122. LIQUID HEATERS & VAPORIZERS,
Flue, Vertical, Internal water tube,
Internal fire tube,

WILLIAM H. IVENS.

Improvement in Steam-Generators.

No. 114,146. Patented April 25, 1871.

Fig. 1.

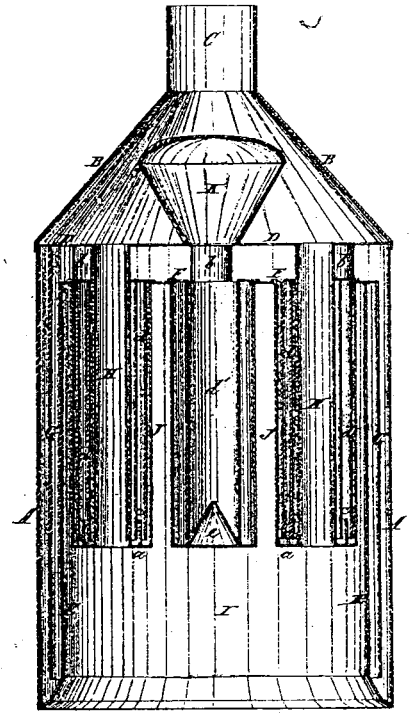

Fig. 2.

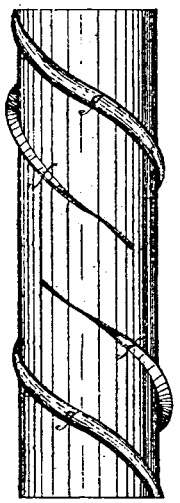

Fig. 3.

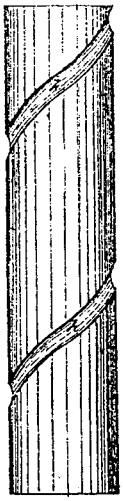

Fig. 4.

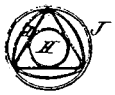

Fig. 6.

Fig. 5.

Witnesses:

Fanny E. Smith

Z. C. Robbins

Inventor:

William H. Ivens

by Attorneys

Brown, Coombs & Co

WILLIAM H. IVENS.

Improvement in Steam-Generators.

No. 114,146. Patented April 25, 1871.

Letters Patent No. 114,146, dated April 25, 1871.

IMPROVEMENT IN STEAM-GENERATORS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, WILLIAM H. IVENS, of Trenton, in Mercer county and State of New Jersey, have invented certain new and useful Improvements in "Steam-Generators;" and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing through letters of reference marked thereon, and in which—

Figure 1 represents a central vertical section of a boiler embracing my improvements;

Figures 2 and 3 show modifications of the circulating-tubes in elevation;

Figure 5 represents a section of the same combined; and

Figures 4 and 6 are modifications of the same in transverse section.

The same letters occurring on the several figures indicate like parts.

The object of my invention is to produce a more perfect circulation of the water in a steam-generator, and thereby prevent the deposit of sediment at or in the parts most exposed to the action of the fire; and it embraces various details of construction, which will be hereinafter fully described.

Referring to the drawing—

A represents the outer case or cylinder of the boiler, which is constructed with a conical upper portion, B, making connection with the smoke-stack C.

At the upper end of the cylinder A, and between it and the cone B, is the upper flue-sheet D.

An inner cylinder, E, is connected at the lower end with the cylinder A, and extends upward to within a few inches of the upper flue-sheet, where it is connected, in a steam-tight manner, with the lower flue-sheet F, leaving an annular water-space between the two cylinders A and E.

Within this annular space is another cylinder, G, which serves to create a circulation, by the heat being applied to the inner side of this water-chamber, in an upwardly direction between it and the inner cylinder E, and downwardly between it and the cylinder A, whereby the deposit of sediment at the bottom of this space is prevented.

Connected with the upper flue-sheet D is a series of tubes, H, extending downward through the lower flue-sheet F and into the fire-chamber I; and around each of these tubes H is a tube, J, of larger diameter, connected with the lower flue-sheet F.

These tubes H and J are then connected at their lower ends by an annular plate, *a*, thus forming a series of annular water-legs, suspended from the two flue-sheets within the fire-chamber I, and in open communication with the water-space F.

Around the exterior of said water-legs the products of combustion pass through the flues *b* into the cone B, and thence to the smoke-stack C, while another current of caloric passes through the interior tubes H to the same exit.

In order to create a circulation of the water in these legs I suspend in each, from the lower flue-sheet, a double tube, *d*, or one tube within another, extending downwardly from said flue-sheet nearly to the annular plate *a*, which closes the bottom of the leg, and to which is attached an upwardly-projecting collar, *c*, which rises a short distance in the leg between the two tubes *d*, so that the heat, being applied to both outer and inner surface of these annular water-legs, will cause an upward current there, while the return current or feeder will be downward between the two suspended tubes *d*, and which current, on reaching the lower end, will be split by the collar *c*, and one portion be caused to take the outer course, while the other takes the inner one, and thus keep up the circulation.

The central water-leg, being immediately under the steam-drum K, has no central flue for the passage of the caloric, but is provided with a single suspended tube, *d'*, to act as a feeder to the upward current at its periphery; and at the lower end of this water-leg is inserted a cone, *e*, which serves to deflect and divide the downward current and present it more evenly around the outer surface of the leg.

Several modifications in the construction of these water-legs may be made, as, for instance, that represented in figs. 2, 3, and 5, in which the outer tube, fig. 2, is represented as having an exterior spiral rib, *g*, or sectional spiral vanes *f*, to fit or come in contact with the interior of the tube J; and the inner tube, fig. 3, has an interior spiral rib, *h*, to close upon the flue H, whereby the direct upward current of the water on either side of the water-leg, owing to the application of more intense heat to one side than to the other, is prevented, and a more perfect absorption of caloric is obtained.

Other modifications are represented in section in figs. 4 and 6, where polygonal divisions are substituted for cylindrical ones to divide the upward from the downward currents.

Another feature of my invention consists in the arrangement of an upwardly-enlarging steam-drum, K, attached to upper flue-sheet and within the upwardly-contracting smoke-chamber B, for the purpose of deflecting the current of the products of combustion in their passage from the fire-chamber I to the stack C, and causing a more even distribution of them through the several flues H and *b*.

What is here claimed as new, and desired to be secured by Letters Patent, is—

1. The combination of the outer tube J, secured

at its upper end in the lower flue-sheet F, and the inner tube H, secured in the upper flue-sheet D, and united at their lower ends, forming a water-leg, substantially as described, with an intermediate feeder, *d*, so that the caloric surrounding the outer tube J and passing through the inner one H will cause an ascending current near each fire-surface and a descending one through said feeder, essentially as specified.

2. The dividing-collar *c*, arranged to extend upward into the feeder-space *d* to divide the descending current, substantially as shown and described.

3. The arrangement of the conical steam-drum K, enlarging toward its upper part within the flue-chamber B, substantially as and for the purpose set forth.

4. The combination of the double polygonal divisions, figs. 4 and 6, with the annular water-legs, substantially as shown and described, for the purpose set forth.

5. The annular feeder-cylinders, provided with spiral wings *f*, or continuous spiral ribs *g h* on their respective external and internal surfaces, whereby the upward currents are caused to rotate within the water-legs around their axes, as and for the purpose specified.

WM. H. IVENS.

Witnesses:
SYDNEY E. SMITH,
W. MORRIS SMITH.