F. B. RICE.

FEED-WATER HEATER.

No. 191,471. Patented May 29, 1877.

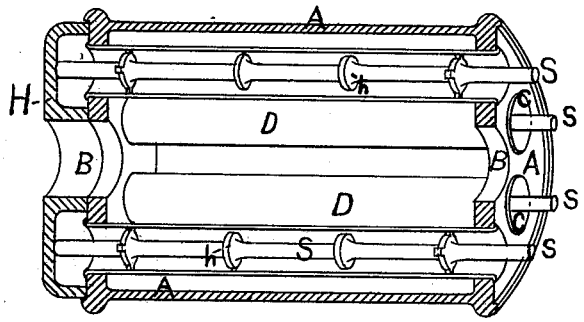

Fig. 1

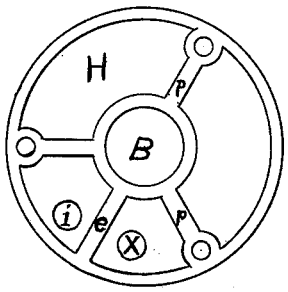

Fig. 2

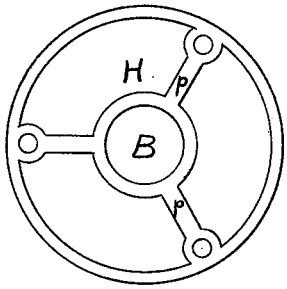

Fig. 3

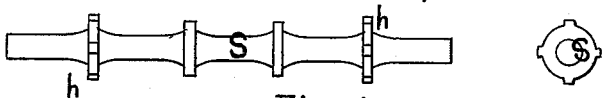

Fig. 4

Witnesses;

S. Hussey

H. G Walton

Inventor;

Fred. B. Rice.

UNITED STATES PATENT OFFICE.

FRED B. RICE, OF DUNKIRK, NEW YORK.

IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **191,471**, dated May 29, 1877; application filed May 3, 1877.

To all whom it may concern:

Be it known that I, FRED B. RICE, of Dunkirk, in the county of Chautauqua, and State of New York, have invented certain new and useful Improvements in Feed-Water Heaters for steam engines, which improvements are fully set forth in the following specification, reference being had to the accompanying drawings.

The object of my improvements is to produce a compact and efficient heater that can be easily attached to, or inserted in, an ordinary exhaust-pipe without the use of elbows, that is cheap to build, not deleteriously affected by the expansion and contraction of its parts, easily drained, neat in appearance, and readily accessible on both sides of the heating-surface for cleaning.

In most heaters for small engines it is a common practice to use ordinary iron pipe screwed into return elbows, by means of which a coil is made, through which the feed-water is forced, and around which the exhaust steam passes. These coils, by reason of numerous turns, cannot be cleaned inside, and are very apt to be destroyed in winter by freezing, on account of not draining properly. Besides the costliness and clumsiness of the old method, another objection is that the common screwed pipe is unnecessarily thick and heavy, making poor heating-surface and needless weight. In heaters using thin tubes riveted into heads the water has a tendency to find a free passage and follows it, instead of passing equally through all the tubes, and it also has a tendency in all heaters to pass through the center of the tubes faster than through the part next to the circumference of the tubes, thereby necessitating longer tubes to heat the water than would be necessary if the flowing water were kept in close contact with the heating-surface, for if the water took its natural course through the center it would have to be heated through a protecting-jacket of comparatively stationary water, which clings to the inside of the tubes.

By reference to the drawings it will be seen how my invention obviates these objections. Figure 1 is a perspective sectional view. Fig. 2 shows the inside of one head. Fig. 3 shows the inside of the opposite head. Fig. 4 shows a spindle enlarged.

The shell A consists of a simple casting. It has thick ends cast in, in the center of which are cast the holes B B for the passage of the exhaust steam. In the annular space surrounding the passage B are drilled the holes C C for a suitable number of tubes. In this case six are shown, but more or less may be used to suit different circumstances. The tubes D D are thin boiler-tubes, expanded and riveted into the ends in the same manner that they are fixed into tubular boilers. The heads H, Figs. 2 and 3, are made from the same pattern, the only difference being that in Fig. 2 it has an additional rib, *e*, for separating the incoming from the outgoing water. The spaces between the ribs or partitions *p* in the heads are arranged to inclose the ends of two tubes each. The heads are attached to the heater in such a way that the ribs of one come across the spaces of the other, no pair of tubes opening into the same space at both ends.

The spindles S S have heads a little smaller than the inside of tubes, the end heads *h h* having small projections that fit the tube for the purpose of keeping the spindle central. The water being introduced at *i*, it will be seen that it must flow successively through every tube until it escapes at *x*, and also that as the spindles S occupy the center of the tubes, the water must flow through the space outside of the heads on the spindles, and cannot lodge in such a way as to prevent the passing current taking up the heat from the tubes in the most advantageous manner. This arrangement of heater permits the use of tubes of such diameter and number that they may be so short that the difference in expansion, due to a variation of temperature between them and the casting A, has no perceptible effect, and does not loosen them as tubes are loosened in many heaters heretofore made.

This heater may be easily scraped and cleaned by removing one of the heads H, the outside of the tubes being scraped through the central opening B, and the inside of the tubes by removing the spindles S S, which leaves them free and accessible.

Having thus described my invention, I would add that I do not claim to be the original inventor of heaters with tubes riveted in, nor of heaters the tubes of which contain a central hinderance to the water; but I claim as my invention—

1. The combination, with the tubes D, of the shell A and heads H, the interior of the heads being divided into spaces by partitions *p*, and attached to shell A in such a manner as to cause the current of water to be reversed every time it passes through a tube, substantially as and for the purposes set forth.

2. The spindles S, with enlargements or heads *h*, and projections on said heads, for the purpose of holding the spindles central, in combination with tubes, substantially as described.

FRED B. RICE.

Witnesses:
S. HUSSEY,
H. G. WATSON.