

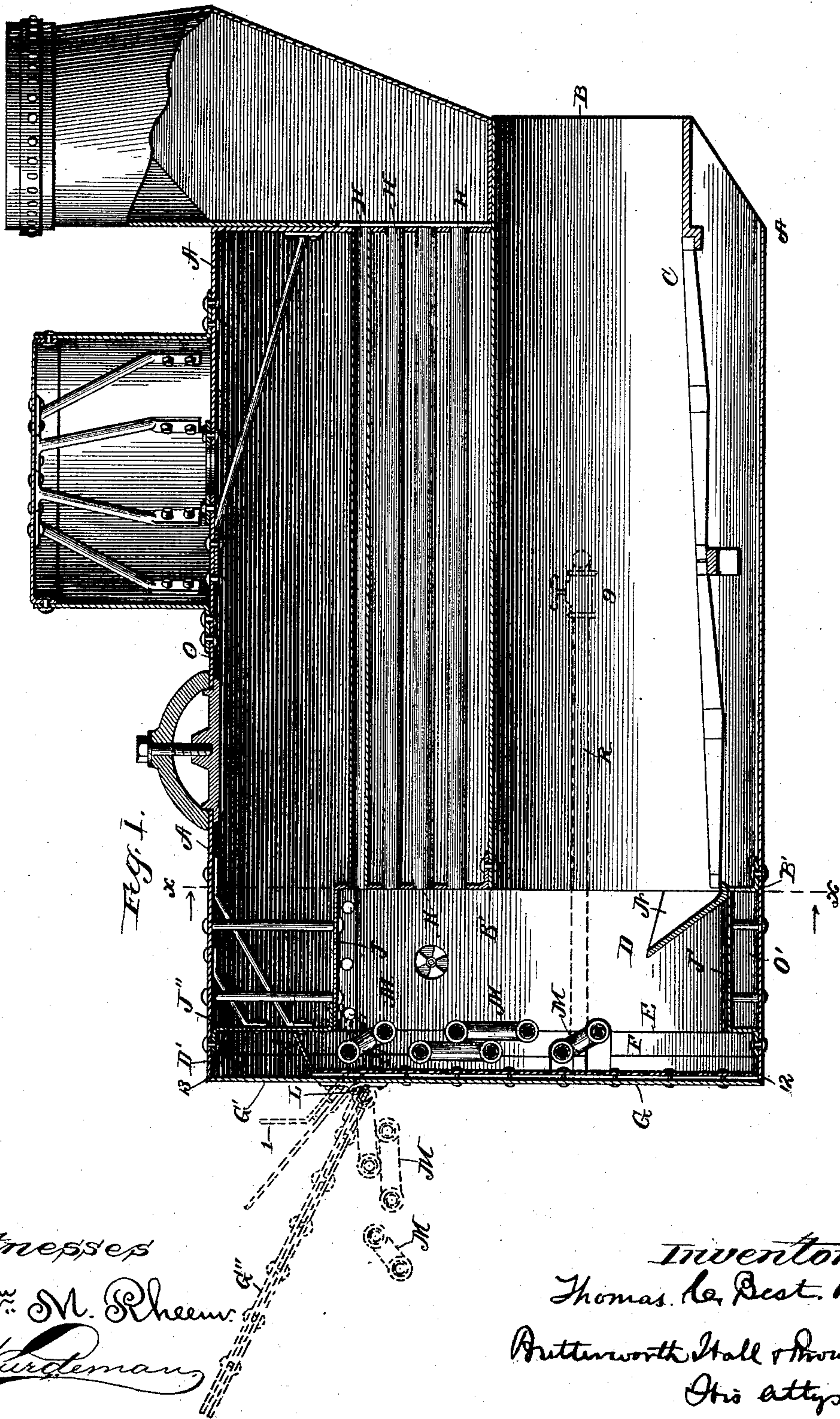
(No Model.)

2 Sheets—Sheet 1.

T. C. BEST.
STEAM BOILER.

No. 474,517.

Patented May 10, 1892.



Witnesses
Wm. M. Rheem.
E. Hurdman.

Inventor:
Thomas C. Best. By
Buttsworth Hall & Brown
His attys—

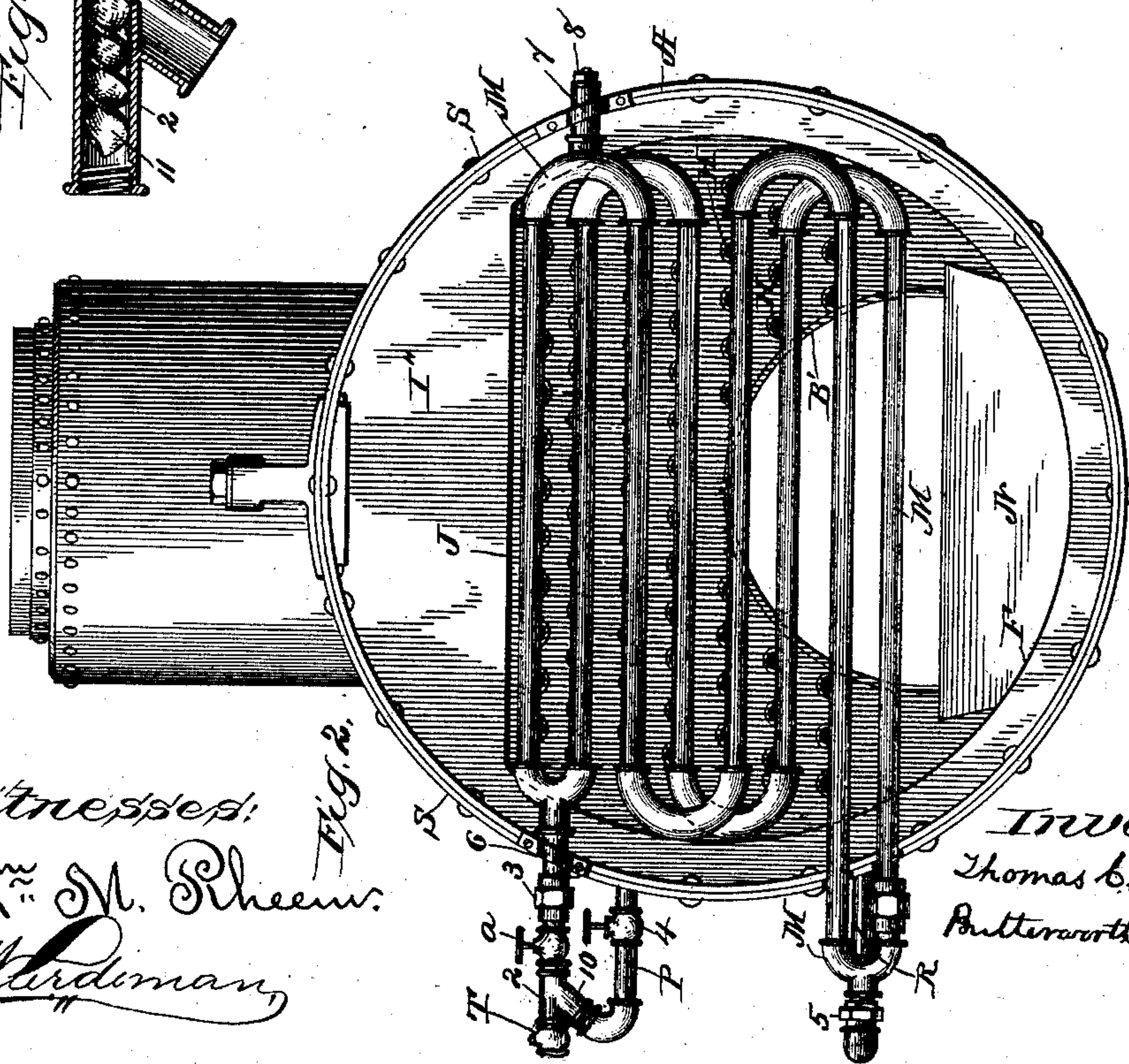
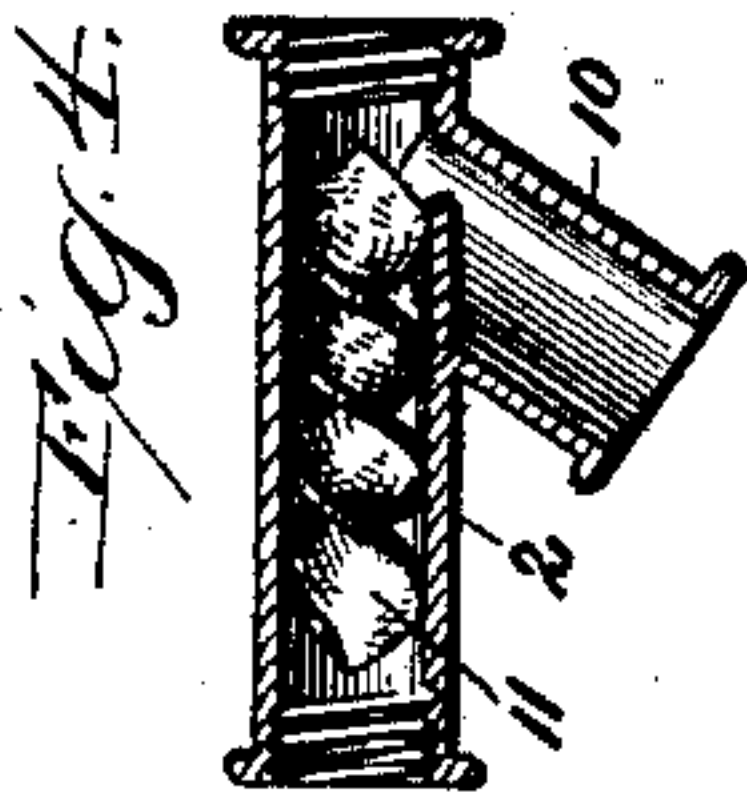
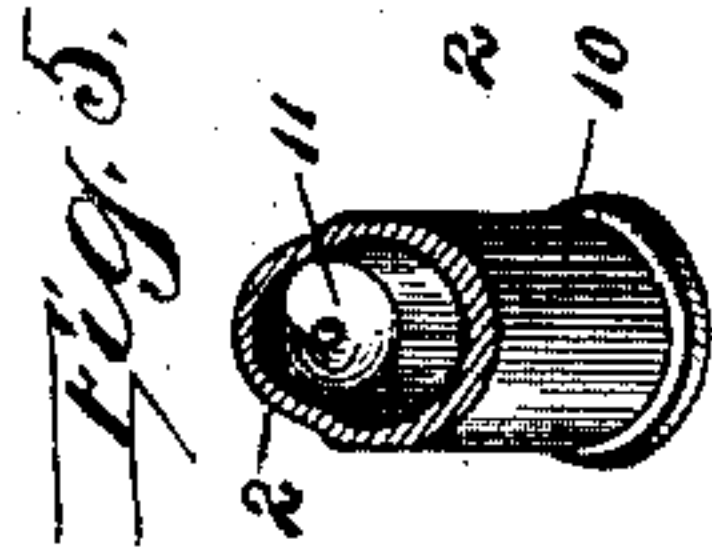
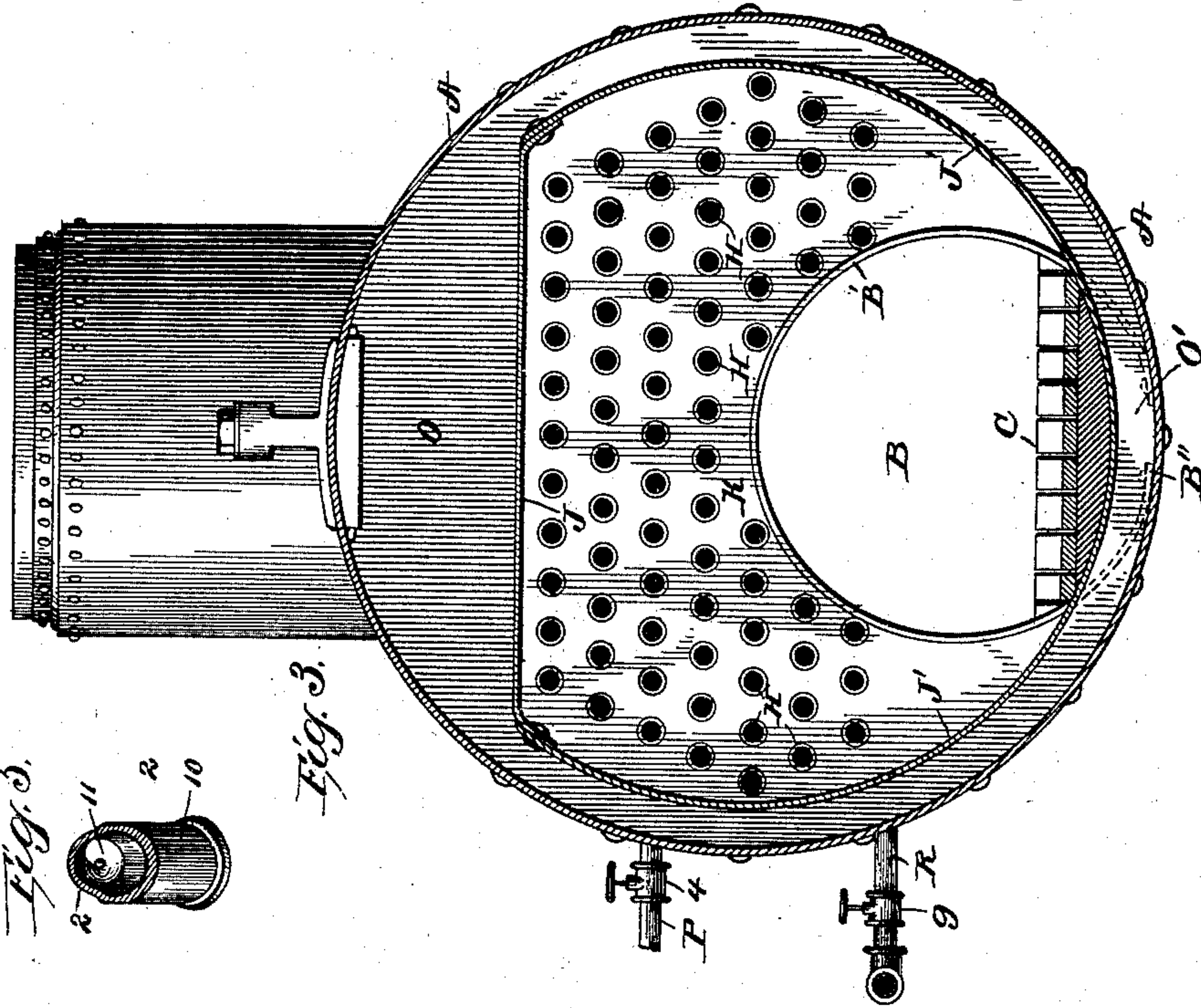
(No Model.)

2 Sheets—Sheet 2.

T. C. BEST.
STEAM BOILER.

No. 474,517.

Patented May 10, 1892.



Witnesses:
M. M. Rheem.
H. H. Hurdman.

Inventor
Thomas C. Best, By
Butterworth Hall & Brown
His attys.

UNITED STATES PATENT OFFICE.

THOMAS C. BEST, OF CHICAGO, ILLINOIS.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 474,517, dated May 10, 1892.

Application filed October 13, 1890. Serial No. 367,922. (No model.)

To all whom it may concern:

Be it known that I, THOMAS C. BEST, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Steam-Boilers, of which the following is a specification.

My invention relates to an improvement in steam-boilers for generating steam; and the objects of my invention are, first, to provide a boiler in which the lower part or segment of the furnace-chamber is integral with the lower part or segment of the outer shell of the boiler, thus avoiding space at such lower part of the boiler for "dead-water," as it is commonly called; second, to increase the heating-surface of the boiler by the arrangement and construction of the fire-chamber at the rear end of the boiler; third, to arrange in the rear fire-chamber a generator consisting of a series of continuous pipes exposed to the heat of the furnace and through which the fresh supply of water is fed into the boiler, causing a constant circulation between the heated water in the boiler and the fresh water; fourth, to provide a movable and removable generator, as above shown; fifth, to provide a movable and removable back for the boiler, so that immediate access can be had to the interior chambers of said furnace for repairs, stopping leaks, &c., without waiting for the boiler to cool. There are other matters of detail required to carry out these improvements and make them operate more effectively, which will be hereinafter explained. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a sectional view of a boiler as improved and constructed by me. Fig. 2 is an end view of the rear of the boiler with the back removed. Fig. 3 is a cross-sectional view of the boiler on the line X X, Fig. 1. Fig. 4 is a sectional view of a part of the fresh-water-injection pipe with its connection and showing within it a screw or spiral piece. Fig. 5 is a vertical view of a part of the injection-pipe with part of the pipe cut away.

Similar letters and figures refer to similar parts throughout the several views.

Letter A represents the exterior shell of the boiler, which, it will be seen, extends beyond the boiler proper to the points 12, Fig. 1, the rear portions of the boiler proper being closed by the plate J'' and the crown-sheet J and the head K, into which the flues are introduced.

The furnace-chamber, which is preferably but not necessarily cylindrical, is shown by the letters B B'. Its seam may be riveted, so as to make a complete and solid cylinder, or the lips of the seam may be left open and riveted to the lower part of the shell of the boiler, as shown at B'', Fig. 3. It is usual in the construction of boilers to arrange the furnace-chamber above the shell of the boiler, so that the water may extend under and entirely around the former; but experience has shown that this is not desirable, as the fire will not heat the water immediately under the furnace to the same degree as other portions of the boiler, and the lower surface of the boiler itself is cooler than the upper portions, causing straining of the shell and other parts.

The usual and ordinary grates are introduced, as shown by C, and supported in any of the usual methods known to the mechanic. At the rear extremity of the furnace is located a deflector N for the purpose of directing the current of heat upwardly toward the generator M M, hereinafter described. The crown-sheet J and the plate J'' and cylindrical plates J' extend from the head-plate K, containing the rear ends of the flues, to E, where by means of integral flanges they are riveted to the shell of the boiler, the rear extension of the flanges being shown by the line F, Fig. 1. It will be thus seen that the water and steam chamber O is over the furnace-chamber, and that it does not extend wholly around and under it, but that to the rear of the line X X, Fig. 1, and extending to the line E the water and the steam chamber O O' extend around and under the combustion-chamber D, producing a continuous heating-surface. The combustion-chamber D extends up behind the plate J'', forming a smaller combustion-chamber D'. The proper water-line in the boiler is about four inches above the crown-

sheet, and it is important that the intense heat from the furnace and the combustion-chambers does not come in contact with any part of the plate J'' that is above the water-line. To prevent this, an iron plate or apron 1 is attached to the back G', as hereinafter explained, so that when the latter is in proper position the plate or apron 1 rests against the plate J'' at the water-line, forming a cover for the lower portion of the chamber D' and preventing any considerable degree of heat entering the upper portion of said chamber or coming in contact with that portion of the plate J'' that extends above the water-line.

T, M, P, and R represent what I term a "feed-water heater, circulator, and steam-generator," its object being to introduce the fresh supply of water into the boiler required and bring it to the same degree of heat as it reaches the boiler as that of the water in the boiler. It also constitutes a heating steam-generator and adds greatly to the heating-surface of the boiler. The pipe T is connected with the usual force-pumps for injecting water into steam-boilers. It has an elbow connection 2 10, a globe-valve *a*, and a union 3. It then passes through the extended shell of the boiler at 6, which is cut so as to form a bearing for it to rest in. Within the boiler the pipe T is bifurcated or doubled, as shown by M M, forming a series of pipes extending back and forth across the rear portion of the heating-chamber D. They are arranged behind and in front of each other, so that the branch of the pipe will be located in front of the space of two of the other branches, so as to form a close artificial backing to the fire-chamber. The last pair of these pipes passes out of the boiler and is connected by a union 5 with the pipe R, which extends forward, and, being provided with a globe-valve 9, enters the lower part of the water-chamber of the boiler. At the opposite end of the first turn of the pipe M is attached a journal 8, to rest in a bearing 7, cut in the extended portion of the shell of the boiler and held in position by a strap or other well-known means. This enables the frame of pipes, which is called the "generator," to be rocked upon 6 and 8 as the axes or journals and lifted up out of the way, and also to be entirely removed from the boiler by removing its connections with the pipes P and R.

The back of the boiler is constructed in two sections G and G'. G is made of a solid exterior plate with an interior perforated plate held by rivets, with small air-spaces between them. The upper plate G' is provided with an interior plate *l*, which is bent, forming such an angle with the main plate that when in position the bent portion of *l* inclines upwardly and rests against J'', forming a dome or cover to the fire-chambers D and D'. The two sections of the back G G' are supported upon hinges L, which are attached to the shell of the boiler at opposite sides by the usual means

and are held in position closely to the end of the boiler by latches, straps, or other means. Either can be swung open on its hinge without moving the other, or both can be opened at the same time, and both can be readily entirely removed.

Having thus explained the construction of the various parts of my improvements in steam-boilers, I now proceed to explain their mode of operation. The furnace-chamber being in actual contact or integral with the bottom of the shell of the boiler prevents dead-water from resting or remaining there. It also increases the capacity of the water and steam chamber above and around it and enables the introduction of a greater number of flues. Heretofore it has been usual to line the interior of the fire-chamber D with fire-brick; but the fire-brick added greatly to the weight of the boiler and the brick were liable to fall down, making it necessary to cool off the boiler, so as to enable the workmen to enter through the furnace-chamber and repair the brick lining. So, also, in case of leakage of any of the interior parts of the boiler or bursting of the flues the only access to the interior chambers was through the furnace-chamber; but in my construction, as shown, the fire-chamber is entirely surrounded by a water-chamber O O', while the end or back of the fire-chamber is constructed of a wall or frame of water-pipes, the cross-pieces lying so close and one pipe in one section located opposite the space between the two pipes in the other section as to prevent the flames and intense heat from coming directly against the exterior back G G'. In the drawings these pipes thus constituting the generator are not brought as close together nor are there as many cross-sections in the coil as there may be employed. I prefer to have this generator constructed with a sufficient number of cross-sections of pipe and located sufficiently near each other to extend from a point slightly below the upper edge of the deflector N to a point above the crown-sheet J. I do not limit myself to two bifurcations or doubling of these cross-sections as they proceed from the pipe T; but they may be increased in number and the form and arrangement of the coil may be changed and varied without departing from the spirit of my invention, the object being to form a water-containing back to the fire-chamber to heat the fresh supply of water and create a circulation between the hot water of the boiler and the fresh water as it enters through the pipe T. By this arrangement the fire-chamber is practically surrounded by water on all sides. The pipe P enters the water-chamber and the water in it is at all times of the same temperature as that within the boiler. When cold water is forced through the elbow-section 2, it pumps or draws with it hot water from the boiler through the inclined elbow 10. It then passes into the double pipes of the gen-

erator M M, where its current or motion is slowed one-half and it is exposed to the heat of the fire-chamber. The constant circulation from the boiler of hot water mingling with the cold water and the heat of the furnace brings the current of water passing through the generator to the same heat of that within the boiler, and when this heated water enters the boiler through the pipe R it is as ready to flash into steam as the water within the boiler. By means of the globe-valves *a* and 4 the fresh water can be cut off from its connection with the pipe P, or it can be cut off from the generator and caused to flow directly into the boiler through P. By means of the globe-valve 4 in tube P and 9 in tube R and the union 3 in the pipe T and the union 5 in pipe R the generator can be disconnected from these several pipes and swung upon its axes 6 and 8 out of the way, so as to admit access to the fire-chamber, or it can be entirely removed until repairs are made, leaks stopped, &c., without waiting for the boiler to cool.

The exterior back G and G', supported upon the hinges L, as explained, is protected by the presence of the generator from the direct and immediate heat of the fire-chambers. They fit the extended edge of the shell of the boiler closely, preventing the escape of smoke, gas, sparks, &c. They can be opened together, separately, or removed, giving access to the generator and fire-chamber. They may be attached or swung to the shell of the boiler by any well-known means, the object being that, while they form a back to the boiler, they may be readily opened or removed.

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

1. In a steam-boiler, the combination of a main boiler for the water and steam chamber and provided with flues therein with a furnace-chamber located within said main boiler-shell, the under side or edges of the shell of said furnace-chamber being rigidly attached throughout its entire length to the inner bottom of the main boiler-shell, said furnace-shell approximating to a cylindrical form down to the line or lines where it is thus rigidly attached to the main boiler-shell, whereby the water is excluded from passing immediately beneath said fire-chamber where it is thus rigidly connected, and said main boiler-shell extending beyond the front of the fire-chamber and, in connection with end plates, crown-sheet, and walls, forming a combustion-chamber and a water-space all around the periphery of said combustion-chamber, all substantially as shown.

2. A steam-boiler whose shell forms a water and steam chamber, through which pass longitudinal flues, having a combustion-chamber entirely surrounded in cross-section by a water-chamber, the flange-sheet of the crown-sheet and the front plate or plates of such surrounding water-chamber being flanged

and riveted or otherwise rigidly connected with the shell of said boiler, said shell extending outwardly beyond the line of such connection and forming a hot-air chamber, all substantially as shown.

3. A steam-boiler provided with a combustion-chamber, the crown-sheet and peripheral walls of which are surrounded by a water-chamber, the main shell of said boiler extending beyond the limits of said combustion-chamber and water-chamber and being provided with a back hinged to said extension of said main shell and capable of being opened or removed, all substantially as shown.

4. A steam-boiler provided with a combustion-chamber, the crown-sheet and peripheral walls or plates of which are surrounded with a water-chamber as far as the combustion-chamber proper extends and having at the rear of such combustion-chamber a coil or continuous series of feed-water-heating pipes arranged closely together, with external connections, all substantially as shown.

5. A steam-boiler provided with a combustion-chamber, the crown-sheet and peripheral walls of which are surrounded with a water-chamber as far as the combustion-chamber proper extends and having at the rear of such combustion-chamber a series of feed-water-heating pipes arranged closely together, two or more of them connected at their ends, respectively, with a single inlet and outlet pipe, substantially as shown.

6. A steam-boiler provided with a combustion-chamber, the crown-sheet and peripheral walls or plates of such chamber being surrounded by a water-chamber and having at the rear of such combustion-chamber a series of feed-water-heating pipes, two or more of them connected at their ends, respectively, with a single inlet and outlet pipe, said series of feed-water-heating pipes being movably supported by bearings in the extension of the main boiler-shell, all substantially as shown.

7. A steam-boiler provided with a furnace-chamber located within the main boiler-shell that forms the water and steam chamber and through which extend flues, the lower portion or part of the shell of such furnace-chamber being rigidly attached throughout its entire length with the inner bottom of the main boiler-shell, said boiler also being provided with a combustion-chamber, the crown-sheet and peripheral walls of which are surrounded by a water-chamber, and at the rear of which combustion-chamber is held by connections a coil or series of feed-water-heating pipes having external connections with the water feed and supply pipes, all substantially as shown.

8. A steam-boiler provided with a furnace-chamber, above whose crown-sheet and peripheral walls or plates is extended the water-chamber, a coil or series of feed-water and heating pipes held in said chamber by connections and extending from the line of the crown-sheet down to a point opposite the line

of the lower opening of the furnace-chamber, and a back to said boiler supported upon hinges and attached to the shell of said boiler, all substantially as shown.

- 5 9. A steam-boiler provided with a furnace-chamber located within the main boiler-shell, a deflector at the rear end of such furnace-chamber, a combustion-chamber around which extends a water-chamber, and a series of pipes

located at the rear of said combustion-chamber, the ends of two or more of said pipes respectively connected with a single inlet and outlet pipe, all substantially as shown.

THOMAS C. BEST.

Witnesses:

A. G. WATERMAN,

E. C. MERRILL.