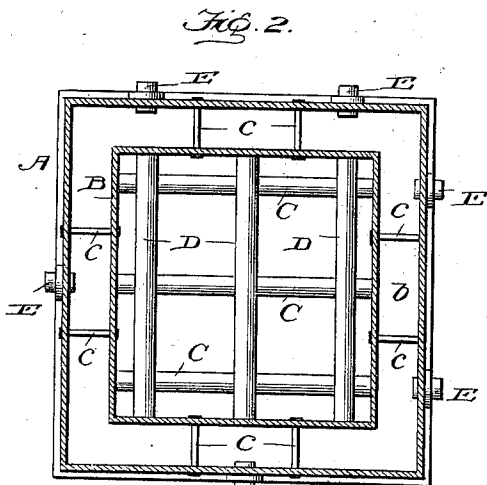
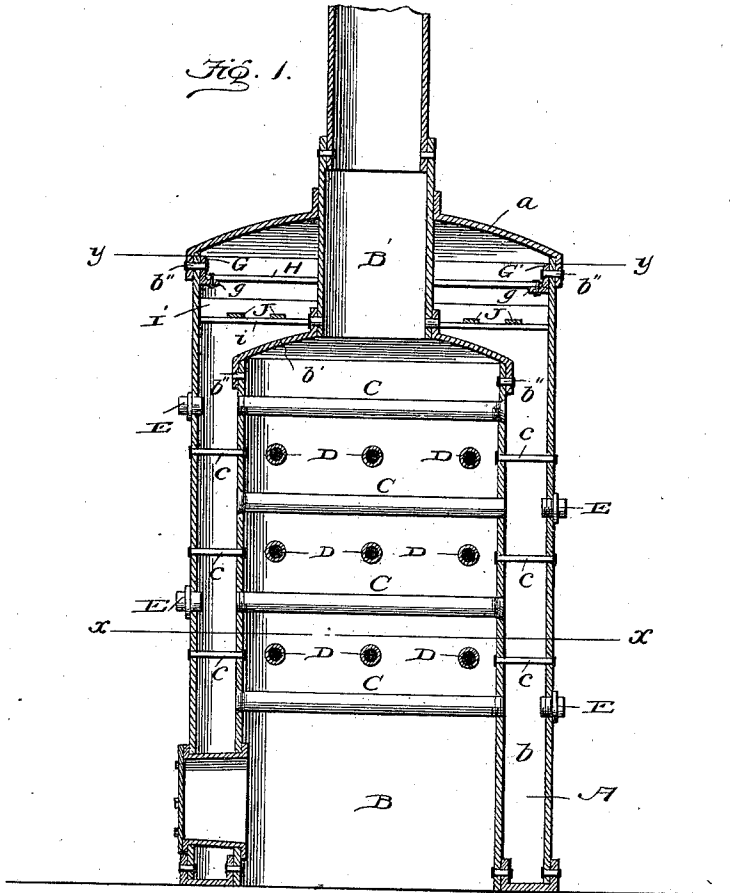


(No Model.)

G. COOK.
WATER TUBE BOILER.

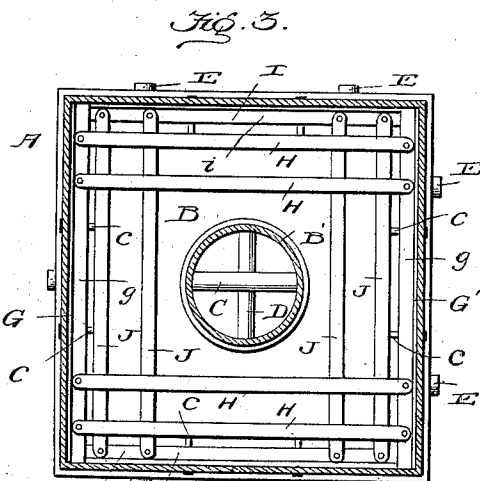
No. 566,500.

Patented Aug. 25, 1896.



Witnesses:

Wm. C. Endicott.
J. H. Northshead.



i E I - George Cook -
Inventor

-By- Edsall Bros. Attys.

UNITED STATES PATENT OFFICE.

GEORGE COOK, OF SYRACUSE, NEW YORK.

WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 566,500, dated August 25, 1896.

Application filed February 25, 1896. Serial No. 580,659. (No model.)

To all whom it may concern:

Be it known that I, GEORGE COOK, a citizen of the United States, residing at Syracuse, in the county of Onondaga and State of New York, have invented certain new and useful Improvements in Water-Tube Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in water-tube boilers in which the tubes and the cleaning-plugs are arranged in the inner and outer shells in a manner to permit ready access to the tubes for the purpose of removing either of them at will and for cleaning said tubes of sediment which may accumulate therein. I arranged the removable plugs in a manner to prevent weakening the outer plate or shell of the boiler, thus preserving the stiffness and rigidity of the shell. My boiler is thoroughly braced and strengthened by having its inner and outer shells united by a number of stay-bolts, and the top part of the boiler or the steam-space thereof is thoroughly braced and strengthened by a novel form of bracing or stiffening means.

To the accomplishment of these ends my invention consists in the novel combination and construction of parts, which will be hereinafter fully described and claimed.

To enable others to understand my invention, I have illustrated the preferred embodiment thereof in the accompanying drawings, in which—

Figure 1 is a vertical sectional elevation of a water-tube boiler embodying my improvements. Fig. 2 is a horizontal transverse sectional view thereof on the plane indicated by the dotted line *xx* of Fig. 1. Fig. 3 is a similar horizontal and transverse sectional view on the plane indicated by the dotted line *yy* of Fig. 1.

Like letters of reference denote corresponding parts in all the figures of the drawings.

A designates the outer shell of my improved boiler, and B is the inner shell of the same. As shown in the accompanying drawings, my invention is illustrated as adapted or embodied in a vertical boiler, in which the shells A B are arranged in vertical positions and

the two series of tubes C D are arranged in horizontal positions, but this relative arrangement of the shells and tubes may be reversed in the embodiment of my invention in a horizontal boiler. The external shell A is built up or made of sheets in the usual way well known to those skilled in the manufacture of water-tube boilers, and at its upper end it has a crowning-plate or cap *a*, which is flanged and riveted to the shell A in the usual way. The external shell is provided with the usual door and other appurtenances proper to be supplied to boilers, but which I have not deemed necessary to illustrate in the drawings because they are well known to manufacturers and others skilled in the production and use of boilers for engines, &c. The inner shell B is arranged within the shell A, parallel to the same or concentric therewith. The two shells A B may be made of square or rectangular form, as indicated by the drawings. This inner shell B is united at its lower end to the shell A, so as to produce the water-space between the two shells, (indicated at *b* in the drawings,) and the upper end of the inner shell is closed by means of a head or crown sheet *b'*, which is flanged and riveted to the shell B in the usual or any preferred way. The two shells A B are held in their proper positions by a large number of stay-bolts *c*, which unite the vertical walls of the shells as shown, and the top or crown sheets *a b'* of said shells are united by the stay-bolts *b''*, whereby a strong, durable, and simple structure is provided.

The series of tubes C are arranged in alternation with and at right angles to the other series of tubes D, and these two series of tubes C D extend practically or nearly the height of the inner shell B. The two series of tubes are spaced at proper intervals from each other to provide spaces for the passage of the smoke and products of combustion, which are free to circulate around and in contact with the tubes and the inner shell B, and the smoke and products of combustion escape from the shell B through the exit-pipe B', which extends across the steam-space of the shell A and through the crown-sheet *a* of the shell A, this exit-pipe B' leading to a suitable source of discharge for the smoke, &c.

The tubes C D are secured in the flue-

sheets formed by the walls of the shell B in any suitable manner. As, for instance, one end of each tube may be threaded to screw into a threaded aperture provided in one side of the shell, while the other end of said tube may be expanded or flanged to have a tight joint with the opposite side of the shell; or, if desired, both ends of each tube may be expanded, by a suitable tube-expander, to have tight joints with opposite walls of the shell B.

In connection with a boiler of the construction specified I have provided the plugs E, which are arranged in line with the tubes C D, for the purpose of having access to said tubes to enable them to be removed or cleaned; and these plugs E are disposed in the outer shell A in a novel manner to prevent weakening of the shell A and to retain the stiffness thereof, whereby the outer shell is made stronger and more durable than in other types of boilers in which a very large number of removable plugs are used, and which are disposed indiscriminately in the outer shell without regard to the preservation of the strength and stiffness thereof. As illustrative of the plan adopted by me for retaining the stiffness of the shell A, reference will be made to the example illustrated by Fig. 2. By reference to this figure it will be seen that the row of tubes C consists of three tubes arranged parallel to each other and in the same horizontal plane. On one side of the boiler-shell A, I have provided two of the plugs E, which are in line with the two outside tubes, while on the opposite side of the boiler I provide a single plug E, which is in line with the central tube of the row of three tubes. It will be seen that the two plugs on one side of the boiler in the horizontal plane of a set of three tubes C are arranged some distance from each other to avoid any material weakening of the shell A, while on the opposite side of the shell the plug E in line with the central tube of the series of three tubes and in the same plane with the other plugs devoted to the same set of tubes simply requires a single puncture or opening in the shell A on the plane of the set of tubes C and of the two other plugs. This disposition of the plugs in the shell A enables me to avoid weakening the shell A on any of its sides in line with the set of tubes. Of course I do not confine myself to the use of any particular number of tubes in each series of tubes C or D, as the number may be increased or diminished, according to the capacity and power required to be generated by my boiler; but in case the number of tubes is increased, the plugs E are spaced and arranged in a manner to secure an unequal distribution and comparatively wide separation of all the plugs devoted to each series of the tubes employed in the boiler.

My construction and arrangement of the tubes and plugs enables me to have access to any one or more of the tubes simply by removing the proper plug in line with the tube

which it is desired to remove or clean. Any tube in the boiler can be easily taken out and replaced by a new tube when the old tube becomes leaky or has become deteriorated to such an extent as to impair its efficiency. It will be noted that I do not employ two plugs to each tube, as such arrangement and grouping of the plugs with reference to a single tube is thought to be superfluous and tends to weaken the outer shell A; and I prefer in my boiler to have the end of the tube most remote from its plug threaded into the side of the shell B, while the end of the tube nearest to the plug is flanged and expanded into tight engagement with the shell B, whereby the tube may be readily taken out and replaced. The steam-dome of the boiler is, of course, subjected to great pressure from the accumulated steam in the boiler, and to make this dome very strong, so as to effectually resist the steam-pressure and prevent the head or crown-sheet *a* from blowing out, I have adopted a novel system of braces and struts for the steam-dome. To the inner side or face of two walls of the shell A, and in the upper part of the dome, I securely fasten the angle irons or bars G G', the vertical flanges of which are preferably riveted to the walls of the shell A, while the horizontal flanges of said angle-irons form seats *g* for the ends of the transverse struts or braces H, which are secured to the flanges *g* by rivets or in any other suitable way. Below these flanged bars G G' and the braces H, I provide another set of angle-irons I I' and braces or struts J, which extend at right angles to the angle-bars and the braces, respectively, previously described. These lower angle-bars I I' are riveted or otherwise fastened to the opposite walls of the shell A to which the bars G G' are not fastened, and the horizontal flanges of the bars I I' form the seats *i*, to which the ends of the braces or struts J are riveted or otherwise securely attached. This construction and bracing very materially strengthens and stiffens the parts of the boiler exposed to steam-pressure and which is not strengthened by the employment of stay-bolts.

It is thought that the construction and advantages of my invention will be readily understood from the foregoing description, taken in connection with the drawings; but I would remark that my invention provides a simple, durable, and substantial construction in which the shells and tubes are united in a strong steam and water tight manner and in which ready access may be had to any tube through the medium of removable plugs arranged or disposed in the outer shell in a manner to preserve or retain the stiffness, strength, and rigidity of the shell A.

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

1. In a water-tube boiler, the combination with the shells A, B, of the angle-bars arranged at right angles to each other within

the steam-dome and united to the sides of the shell A, and the struts or braces arranged with one series of braces at right angles to another series of braces and attached to the angle-bars, substantially as described.

2. In a water-tube boiler, the combination with the inner and outer shells, of the series of tubes C fastened in the inner shell, the other series of tubes D arranged at right angles to, and alternating with, the tubes C, each tube having one end threaded in one wall of the inner shell and its other end expanded to form a tight joint with the oppo-

site wall of said inner shell, and the plugs E fastened in the walls of the outer shell, in alinement with the tubes C, D, and with the plugs for adjacent tubes which lie in the same horizontal plane secured in opposite walls of the outer shell, one plug only being devoted to each tube, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

GEORGE COOK.

Witnesses:

HENRY E. COOPER,
H. T. BERNHORD.