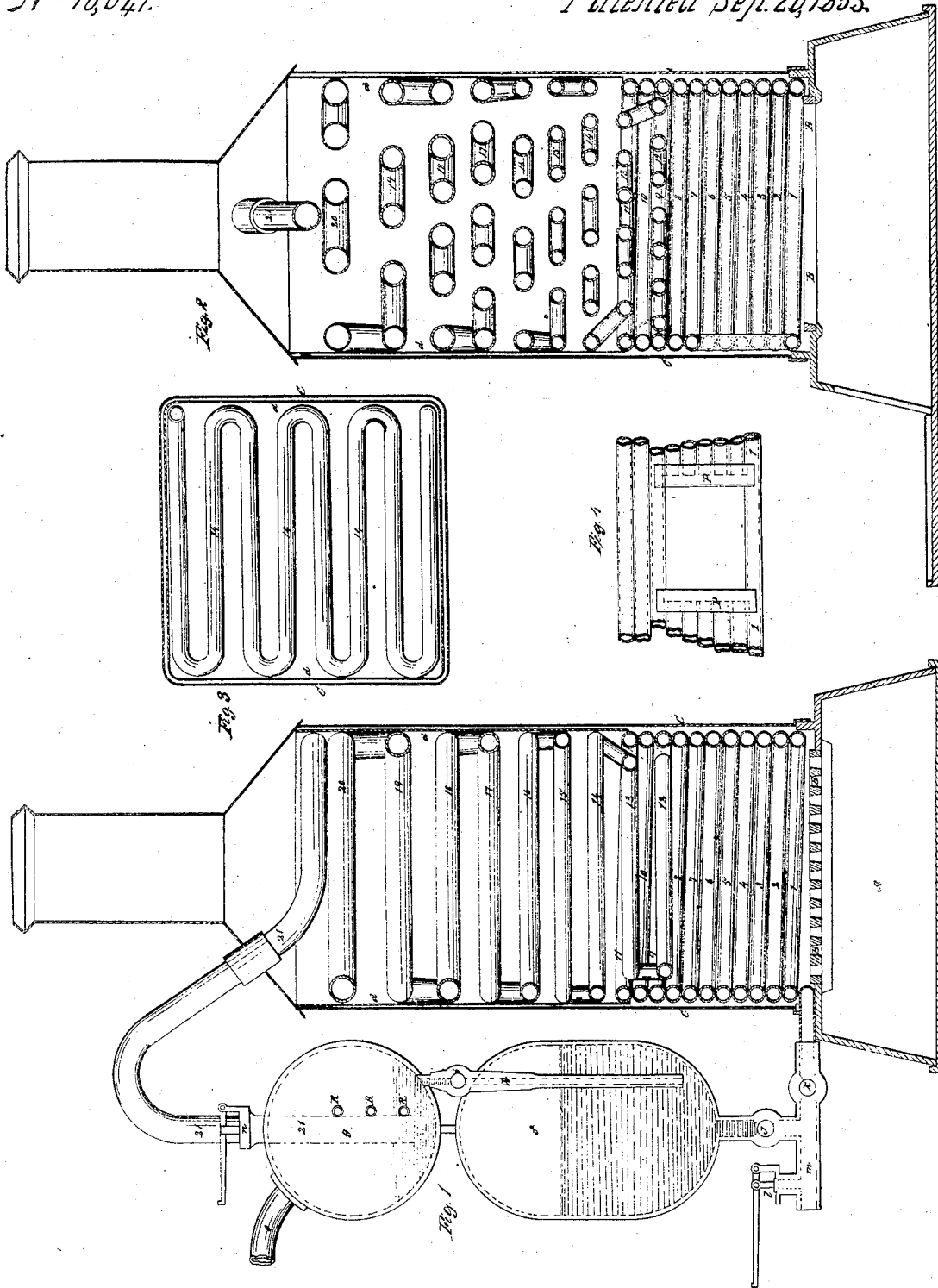


A. Hawk

Steam-Boiler Water-Tube

N<sup>o</sup> 10,041.

Patented Sep. 20, 1853.



# UNITED STATES PATENT OFFICE.

ABEL SHAWK, OF CINCINNATI, OHIO.

## IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. 10,041, dated September 20, 1853.

### *To all whom it may concern:*

Be it known that I, ABEL SHAWK, of Cincinnati, in the county of Hamilton and State of Ohio, have invented a new and useful Improvement in Steam-Generators; and I do hereby declare that the following is a full and exact description thereof.

The nature of my invention consists in a tubular generator which has a forced circulation, and which, while it lines the fire-box and is expanded in its diameter from above the fire-box to its termination, is connected to a steam-chamber or receiver outside of or exterior to it.

First, I form a fire-box or furnace by bending a tube into a rectangular or other form, as may be desired, and bring the bends immediately over each other, repeating the bends until a sufficient height has been obtained to form the fire-chamber or furnace and to protect the jacket or outside covering from the hot flames ascending therefrom. Through the side of this fire-chamber there is a doorway cut to introduce the fuel. The frame of the doorway is made hollow, so that the water may pass through the tube into the frame and circulate freely around it while on its way to supply the generator. To the upper end of this tube I attach the lower end of the generator, (of which it becomes a part,) after bringing it down a sufficient distance within the chamber to make the first section of the generator (which is spread out horizontally) to come within the proper distance of the fire. The sections of the generator are placed horizontally over each other, as it were, in plates occupying the whole breadth of the chamber, the tube rising alternately at the center and circumference of each successive section, as the case may be, a proper distance to give the flame freedom to circulate around and about, between, and upward through the turns, leaving just space enough between the turns of the sections, and placing them the proper distance above each other to allow the flue room necessary to create a good draft. This arrangement is for the purpose of bringing the greatest possible amount of fire-surface in contact with the heat and flame in the least possible space, together with perfect security from danger of explosion.

Second. From the point where the tube of the casing round the fire and the lower end

of the generator are united, the tube of the generator is to be gradually increased in size until it enters the steam-receiver, for the purpose of giving the water forced into it and formed into steam the greatest possible freedom to expand on its way to the steam-receiver with the least possible friction and resistance consistent with the pressure desired. An air-vessel with a stop-cock in the throat is to be placed on the connecting water-pipe, and a cock in the pipe between the air-chamber and the generator; also a safety-valve between the air-chamber and a force-pump placed at the end of the water-supply pipe. This arrangement is to give a steady and constant supply of water to the casing and generator.

By closing the cock in the supply-pipe and opening the one in the throat of the air-chamber, and suspending a weight to the lever of the safety-valve sufficient to give the pressure necessary to supply the generator against any reacting pressure of the steam therein, and then charging the air-vessel with water from the force-pump to the desired pressure, which will be seen by the escape of water at the safety-valve, and closing the cock in the throat of the air-chamber, it will appear that there has been a certain pressure of water locked in the chamber. Now, if the cock in the supply-pipe be opened when we desire to generate steam and open the cock in the air-vessel at the same time we light the fuel in the furnace, we will find the water forced by the pressure in the air-vessel to flow through the casing into the generator, where it comes in contact with the heated surface and is converted into steam. The steam thus produced starts the engine to which it is applied, which gives motion to the force-pump, and is supplying water to the air-vessel long before it is exhausted by the supply from it to the generator. Then by partly closing or opening the cock in the supply-pipe the exact quantity of water may be supplied to the generator to make the amount of steam desired.

The generator above described may be placed vertically, diagonally, or horizontally, or may be made of any shape to suit the place where it may be desired to be placed.

About the year 1820 or 1824 a Mr. Buchanan, of Lexington, Kentucky, invented a steam-generator made of tubing formed into con-

centric spirals, making the turns rise gradually, at the same time converging toward a center, and when near the center causing the turns to diverge, gradually rising somewhat in the shape of an hour-glass, until the desired amount was coiled to give the fire-surface desired. This generator he placed within brick-work or an iron flue, which formed the furnace or fire-chamber. The tube was the same size from the lower to the upper end, and was supplied by water from an ordinary force-pump. Mr. Buchanan called his improvement the "capillary steam-boiler." His model and drawings were destroyed by the burning of the Patent Office.

In 1842 Messrs. Lesh, Lesh, Deardorf, and Beason, of Indiana, invented a steam-generator and patented the same, which was a tube wound round in a spiral form, one turn above the other, and rising between the turns, so as not to touch each other, and entering a steam-chamber above. The tube was of the same diameter from where the water entered to where the steam emerged into the steam-chamber. A branch pipe of smaller diameter than the main pipe may, they say, extend from the lower coil, and after winding round spirally inside the main spiral tube enter the upper coil, where it may be increased in diameter. The diameter of the tube, they say, should generally be the same as that of the column of water forced into it by the pump.

The similarity between Buchanan's plan and Lesh, Lesh, Deardorf, and Beason is very striking. They have neither of them been brought into practical use, notwithstanding Mr. Buchanan's has been invented about thirty-three years, and Lesh, Lesh, Deardorf, and Beason's more than eleven years since patented.

The practical difficulty I have found to be in the shape of the tube in which the steam was generated. The area of the tube being the same (in both cases) from where the water enters to where the steam emerges, must necessarily confine the steam after it is formed to the same diameter of the tube the water occupies after it is forced into the lower end of the tube, thus cramping the steam, caus-

ing friction, and consequently great reaction before it can reach the steam-chamber. This defect I have obviated and triumphantly established the practicability of by enlarging the tube from where the water enters my generator to where it enters the steam-receiver, thereby allowing the increasing diameter to give room for the increased expansion of the water converted into steam to pass through it freely while on its way to the steam-receiver.

A more comprehensive and concise idea will be obtained by reference to the accompanying drawings.

The letters and figures in Figures 1, 2, 3, and 4 have reference to the same parts in the different figures. Fig. 1 is a vertical section showing the manner in which the tubing around the fire-chamber is connected with the generator, a part of the generator being embraced within the casing and the balance above. The figures from 1 to 11 designate the tubing forming the fire-chamber, and the figures from 12 to 21 represent the generator gradually enlarged to the steam-receiver.

A is the ash-pit; B, the grate-bars; C, the outside jacket; D, the inside jacket; e, the chimney; f, the air-vessel; g, the end of the generator; h, blow-off pipe; i, cock in blow-off pipe; J, cock in the throat of the air-vessel; k, cock in the supply-pipe; l, safety-valve on supply-pipe; m, supply-pipe; n, steam safety-valve; O, steam-pipe from steam-receiver; P, door-frame to fire-chamber; R, gage-cocks in steam-chamber.

Having thus fully described the nature of my invention, what I claim therein as new, and desire to secure by Letters Patent, is—

A tubular generator which has a forced circulation, and which, while it lines the fire-box and is expanded in its diameter from above the fire-box to its termination, is connected to a steam chamber or receiver outside of or exterior to it, arranged in the manner herein described.

ABEL SHAWK.

Witnesses:

MARTIN BENSON,  
G. H. GETZENDANNER.