(No Model.) 3 Sheets—Sheet 1.

C. L. SEABURY.

STEAM BOILER.

No. 497,432. Patented May 16, 1893.

Fig. 1.

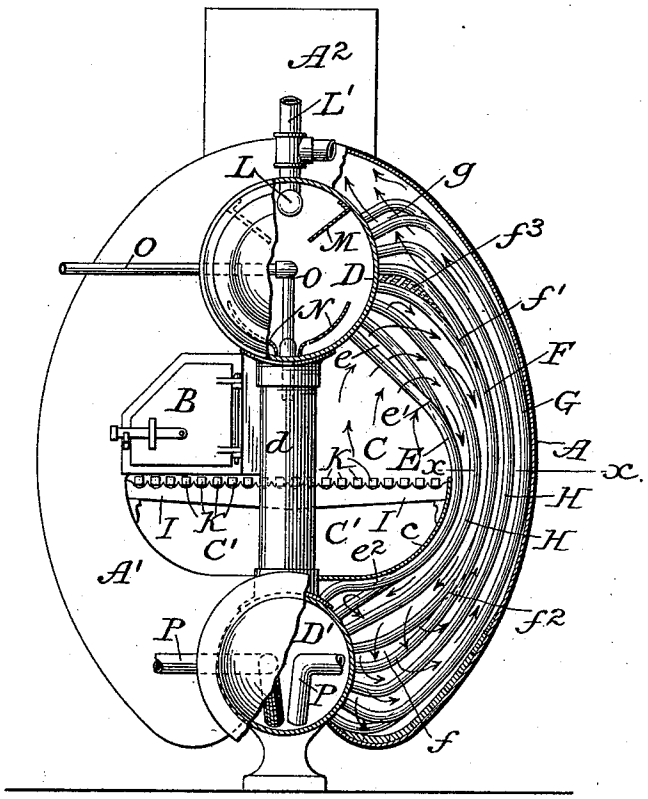
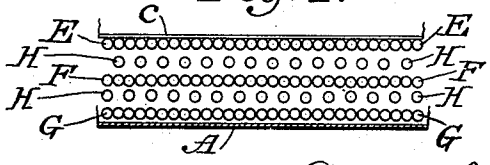


Fig. 2.



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A. Stidder

(No Model.)

3 Sheets—Sheet 2.

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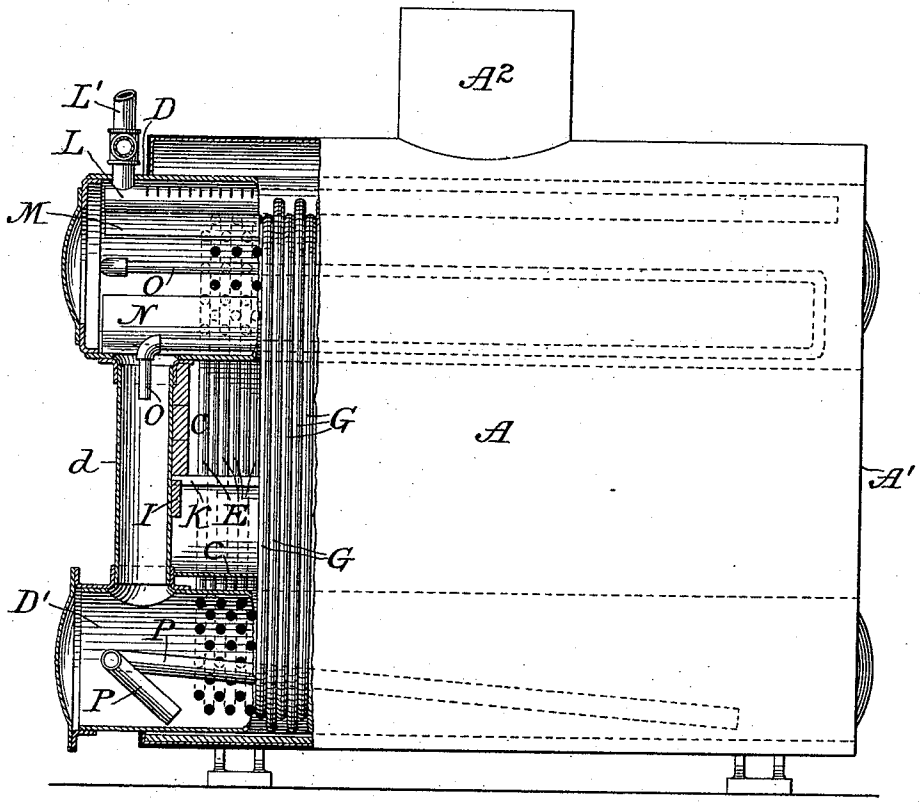
Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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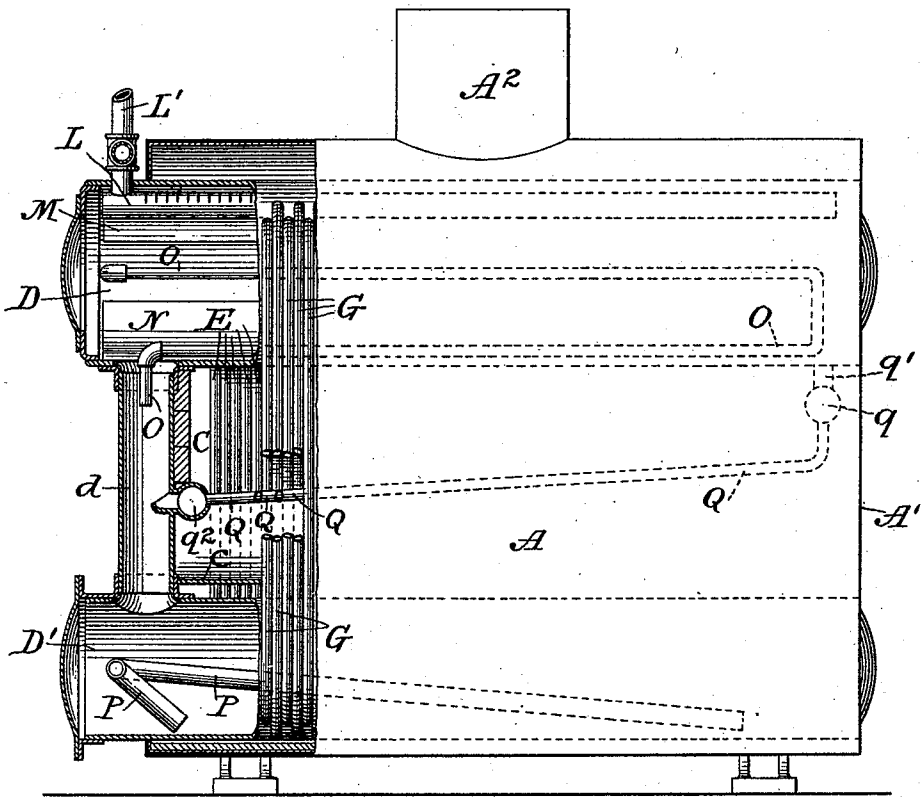
Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES LINCOLN SEABURY, OF NYACK, NEW YORK.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 497,432, dated May 16, 1893.

Application filed June 8, 1892. Serial No. 435,948. (No model.)

To all whom it may concern:

Be it known that I, CHARLES LINCOLN SEABURY, of Nyack, in the county of Rockland and 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, and to the letters of reference marked thereon, making a part of this specification.

My invention relates to the general class of water-tube steam-boilers in which the water is caused to circulate through small tubes between upper and lower drums, and the objects of my invention are to effect a very rapid circulation of the water in the boiler and to cause the absorption by the water of a very large proportion of the quantity of heat developed by the consumption of the fuel. For the former purpose that portion of the circulatory system through which the water descends from the upper drum to the lower drum is placed outside of the shell of the boiler so that the water therein shall be cooled slightly and thereby descend the more rapidly, while for the latter purpose the boiler is so constructed that the combustion chamber or fire-box is completely inclosed by the water-tubes, and that the heated gases are compelled to travel back and forth among the water-tubes and to pass first on one side and then on the other of each series of tubes and so remain in contact therewith for a long time.

In the drawings: Figure 1 is a front view, partly in elevation and partly in transverse section, of one form of my improved boiler. Fig. 2 is a diagrammatic section of a part of the boiler on the line x—x of Fig. 1, illustrating the arrangement of the tubes. Fig. 3 is a side view of the same, partly in elevation and partly in longitudinal section. Fig. 4 is a view similar to Fig. 3 showing a different form of the boiler.

The shell A, of suitable shape to inclose the tubes, has front and rear end plates A′, A′. The front end plate is provided with doors B (one of which is shown in Fig. 1) through which access may be had to the fire-box or furnace C. Near the top and bottom of the shell are supported the upper and lower drums D and D′, which are centrally and longitudinally disposed, and project far enough through the front plate A′ to permit the water-leg d, which connects them, to stand outside the shell. Within the shell the two drums are connected by many water-tubes which are so arranged as to form the walls of flues through which the products of combustion must pass on their way to the stack A^2. As shown in Figs. 1, 3 and 4, the first series of tubes E, on each side of the middle line, are united to the drums D and D′ in a staggered or zig-zag line, not only to avoid weakening the drums but to leave spaces between their upper portions, as at e. They are so bent as to stand in the same curved plane from a point somewhat below their upper ends, as at e', to a point e^2 near their lower ends, and as they are in contact laterally from the point e' to the point e^2, they form a deflecting wall. The second series of tubes F are similarly connected to the drums and are similarly bent to stand in the same curved plane and laterally in contact between the points f' and f^2, leaving open spaces f between their lower portions. The spaces between their upper portions are filled with asbestus or other similar material to constitute a baffle plate f^3. A solid deflecting wall is thus formed from the upper drum to the point f^2.

If desired, another series of tubes G may be similarly connected to the drums outside of the tubes F, the open spaces g being left between their upper portions. Also, if desired, separate tubes H may be placed between the several series. The fire-box or furnace C is thus wholly contained between the two drums and the two series of pipes E, E, so that whatever heat is radiated, even from the ash-pit C′, may be absorbed, in whole or in part, by the water in the circulatory system. A plate c forms the bottom of the ash-pit and supports the transverse bars I on which rest the grate-bars K.

It will be observed that the cross-section of the boiler with its shell is substantially circular or oval and that the tubes of the several rows are bent to stand substantially parallel with the curved shell. This form and arrangement I have found to be productive of good results both as regards economy and effectiveness of fuel and as regards the strains

upon the boiler due to the contraction and expansion of the tubes.

Within the drum D is supported a pipe L, preferably perforated on its upper side to receive the steam and deliver it to the main L'. Baffle plates M, M, are secured to the interior of the drum D above the highest point at which any of the water tubes is connected to the drum, to deflect the water rising through the tubes from the steam chamber which is formed between the plates. Other deflecting or baffle plates N, N, are secured near the lowest line of the drum D to insure a proper circulation of the water within the drum. The feed-water tube O is preferably introduced into the front end of the drum D and is led back and forth therein with its discharge end directed downwardly into the water-leg *d*.

Blow-off pipes P, P, may be suitably located in the lower drum D'.

In the operation of this form of my improved boiler the products of combustion pass from the combustion chamber C through the spaces *e* between the upper portions of the first series of pipes E and thence downwardly between the walls formed by the pipes E and F, through the spaces *f* between the lower portions of the pipes F and upwardly outside of the pipes F. If still another set of pipes G is placed outside of the pipes F the products of combustion pass through the spaces *g* between the upper portions of the pipes G into the space between the drum D and the tube of the shell A and thence into the stack. If additional tubes H are employed the products of combustion circulate freely about them in their passage through the flues described. The amount of boiler surface thus exposed to the heated gases is not only very large, but by the disposition of the tubes close together to form walls or deflecting plates the said gases are caused to circulate in every part of the boiler and to remain in contact with water bearing tubes for a very long time, thus giving up to the water in the boiler a very large proportion of their heat. Furthermore, as the combustion chamber is wholly surrounded and inclosed by water-bearing tubes there is no waste of radiated heat even from the ash-pit.

Many variations may be made in the general arrangement of the boiler without departing from the spirit of my invention; thus in Fig. 4 I have shown the grate itself as composed of water-tubes Q which are connected at their rear ends to a transverse head *q*, from which connection is made from the drum D through a water-leg *q'*, the head *q* and the water-leg *q'* being shown in dotted lines in Fig. 4. At their front ends the tubes Q are connected to a transverse head q^2 which is itself directly connected to the external water-leg *d*. The water-grate is thus formed thus in a circulatory system and is connected thereto at such a point as to receive the coolest water in the boiler.

I claim as my invention—

1. In a steam-boiler, the combination with an inclosing shell, of two drums longitudinally disposed in the space inclosed by said shell and one above the other, water-tubes connected to said drums on both sides, the combustion chamber being wholly inclosed between said drums and said tubes, a water-leg connecting said drums, a transverse head at the rear end of said combustion chamber and connected to the upper drum, a second transverse head at the forward end of said chamber and connected to said water-leg, and a series of tubes connecting said transverse heads and constituting a grate in said chamber, substantially as shown and described.

2. In a steam-boiler, the combination with an inclosing shell, of two drums longitudinally disposed in the space inclosed by said shell and one above the other, and several series of tubes connecting said drums, the tubes of each series being connected to the drums in staggered or zig-zag lines and bent to stand laterally in contact for a portion of their length, the said several series of tubes thereby forming several walls or deflecting plates to compel the circulation of the heated gases throughout the space inclosed by said shell, and the spaces between the ends of each series of tubes being closed alternately at the top and bottom to compel the heated gases to pass first on one side and then on the other of each series of tubes substantially as shown and described.

3. In a steam-boiler, the combination with an inclosing shell, of two drums disposed one above the other, a series of tubes connected to said drums in staggered or zig-zag lines and bent to stand laterally in contact for a portion of their length, the spaces between the upper portions of said tubes being left open, a second series of tubes outside of the first, similarly connected to said drums and similarly bent to stand laterally in contact for a portion of their length, the spaces between their upper portions being closed by a baffle-plate while the spaces between their lower portions are left open, substantially as shown and described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES LINCOLN SEABURY.

Witnesses:
A. N. JESBERA,
A. WIDDER.