# A. C. Stimers,

## Steam-Boiler Fire-Tube.

No. 43,872. Patented Aug. 16, 1864.



Fig. 1.



Fig. 2.



Fig. 3.

Witnesses.

Geo. Thompson Jr.

Geo. W. Hall

Inventor.

Alban C. Stimers

# UNITED STATES PATENT OFFICE.

ALBAN C. STIMERS, OF CASTLETON, NEW YORK.

## IMPROVEMENT IN MARINE STEAM-BOILERS.

Specification forming part of Letters Patent No. **43,872**, dated August 16, 1864.

*To all whom it may concern:*

Know ye that I, ALBAN C. STIMERS, of the town of Castleton, and county of Richmond and State of New York, have invented certain new and useful Improvements in Steam-Boilers; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the annexed drawings, making part of this specification, in which—

Figures 1, 2, and 3 represent, respectively, the plan, front elevation, and longitudinal section of a boiler which embodies my invention, the right-hand half of the plan and the front elevation, Figs. 1 and 2, being drawn in sections to make the whole more clear.

To enable others skilled in the arts to which my invention appertains to make and use the same, I will proceed to describe its nature, construction, and application.

After a steam-boiler has been put into operation so that the steam is being rapidly generated, about nine-tenths of the heat which passes through the heating-surfaces into the water has an immediate effect in converting water into steam, the remaining one-tenth being required to heat the feed-water to the boiling temperature of the boiler. All parts of the heating surfaces in contact with water are therefore constantly generating steam in their immediate contact, and, to be used and to permit all the surfaces to be efficient, provision must be made to facilitate the immediate rising of the newly-generated steam from the water into the steam-chamber in the upper part of the boiler. Not only should this provision be made for the immediate departure from the generating-surface of the newly-generated steam, but care should be taken to prevent as much as possible the contact of this steam with the heating-surfaces situated above that upon which it was generated, in order that such upper surfaces may be as much as possible in contact with water only, because, whereas water at a boiling-temperature receives heat very readily upon its expansion into steam, and thus, where boiling water only is in contact with the heating surface, maintaining a rapid absorption of the heat through the metal into the water, steam, after its generation, receives heat very slowly, and thus with a given length of flue and rapidity of current of the heated gases through it a larger portion of the heat in these gases passes through into the water when the surfaces are kept free from steam than when they are partially in contact with it, and the greater the proportion of water to steam when, as is always the case practically, both are present, the greater will be the absorption of the heat, other things being equal. Added to this advantage, any increase in the provision for facilitating the egress to the surface of the water of the steam formed on the heating-surfaces in the lower parts of the boiler the less will be the liability to foam, with its attendant evils of breaking down the engines and causing the explosion of the boilers. Again, in horizontal tubular boilers there will of necessity be more steam in contact with the upper tubes than with the lower ones, because in a properly-proportioned boiler there will be, when in full operation, a strong upward current of both steam and water, and as this current passes upward from row to row of tubes, a part of the water being generated into steam as it passes each, the proportion of steam is gradually augmented. In the case, therefore, of the upper tubes, the passage of the heat through the metal is slower than with the lower ones, and, as they are usually of the same length, the temperature of the heated gases at their exit is greater, and, as it is necessary to give the boiler such proportions that the temperature of the gases at their exit through the lower tubes is not too much reduced, it follows that those which pass through the upper ones leave them in the ordinary boilers heretofore in common use at a temperature which is wastefully high.

Now, my invention consists in an arrangement of the tubes in what is commonly known as a "horizontal tubular boiler," such as to attain the objects hereinbefore set forth. This arrangement I will now proceed to describe.

The annexed drawings represent a marine steam-boiler having a single return through tubes situated over the furnaces, this being one of the forms to which my invention is applicable. A A, &c., are the furnaces; B B, &c, the ashpits; C C, &c., the back connections, communicating between the furnaces and the back ends of the tubes; D D, &c., the tubes; E E, &c., the front connections communicating between the front ends of the tubes and the smoke-pipe; F F, &c., the

smoke-pipe. It will be observed that the tubes are arranged in vertical rows, as well as horizontal rows, and that the vertical water-spaces between the tubes *g h*, Fig. 2, gradually increase in breadth from the bottom to the top of the tubes. The object of this is to allow the steam which is generated at *g*, and upon the surface of each successive tube above it, and which adds volume to the upward current of steam and water, which is constantly flowing upward at these parts when the boiler is in operation, to have a constantly-increasing space corresponding, if not exactly, at least in part, with the increasing volume. The results of this are to permit a more quiet disengagement of the steam from the water as it comes to the surface, preventing foaming, and supplying a larger proportion of water to the upper tubes than would be in contact with them in the ordinary tubular boiler, and generating a proportionally larger quantity of steam. This increase in the breadth of the water-spaces between the tubes at the upper part is obtained by placing the tubes in regular vertical rows and making the upper tubes of less diameter than the lower.

In the boilers which I am now having built according to this invention, I make each tube one-eighth of an inch smaller in diameter than the one next below it. If preferred, however, the changes in diameter could each be greater and be less frequent; but I do not consider that such an arrangement would obtain the full benefits of my invention. This diminution of the diameters of the upper tubes without increasing their number causes a greater quantity of the heated gases to pass through the lower tubes as compared with the upper ones. This greater quantity also passes with a greater rapidity, because the tubes are of a greater area with the same length. The benefit which I claim as flowing from these facts is that as the proportion of water in the mixture of water and steam in contact with the tubes is greater at the lower than at the upper tubes, the heat is more rapidly absorbed, and therefore there is more nearly an equality of temperature in the exit of the heated gases from the tubes, it being well known to engineers that in the ordinary tubular boiler the gases flow from the upper tubes at a much higher temperature than they do from the lower.

The improvements which I have thus introduced into the horizontal tubular boiler will bring its economical powers fully up to Martin's vertical water-tube boiler, and have the advantage over the latter that it will foam less and be capable of burning a much larger quantity of coal per square foot of grate when desired, thus enabling the steam-vessels into which it is placed to attain a higher rate of speed than if they were supplied with either the ordinary horizontal fire-tube boiler, or with the vertical water-tube boiler of Martin.

I do not claim to have been the first to have suggested this variation in the diameters of the tubes. It was done by Isherwood in his Engineering Precedents, volume 2, page 175, but with the suggestion of the varying diameters of the tubes were connected recommendations of the proportions and arrangements which he considered necessary to render the novel feature efficient. These were such as to entirely exclude the adoption of his suggestion, so that until I connected this novel feature with suitable proportions and arrangements to make a good boiler none were built, nor, to my knowledge, even a model, drawing, or sketch was ever made embodying the feature until I drew it in August, 1862, from which drawing nine steam-vessels were furnished with boilers. Moreover, boiler-tubes varying in their diameter by eighths of an inch were not manufactured by the tube-makers at the time that this first drawing was made, whereas now the introduction of this boiler by me into twenty-nine iron-clad steam vessels has made those intermediate sizes a marketable commodity.

What I claim as my invention, and for which I desire to secure Letters Patent, is—

So arranging the tubes as to result in regularly increasing the vertical water-spaces between the tubes in what is known as the "horizontal fire-tube boiler" from the lower to the upper part thereof, and furnishing a greater cross-area for the flow of the heated gases through the lower than through the upper tubes, all for the purposes and in the manner substantially as described.

ALBAN C. STIMERS.

Witnesses:
J. B. NONES,
WILLIAM E. SMITH.