

(No Model.)

C. AHRENS.
VERTICAL FLUE BOILER.

No. 519,013.

Patented May 1, 1894.

Fig. 1.

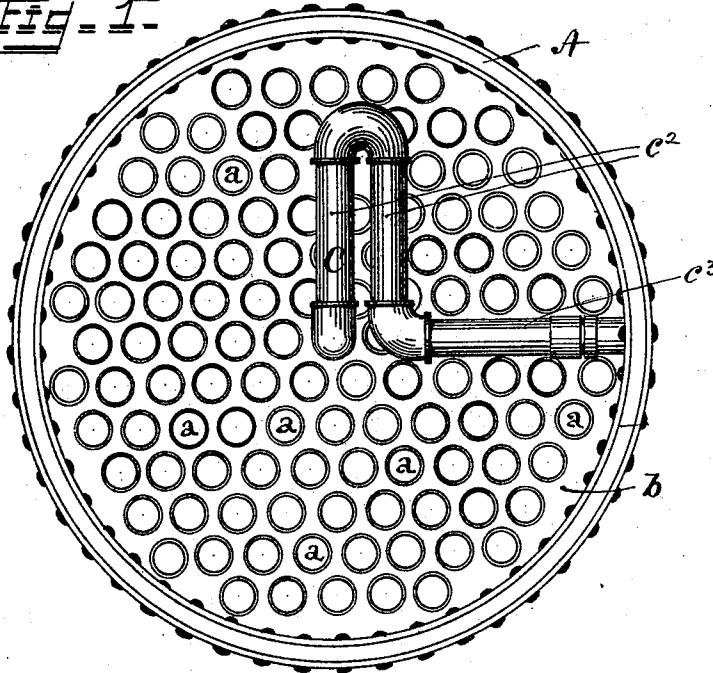


Fig. 2.

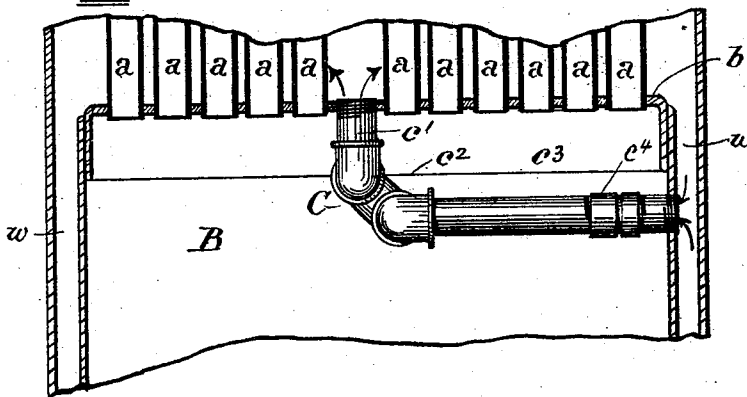
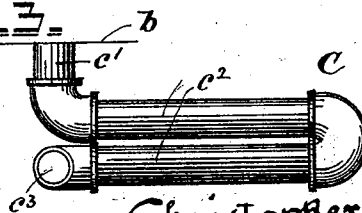


Fig. 3.



Witnesses:
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UNITED STATES PATENT OFFICE.

CHRISTOPHER AHRENS, OF CINCINNATI, OHIO, ASSIGNOR TO THE AMERICAN FIRE ENGINE COMPANY, OF SAME PLACE, AND SENECA FALLS, NEW YORK.

VERTICAL-FLUE BOILER.

SPECIFICATION forming part of Letters Patent No. 519,013, dated May 1, 1894.

Application filed July 8, 1893. Serial No. 479,872. (No model.)

To all whom it may concern:

Be it known that I, CHRISTOPHER AHRENS, a citizen of the United States, residing at Cincinnati, Ohio, have invented new and useful
5 Improvements in Vertical - Flue Boilers, of which the following is a specification.

My invention relates to vertical tubular boilers of the type in which a central fire-box is embraced within the outer shell, with vertical flues opening through the crown sheet of the fire-box and the top or head of the boiler. In such boilers, especially those in which the number of flues opening through the crown-sheet is large in proportion to its area,—being
10 therefore set close together and crowding the water space,—the intense heat concentrated at the crown-sheet tends to drive the water away from the same. At the same time, the forest of flues opening through and extending
20 above such crown-sheet leaves insufficient circulating space for the water to return from the outer and cooler parts of the boiler to supply the place of that driven away; inasmuch as the supply is necessarily compelled
25 to pass inward through the contracted space between the heated tubes and over the highly heated crown-sheet. In boilers so constructed, priming, and the burning-out of crown-sheet and flue-ends, are the dangerous and inevitable results of heavy firing. As a remedy
30 for this condition, circulation pipes have been introduced in the fire box, connecting the crown-sheet and the water-leg,—usually curved tubes or a system of radially arranged
35 tubes concentrated at a central vertical connection entering the crown sheet. Such constructions are, however, found to be inefficient by reason of the great expansion caused by the intense heat to which they are exposed,
40 and subsequent contraction by cooling, which soon destroys the efficiency of the joints; these defects being aggravated in some cases by the contact of the tubes themselves with the incandescent fuel of the fire-box, which
45 injures the metal of the tubes. Moreover, such constructions are expensive and difficult to repair, in that the forms of the connection-tubes are special and require great skill, and nicety of fit, and also because they can only
50 be inserted by taking the boiler itself apart—all of which causes delay and incidental expenses.

My improvement presents a complete remedy for these difficulties: and consists in a circulating-pipe-connection which may be contained in the fire-box wholly above the fuel
55 upon the grate, and embodies a horizontal "return bend" connected at one free end by an elbow and vertical pipe with the crown-sheet, and at the other by an elbow and horizontal pipe with the water-leg. The construction is entirely made up of straight sections
60 of pipe with "elbows" and a "U-bend," secured in the usual manner, and screw-threaded into the boiler shell. The construction thus presents the terminal boiler-connections in
65 each case at right angles to the intervening return-bend; so that the terminal and indeed all the joints are entirely relieved of the ill effects of expansion and contraction; and also one made up of materials easily obtainable in the market and adapted to be cut,
70 fitted, and put together, without special skill, and applied without taking the boiler apart or removing it from its foundations. In preferred form, as hereinafter shown, the horizontal connection to the water leg is a tube in
75 two parts, abutted end to end, and secured by an ordinary screw collar: but this may be a single tube oppositely threaded at the ends—
80 alternative constructions common in the art. My invention is illustrated in the accompanying drawings, in which—

Figure 1, is an under plan of a vertical flue boiler to which my invention is applied. Fig. 85 2, is a partial axial section showing my improvement in front elevation: and Fig. 3, is a detail side elevation of my improvement.

Referring now to the drawings:—A, designates a vertical boiler of the common fire-box type, having flues, *a*, for the passage of combustion-products through the water-space of the boiler overlying the crown-sheet, *b*. As the flues, *a*, constitute the principal variable element of the heating surface, the steaming
90 capacity of the boiler is in proportion to their number; and in boilers designed for quick and abundant generation of steam, the number of such flues is increased as much as practicable, while the diameter of the boiler
100 is enlarged to increase the grate surface. These conditions, as will readily be seen, tend to impede the free circulation of water over the crown-sheet, *b*, of the fire-box, B, owing

to the closely-set forest of flues, *a*, having only narrow spaces between them. The location of the crown-sheet, *b*, at the top of the fire-box, B, directly over the incandescent fuel upon the grate, naturally subjects it to the most intense heat, especially at the central portions. Here, then, are presented two opposite and interfering conditions, namely: concentration of heat at the central portions of the crown-sheet demanding the freest access of water thereto: and (second) a forest of tubes around and between which the water, to cover the crown-sheet, must necessarily pass,—obstructed not only by the presence of the tubes, but also by the intense heat transmitted to the water passing between them. To remedy these conditions, I omit the central one or more of the flues, *a*; and, in the crown-sheet opening at that point, I attach one end of a water-tube connection, C, extending thence through the combustion-chamber of the fire-box, B, to the water leg, *w*, of the boiler. The tube, C, thus forms a free and unobstructed water-connection between the part of the interior surface of the crown-sheet exposed to greatest heat and the outer and relatively coolest portion of the boiler. The demand for increased water-circulation over the crown-sheet is therefore freely supplied at the point where most needed.

In constructing the connection, C, I first insert in the crown-sheet, *b*, a nipple, *c'*, to which, at right angles, is attached a "return bend," *c''*, placed in an inclined position as shown in Fig 2, to facilitate the upward movement of water. At the free end of the "return bend," the connection pipe, *c'''*, is attached, at right angles, and thence enters the vertical shell of the fire-box, B. The connection pipe *c'''* may be a single pipe-section oppositely threaded at its ends and inserted in correspondingly threaded apertures, or it may be composed of two abutting sections of pipe connected by a screw-threaded collar *c''''*—both constructions

being commonly used in the art and making detachable joints. It will be readily seen that the expansion of the connection tubes is accommodated by the natural elasticity of the metal disposed in long right-angled connections, without straining the joints at the crown-sheet or the water leg: while at the same time, additional heating surface is offered, and the rapidity of the flow through the connection, C, increased thereby.

If desired, an additional number of connections, C, may be employed according to the dimensions of the boiler, reaching the central portion of the crown-sheet and connecting thence to opposite radial portions of the water leg.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. In a fire-box steam-boiler, one or more circulating tubes consisting of straight sections of tubing united by curved elbow-connections to present a vertical entrance into the crown sheet and a horizontal entrance into the water-leg, with an intervening horizontal return bend placed at an angle to the horizontal connection, substantially as set forth.

2. In a fire-box steam boiler, a circulating pipe consisting essentially of two horizontal parallel pipe-sections united at one end by a U-coupling to form a "return bend," one end of said return bend being connected by an elbow vertically to the center of the crown sheet, and the other end by an elbow and detachable pipe-section horizontally to the water-leg, substantially as set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHRISTOPHER AHRENS.

Witnesses:

L. M. HOSEA,
L. C. HOSEA.