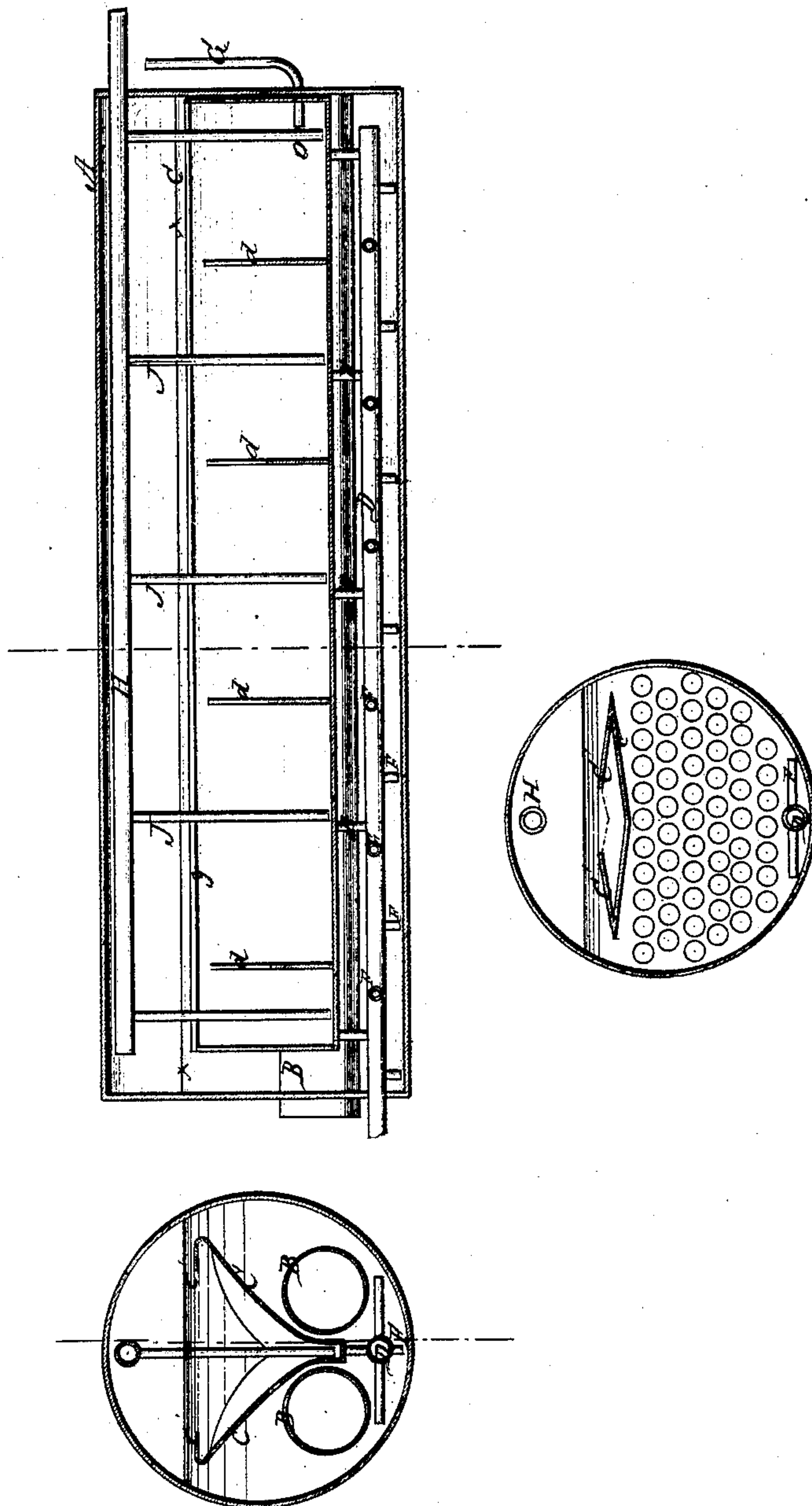


L. S. Ives,

# Steam Generator.

No. 94827.

*Patented Sept. 14. 1869.*



**Witnesses :**

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# United States Patent Office.

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Letters Patent No. 94,827, dated September 14, 1869.

## 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, LEVI S. IVES, of Pittsburg, in the county of Allegheny, and State of Pennsylvania, have invented a new and useful Improvement in Steam-Generators; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

The object of this invention is three-fold, namely:

First, to separate from the feed-water all mineral and organic matter in solution and suspension, thereby preventing incrustation of the boiler;

Second, to heat the feed-water to the same temperature as that in the boiler, before it is thrown upon the heating-surfaces; and

Third, to prevent priming or foaming.

Figure 1 is a longitudinal vertical section of a flue-boiler—flues not shown—with receiving-pan and connecting-pipes.

Figure 2, a cross-section of the same.

Figure 3, a cross-section of a tubular boiler, or locomotive, with the pan and pipes in their proper position.

Similar letters of reference indicate corresponding parts.

A is the shell of the boiler.

B B, the flues.

C is a pan, of galvanized iron, thin boiler-iron, copper, cast-iron, or any metal desired.

C' is a flanch, on the upper edge of the pan C, projecting inward toward the middle of the pan.

d d d d are partitions, placed in the pan crosswise, but not so high as the sides of the pan.

D is a pipe, placed near the bottom of the boiler, running lengthwise, capped at one end, and passing through the boiler-head at the other end; or it may pass out at the side or top of the boiler, if more convenient. A blow-off valve is to be attached to this end, outside of the boiler. The capped end of this pipe may pass through the other boiler-head, to which the feed-pipe may be connected, if preferable.

E E E E E are vertical pipes, connecting the pan C with the blow-off pipe D, at intervals of two, three, or four feet apart, or more.

F F F F are branches of blow-off pipe D, running in any direction from said pipe.

The area of the cross-section of the pipe D should be a trifle greater than the sum of the areas of the pipes E and F leading into it, so as to produce strong currents through E and F when blowing off through pipe D.

G is a feed-pipe, passing through the boiler-head into pan C. It may pass through any part of the shell of the boiler, or either head, most convenient, in either end of the pan C.

The line *x* is the usual water-line.

The line *y* is the top edge of the pan C.

H is a pipe, near the top of the boiler, running lengthwise.

J J J J J are pipes, running down from the pipe H to near the bottom of pan C. In tubular and locomotive boilers, as generally constructed, it is preferable to use them instead of pipes D and E. (See figs. 1 and 2.) They may, in like manner as in tubular boilers, be used instead of pipes D and E, if desirable. Of course, when one set of blow-off pipes is used, the other is unnecessary, except in tubular or locomotive boilers. The pipes D and E may be used to blow off sediment from the bottom, separately from the pipes H and J. (See fig. 3.) This is the proper method of using where it is inconvenient to connect the parts in the manner shown in figs. 1 and 2.

The pan C may be placed nearest the back end of the boiler, and the feed-pipe at the same end, allowing the water, after being freed from its impurities, to flow from the front end of the pan, if such arrangement is preferable.

The operation of the apparatus is as follows, namely:

The feed-water enters the pan at C, and being colder, is specifically heavier than the surrounding water, and, being urged forward by the incoming feed, flows along toward partition *d*, rises over it, and falls to the bottom of the next compartment, leaving a portion of the suspended matter in the first compartment. It rises successively over each partition, and as the water becomes heated, it leaves at first a heavy deposit of mineral, and, gradually less and less, till before it reaches the other end of the pan, it deposits its precipitated matter and sediment in the different compartments, till the feed is heated to the temperature of the surrounding water, which will be the temperature due to the pressure. It will, consequently, deposit in the pan all mineral matter that can be separated by the heat in the boiler at that time, for the greater the degree of heat the water is subjected to, the greater will be the proportion of the minerals in solution that will be precipitated and deposited. And since the feed-water in the pan becomes of the same temperature as the water in any other part of the boiler, it follows that no matter in solution in the feed-water can possibly be precipitated after it leaves the pan, hence the heating-surfaces of the boiler must remain free from incrustation.

The object first in importance, then, in this arrangement, is to receive the water, charged, as it frequently is, with mud, sand, and organic matter, in suspension, and lime, magnesia, and other minerals, in solution, directly into the pan, and retain it there until it becomes as hot as any other water in the boiler, where all foreign matter that the heat in that boiler can precipitate will be separated before it leaves the pan, de-



livering the water to the heating-surfaces free from all scale-producing material.

The object second in importance, is to suspend the pan above all the heating-surfaces, with its upper edges below the usual water-line, but near to it, and let it extend throughout the length and breadth of the boiler, leaving at one end only sufficient room for the water to leave the pan and fall on the parts beneath, and at the sides only space enough to allow the steam to escape from the heating-surfaces to the steam-chamber of the boiler. For if a portion of the sediment or precipitated minerals should escape with the water from the pan, by reason of not remaining long enough in it to subside, before the water holding it in suspension leaves the pan, the rapidly-rising currents caused by the escaping steam will raise such sediment to the surface of the water in the form of scum, and being urged forward by the buoyancy of the steam, and because in the pan no counter-currents agitate the water to oppose its entrance over the sides, it will naturally fall to the bottom of the pan, and remain undisturbed till the blow-off valve is opened, and the contents of the pan will be expelled from the boiler before it has had time to harden into a crust.

The constant flow of water into the pan over the entire length of its sides, aided by the flanged top of the pan C, will press the feed-water forward, and force it to flow lengthwise of the pan, and leave it only at the end opposite to that of its ingress.

The pipe D, and its branches F F F, will carry off

any sediment that is too heavy to be carried up by the steam into the pan, the quantity of which, however, must, in most cases, be small.

The second object, namely, to heat the feed-water before it is thrown upon the heating-surfaces of the boiler, to prevent the strain caused by unequal expansion, is fully accomplished, while the minerals are being separated, as shown when treating of the first subject.

The third object, namely, to prevent priming or foaming, is accomplished in the furnishing, by the pan, of a large surface not agitated by currents, such as cause water in boilers to foam, on which the foam may break down; also, by constantly removing from the water lying upon the heating-surfaces, the matter which is another cause of priming.

Having thus described my invention,

I claim as new, and desire to secure by Letters Patent—

1. The combination, with a steam-boiler, of the pan C, constructed as described, and arranged to receive the feed-water, substantially as specified.

2 The combination, with the boiler and the said pan, of either or both sets of blow-off pipes, D E F or H J, substantially as specified.

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Witnesses:

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