.  
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FIG. 4.

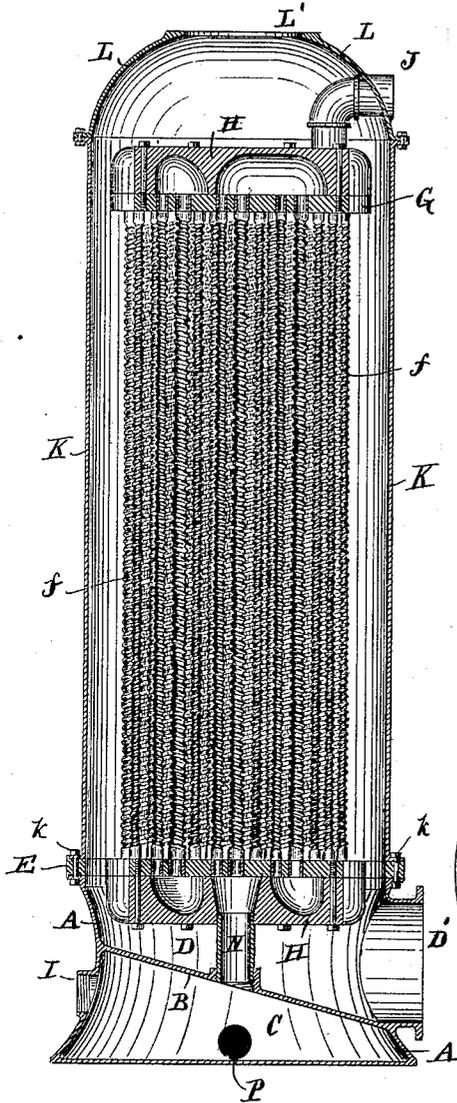


FIG. 5.

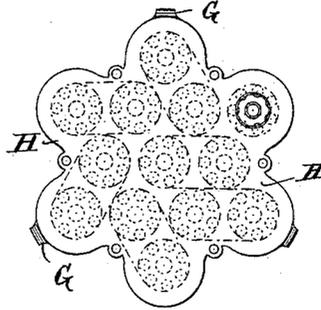
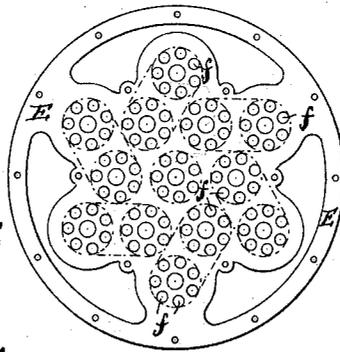


FIG. 6.



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# UNITED STATES PATENT OFFICE.

RONELLO F. PRATT, OF REVERE, AND CHARLES D. WAINWRIGHT, OF MEDFORD, MASSACHUSETTS, ASSIGNORS TO THE WAINWRIGHT MANUFACTURING COMPANY, OF PORTLAND, MAINE.

## FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 395,347, dated January 1, 1889.

Application filed January 12, 1887. Serial No. 224,171. (No model.)

*To all whom it may concern:*

Be it known that we, RONELLO F. PRATT, residing at Revere, county of Suffolk, and CHARLES D. WAINWRIGHT, residing at Medford, in the county of Middlesex, all in the State of Massachusetts, citizens of the United States, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a specification.

Our invention relates to improvements in feed-water heaters whereby they are rendered more efficient and economical than those in common use; and the invention consists of a feed-water heater in which water is supplied at the lower (or it may be at the upper) end and made to pass continuously through a series of vertical spirally-corrugated pipes, all connected together so as to form one continuous passage from the inlet to the outlet by means of core-plates with return-bends cast therein, the exhaust-steam being introduced at the upper (or it may be at the lower) end of the heater, and passing down around the said spiral corrugated tubes, thereby heating the water to a high temperature before it passes off to the boiler. This apparatus may also be employed as a condenser by allowing the steam to pass through the pipes and cold water to circulate around them.

Referring to the accompanying drawings, Figure 1 is a vertical section of a feed-water heater embodying our invention. Fig. 2 is a top view of the upper core and tube-plate. Fig. 3 is a view of the bottom tube-plate and core. Fig. 4 shows a modification of our feed-water heater, and Figs. 5 and 6 are views, respectively, of the upper and lower tube and core plates.

A is a base of cast-iron divided horizontally by a partition, B, so as to form two chambers, C D. Upon the top of this base is placed the base-tube plate E, in which is fitted a series of vertical spirally-corrugated tubes, F, the upper ends of which are secured in the top tube-plate, G. These tubes F are connected with each other by means of core-plates H, having return-bends cast therein, which are bolted to the tube-plates E G, so as to form a continuous passage from the inlet I to the outlet J.

Surrounding the tubes F is a casing, K, of

cast or wrought iron, provided at each end with a flange. The bottom flange, the base tube-plate E, and the base A are all secured together by bolts *k*. The casing K is surmounted by a dome-shaped top, L, secured thereto by bolts passing through the flanges, or in any suitable manner.

The casing K may be surrounded by an outer casing or lagging of wood, M, and the space between the two may be filled with any suitable non-conducting material.

N is a short pipe connecting the chamber C with the return-bend plate H, so as to conduct the water to the center tube of the series. P is the blow-off.

The water enters the chamber C by the inlet I and passes up the pipe N to the series of pipes F, through which it circulates by passing up and down alternately until it arrives at the outlet J, from whence it passes to the boiler.

The exhaust-steam is admitted at L' and passes down around and between the tubes F, containing the water, into the chamber D, from which it escapes at D'; or, if desired, the steam may be admitted at the lower inlet, D', and escape at L'.

By the use of the spirally-corrugated tubes F and the increased circulation obtained by the passage of the water through the different tubes, the water is thoroughly heated, the spirally-corrugated tubes affording the greatest heating-surface in the smallest space, with greatly-increased strength, while the corrugations serve to break up the current of water passing through, thereby gaining the fullest surface benefit.

By the corrugations a uniform longitudinal expansion and contraction of the tubes is obtained without injury to their connections.

Owing to the expansion and contraction of the tubes they are rendered self-cleaning, any scale or sediment which may form on the same being effectually and automatically removed, and the strength of the spirally-corrugated tubing being very great, we are consequently enabled to use thinner metal, thereby greatly increasing the heating efficiency of the tubes.

If it is desired to use the apparatus as a

condenser, the steam is passed through the tubes and cold water caused to circulate around them.

The apparatus may also be used as a super-heater.

Fig. 4 shows a modification of the heater. Instead of the large tubes, as shown in Fig. 1, we employ a series of small tubes, *f f*, arranged in clusters, as shown.

Figs. 5 and 6 correspond with those shown in Figs. 2 and 3.

The small tubes are all spirally corrugated similarly to the larger tubes, *F F*, and each cluster or series is connected to another cluster or series by a casting of return-bends, *H H*, as described with reference to Fig. 1.

The clusters or series of tubes are so arranged that the water will pass up one series and down another, and so continuously through the entire system, as described with reference to Fig. 1.

It will be seen that by the employment of a series of small tubes we are enabled to so divide a large volume of water as to expose it more effectually to the heating-surface, so that a very high degree of temperature will be imparted to water passed through them.

Instead of the spirally-corrugated tubes, plain straight tubes may be employed.

Instead of having the core-plate *H* with return-bends cast therein, the plate may be made with one large aperture, forming a cap into which all the tubes open.

What we claim as our invention is—

1. In the feed-water heater, the base *A*, the tube-plate *E*, resting thereon, the core-plate *H*, bolted to said tube-plate, tubes *F*, tube-plate *G*, core-plate *H*, located thereon, and casing *K L*, in combination with suitable inlets and outlets for water and steam, located substantially as described, and all adapted for the purposes set forth.

2. In combination, a base, *A*, the tube-plate *E*, located thereon, the core-plate *H*, bolted under said tube-plate, tubes *F*, tube-plate *G*, core-plate *H*, located upon said tube-plate, casing *K L*, and the pipe *J*, connected with said tubes *F*, passing through and connected with said casing *K L* and serving to steady the tube-nest *F H H*, the whole provided with suitable inlets and outlets, all substantially as and for the purposes set forth.

3. In a feed-water heater, the base *A*, provided with a chamber, *C* and an exhaust-chamber, *D*, in combination with the casing *K*, dome *L*, and a series of pipes, *F*, connected by core-plates *H H*, having return-bends cast therein, substantially as shown and described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

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CHARLES D. WAINWRIGHT.

Witnesses:

J. H. ADAMS,

E. PLANTA.