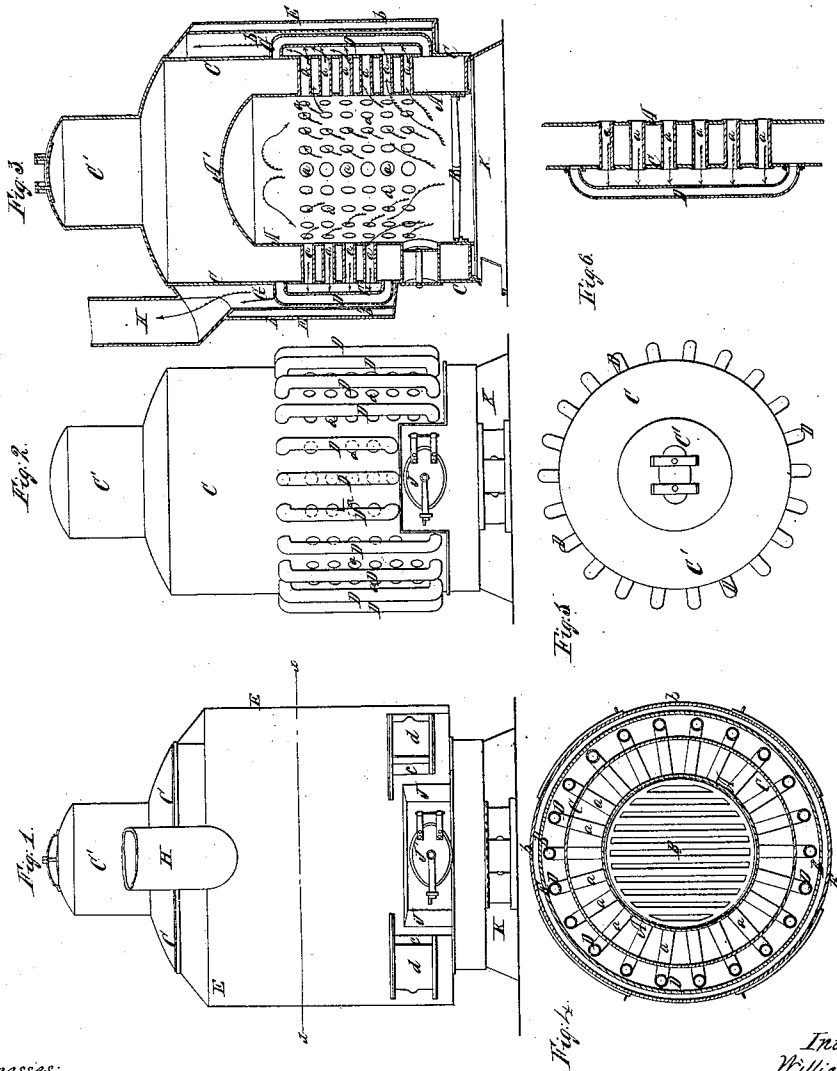


*W. Branagan,
Steam-Boiler Water-Tube.*

Patented July 7, 1868.

N^o 79,544.



Witnesses:
R. J. Campbell
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WILLIAM BRANAGAN, OF BURLINGTON, IOWA.

Letters Patent No. 79,544, dated July 7, 1868.

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 BRANAGAN, of Burlington, in the county of Des Moines, and State of Iowa, have invented certain new and useful Improvements in Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a front external elevation of the improved boiler.

Figure 2 is a similar view of the boiler with its outer casing or jacket removed.

Figure 3 is a diametrical section, taken from front to rear through the boiler and its jacket.

Figure 4 is a section through the boiler, taken in the horizontal plane indicated by red line *x x* in fig. 1.

Figure 5 is a top view of the boiler with outer jacket removed.

Figure 6 is an enlarged sectional view, showing one of the vertical water-pipes and several of the horizontal flues.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates to certain new and useful improvements on tubular upright steam-boilers, whereby provision is made for obtaining in a boiler of a given water-capacity a much larger amount of heating-surface than can be obtained in any steam-boiler with which I am acquainted. Provision is also made for obtaining great economy in fuel, preventing a loss of heat by radiation from the shell of the boiler, preventing the impingement of currents of cool air upon its sides, effecting a complete consumption of the inflammable gaseous products rising in the fire-chamber before they reach the point of exit, and also for utilizing a portion of the heat for warming air, to be used for heating a building in which the boiler is located.

The nature of my invention consists mainly in the application of the two upright cylindrical shells, constituting the principal portion of the boiler, of horizontal flues, which pass radially through the water-space between the said shells, and in the employment, in conjunction with flues thus arranged, of a number of vertical water-tubes, which are applied on the outside of the outer shell, and which communicate with the water-space, said vertical tubes being so arranged with relation to the horizontal flues that the heated products of combustion, after escaping through these flues, shall strike and impinge directly upon the vertical water-tubes, and thus communicate considerable heat to the water therein, as will be hereinafter described.

It also consists in the application, to a tubular upright boiler, having horizontal flues passing through its water-space, of a surrounding double-wall air-jacket, which is so constructed that it forms an external flue-chamber outside of the boiler, and also a non-conducting wall, which will confine the heat around the boiler at the same time that it serves as a means for heating air to be used for warming purposes, without in the least interfering with the draught, as will be hereinafter described.

To enable others skilled in the art to understand my invention, I will describe its construction and operation.

In the accompanying drawings, A represents the internal cylindrical wall or shell of the boiler, which is provided with a grate, B, and a crown-sheet, A', as shown in fig. 3. Surrounding this internal shell is the external shell C, which extends above the crown-sheet A', and is capped by the steam-dome C'. These two shells constitute the boiler proper, and they should be properly secured together and braced, so as to afford the greatest possible strength.

Through the two shells A C, a great number of holes are made, of suitable size and proper distance apart to receive through them the flue-tubes *a a a*. These flue-tubes should be arranged in or nearly in horizontal planes, and in lines radiating from the centre of the boiler, as shown in figs. 3 and 4; and it is desirable to have the tubes arranged, one above another, in or nearly in vertical lines, as shown in figs. 2 and 3, for a purpose which will be hereinafter explained. These horizontal flues *a a a* may be secured in their places in any of the well-known modes for securing flue-tubes to boiler-plates.

To the outer side of the outer shell C of the boiler, and arranged in vertical lines around this shell C, are a number of tubes, D D, which have their ends bent, as shown in figs 2, 3, and 6, so that their upright portions

will stand out from the shell C short distances, and thus allow the products of combustion to escape freely through the flues *a*. These vertical tubes D are arranged directly opposite the several vertical rows of flues *a*, and are secured to the boiler-shell C in any suitable manner, that is, by an elbow and nipple, and screwed into the boiler, so that they can be removed at pleasure, when desired to clean or repair the boiler. The lower ends of the tubes D communicate with the water-space below the flues *a*, and the upper ends of these tubes D communicate with the water-space above the highest range of flues *a*.

Surrounding the outer shell of the boiler is a double-wall jacket, E, which consists of two separated walls, *b b'*, having a space between them, for the circulation of air. This jacket is set off from the shell C, so as to leave a space, G, around it, with an outlet at H, for the escape of the unconsumed products of combustion.

Openings, *c c*, are made through the outer plate *b* of the jacket E, for the purpose of taking out the ashes that accumulate between the jacket and shell of the boiler, and for checking the steam when it gets too high. which openings are provided with suitable valves, *d d*, for regulating the size of said openings, and, when desired, for entirely closing them, at a suitable point near the top of the jacket E. Inlets for cold air, and outlets for conducting away the hot air from this jacket, for warming purposes, are formed in this jacket, as illustrated. An opening, J, is made through the jacket E near its bottom, which affords access to the fire-door opening J'. The base K, upon which the boiler is mounted, affords an ash-pit below the grate B, and also a support for the boiler.

When fire is made in the fire-chamber, within the inner shell A, the heated products of combustion will rise toward the dome A, and pass outward through all of the radial flues *a a* into the flue-space G, between the outer jacket E and the boiler-shell C. The products thence rise and pass off through the chimney H, as indicated by the arrows in fig. 3. After escaping through the short radial flues *a*, the products of combustion will impinge upon the vertical water-tubes D, and subject these tubes and the water in them to considerable heat, which would without them be carried off and wasted.

It will be seen that the boiler is subjected to heat on both sides, that is to say, the water will surround the fire-chamber, and the heated products, after leaving this chamber, will pass through numerous tubes through the water-space, and then surround the water and lower steam-spaces of the boiler.

I not only greatly increase the fire-surface of the boiler by the use of the outside water-pipes D, as described, but by having these pipes located directly opposite the flue-tubes, they will so far obstruct the outward escape of the heated products of combustion through said flues as to effect a most complete combustion of the inflammable products.

It will also be seen that I provide for preventing the escape of heat from around the boiler by the use of an air-jacket, which forms a non-conducting wall, which latter I make serve another purpose, namely, that of a heating-chamber for air to be used for warming the building in which the boiler is erected.

It will also be seen that the flue and water-tubes are so completely enveloped by the heat that they are not liable to injurious expansion and contraction, and that the radial flue-tubes *a a* can be made so very short that they will not be liable to choke with soot, consequently they will not require frequent cleaning. The great number of radial tubes leading from the fire-chamber will insure an excellent draught and perfect combustion.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The fire-chamber A, terminating in a gas-chamber, A', and with a curved top plate, in combination with the horizontal flues *a a*, and with the bent or angular water-pipes D, and with the outer case or water-jacket C, the said pipes D being inserted into the jacket by horizontal branches at points below the gas-chamber and below the first horizontal flue *a*, and the several parts being constructed and arranged together, substantially as described.

2. The angular water-pipes D, arranged directly in line with the flues *a a*, and inserted into the outer case or jacket C, and applied in the space G all around the case C and below the crown-sheet A' of the fire-box or chamber, all substantially in the manner and for the purpose described.

3. A double-wall air-heating jacket, E, applied to a steam-boiler, substantially as and for the purposes described.

WILLIAM BRANAGAN.

Witnesses:

WILLIAM GARRETT,
HENRY H. SCOTT.