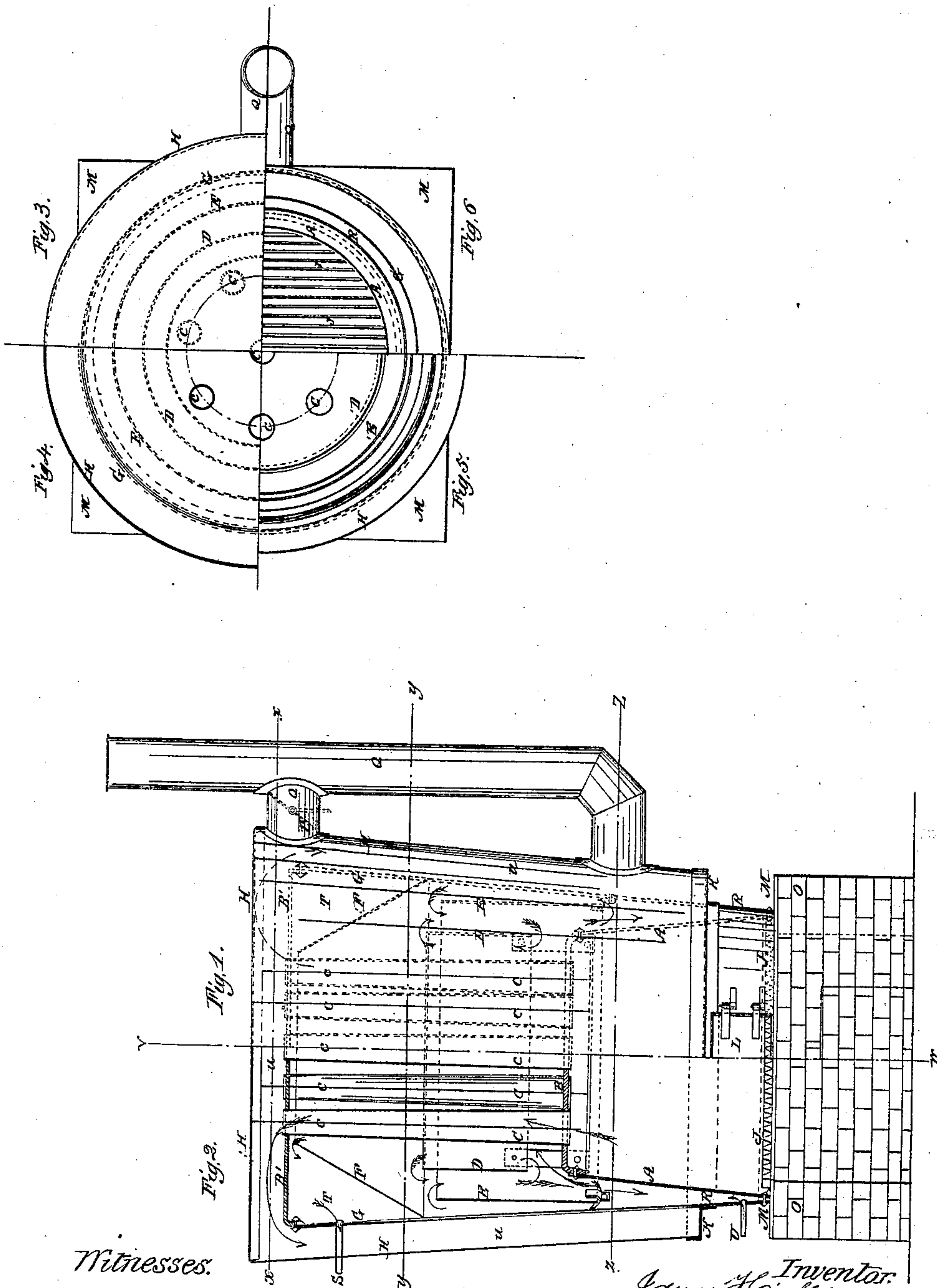


J. M. Hicks,

Steam-Boiler Fire-Tube.

N^o 53,300.

Patented Mar. 20, 1866.



Witnesses:

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UNITED STATES PATENT OFFICE.

JAMES M. HICKS, OF NEW YORK, N. Y.

IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. 53,300, dated March 20, 1866.

To all whom it may concern:

Be it known that I, JAMES M. HICKS, of New York, New York county, in the State of New York, have invented certain new and useful Improvements in Steam-Boilers; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification.

My invention relates more particularly to upright boilers, or that class of boilers in which the tubes are arranged about vertically, and has for its objects to render this class of boilers capable of generating steam more rapidly and in greater quantity with a given supply of fuel, and to produce the steam for use in a drier condition; and to these ends my invention consists in certain novel and peculiar features of construction, which will be hereinafter fully described.

To enable those skilled in the art to make and use my invention, I will proceed to describe the construction and operation of one of my improved steam-boilers, referring by letters to the accompanying drawings, in which—

Figure 1 is a partial front elevation, and Fig. 2 a vertical sectional elevation, of one of my new boilers. Fig. 3 is a partial top view, and Figs. 4, 5, and 6 are partial horizontal sections, taken, respectively, at the lines *xx*, *yy*, and *zz* of Fig. 1.

In the several figures I have designated the same part by the same letter of reference.

A is the fire-chamber of the boiler, which is made of a tapering form and sustained upon suitable masonry O and base-plate M, in the usual manner. J are the grate-bars, and L the fuel-doors.

To the top of the tapering or slightly-conical fire-chamber A is riveted the horizontal lower tube-sheet, B, in which are secured the lower extremities of the vertical flues or tubes C. These tubes are made tapering, being larger at their bottom ends, and have the upper ends secured in the usual manner to the top tube-sheet, B', which is shown as circular, and which is riveted at its circumference to the shell G of the boiler. This shell G is also tapering, being larger at its top than at its bottom part, at which latter part it is secured to the bottom edge of the fire-chamber plate,

so that a space is inclosed or bounded by the fire-chamber plate A, tube-sheets B and B', and shell G, and this inclosed space constitutes the water and steam spaces of the boiler, as will be more clearly explained hereinafter.

H is the outer shell, between which and the inner shell, G B', the heat which passes from the fire-chamber A through flues or tubes C circulates, and from whence the smoke, &c., passes off by the smoke-pipe Q. This smoke-pipe is connected to the boiler near its bottom and also at a point near its top, and in the upper connection is damper P, so that when the fire is started a direct draft may be employed and the products of combustion allowed to pass directly off above the tube-sheet B into the pipe Q, and by closing this damper P after the fire is started the heat be compelled to pass down again, after it escapes from tubes C, around the water-space, and thence into the lower end of pipe Q.

In the upper portion of the boiler is arranged, around the series of tubes C and between them and the shell G, a frustumically-shaped plate, F, the lower and larger circumference or edge of which corresponds in size to the interior of shell G, where it comes in contact with it, and is fitted or closely secured to said shell G, as clearly seen at Fig. 2, and the upper and smaller edge or circumference of which plate F, or funnel, is located at a short distance from the outer set of tubes, C, in such manner that the said plate F forms between its exterior or outer surface and the interior of plates G and H an annular space, T, about triangular in cross-section, as clearly seen at Figs. 1 and 2, and this annular space or chamber T constitutes virtually a drying-chamber, or what would be commonly designated a "superheater" of the steam. From this chamber T the steam is taken through a steam-pipe, S, in the well-known manner.

D and E are two short cylindrical rings arranged within the water-space of the boiler, one around the tubes C, the other between that one and the shell G, and both below the base of the funnel-shaped plate F. The lower edge of ring or thimble D is located a short distance above and over the tube-sheet B, and the lower edge of the other ring, E, is located just below said tube-sheet B and surrounds the plate A

of fire-chamber, and a short distance from it, as clearly seen at Fig. 2. These plates D and E, I may designate "circulating inducing thimbles." Their exact size and shape and precise position may be changed from that shown, and their functions will be presently explained. The boiler may be supplied with water through a feed-pipe, U. (See Fig. 2.)

The operation of my improved boiler may be thus explained: The water-space being filled with water and the fire started in the furnace and fairly going, the damper P is closed and the products of combustion forced to pass up through the flues C, thence down around shell G and between it and shell H, and thence off into the lower part of pipe Q. The level of the water should be kept about just below the bottom edge of funnel or dome F. As the water becomes heated a circulation is induced, in the direction indicated by the red arrows, upward around the tubes C, over the top edge of thimble D, and thence downward between said thimble and thimble E, at the same time the water surrounding thimble E being heated from the flue-space *u* (see Fig. 2) more rapidly than that immediately within said thimble E. Another current of circulation is established upward, outside of plate E, over its top edge, and down again between E and D, as illustrated by red arrows at Fig. 2.

By this arrangement of thimbles D and E it will be seen that the described currents of circulation will be kept up vigorously, and steam consequently be more rapid and economically generated. While at the same time any tendency to foam over the tops of the tubes and into the steam-space is effectually prevented.

The steam generated is all obliged to pass up within the dome F and escape (as illustrated by red arrow, Fig. 2) over the top edge thereof into the annular space T, where it is evident it will be completely dried or superheated.

It will be seen that by the employment of the dome or plate F the steam-chamber T is completely separated from the water-space and that portion of the boiler inside of dome F where steam is generated, so that even if the water rise clear up inside of plate F and around tubes C the steam taken from the boiler will not be wet, as where the water foams into the steam-space, but will be taken from the boiler perfectly dry.

It will be observed that each of the tubes C and also the shell G are made tapering.

The objects of making the tubes C as shown are, first, by having them smaller at top than at bottom the ascending current or volume of heat rising through each from the furnace will impinge to a greater extent on the internal surface of said tube, and consequently a given amount of heat ascending through the tube will heat it to a greater extent than if its

walls were perpendicular, thus increasing the capacity of the boiler to make steam with a given consumption of fuel; second, by having the tubes smaller at top than at bottom the globules formed in the operation of making steam (and which generally cling to and rise in greater numbers close to the tubes than elsewhere) free themselves more readily, their tendency being to rise in perpendicular lines. They do not have to ascend in contact with the external surface of the tubes, but depart from such surface the moment they begin their ascent from any point along the tube where they happen to be formed; and it is clear that from this feature of construction and mode of operation results a more rapid and ready generation of steam close to the tubes than there would be were said tubes perfectly straight.

The same advantage as that just explained arises from the making of the shell G tapering, as shown and described, and also from making the annular plate A of the fire-chamber tapering, as seen.

It is obvious that the different parts of my invention may be employed separately with great advantage, though I deem it most expedient and advantageous to combine them all to make a very desirable upright boiler; and it will be seen that my several features of improvement are subject to various modifications without changing their nature, and that my invention may be carried out in a variety of modes.

In lieu of effecting the peculiar circulation around the tubes resulting from the thimble D, as described, a separate thimble or annular plate may be arranged around each one of the series of tubes, or two or more thimbles may be used, each taking in or surrounding a certain number of said tubes.

The exact proportions and relative positions of the parts shown are not, of course, vital to the carrying out of my invention, though the precise arrangement shown corresponds exactly to full-size boilers which I have built and which are working with great success.

Having fully explained the construction and operation of my improved upright steam-boiler, what I claim as new, and desire to secure by Letters Patent, is—

1. The series of vertical tapering tubes, arranged and operating in the manner specified, for the purpose set forth.

2. The combination, with the tubes and thimble D, of a thimble, E, arranged to operate in the manner and for the purpose set forth.

3. The surrounding division-plate or separator F, or its equivalent, in connection with the tubes and body of a boiler, arranged and operating substantially as and for the purpose set forth.

4. The tapering fire-plate box A, in combination with the tapering boiler-body and fire-space *u*, when the said plate A and body ta-

per in different directions, as hereinbefore described.

5. The combination of the circulation-inducing thimble D with the tubes and separator F, the whole arranged to operate as and for the purpose set forth.

In testimony whereof I have hereunto set

my hand and seal this 15th day of December, 1865.

JAS. M. HICKS. [L. S.]

In presence of—

J. N. MCINTIRE,
W. C. MCINTIRE.