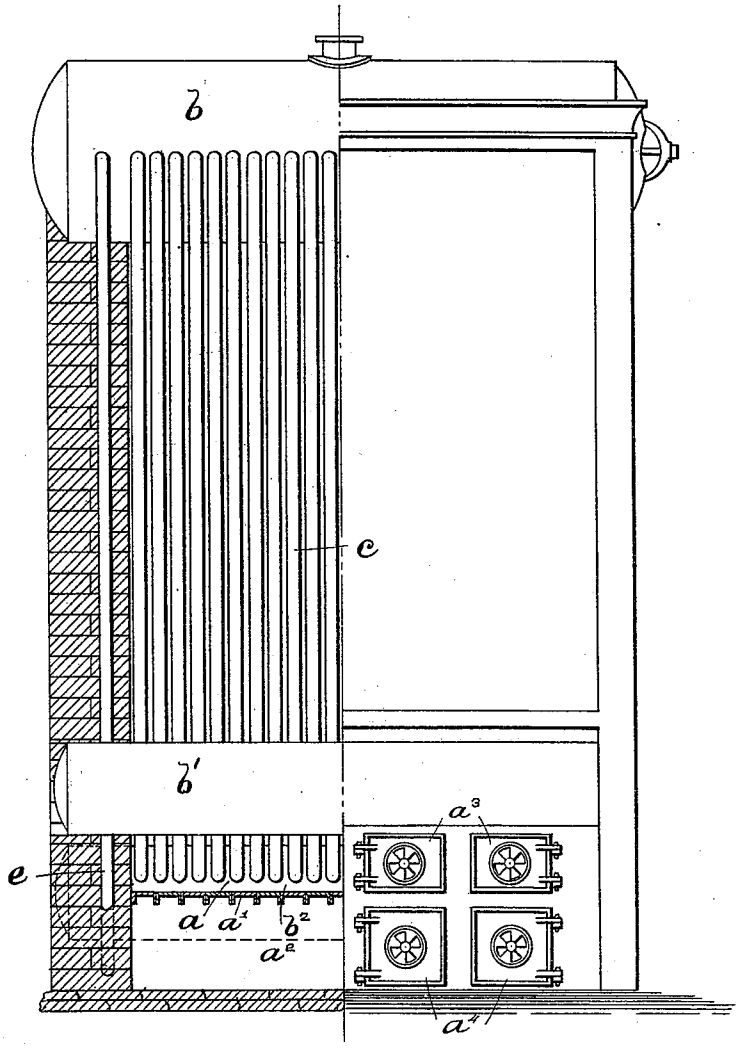
(No Model.) 2 Sheets—Sheet 1.

J. F. CASEY.

WATER TUBE BOILER.

No. 544,285. Patented Aug. 13, 1895.

Fig. 1



WITNESSES:
G. M. Gridley
Chas. I. Welch

INVENTOR
James F. Casey
BY Paul A. Staats
ATTORNEY

(No Model.) 2 Sheets—Sheet 2.

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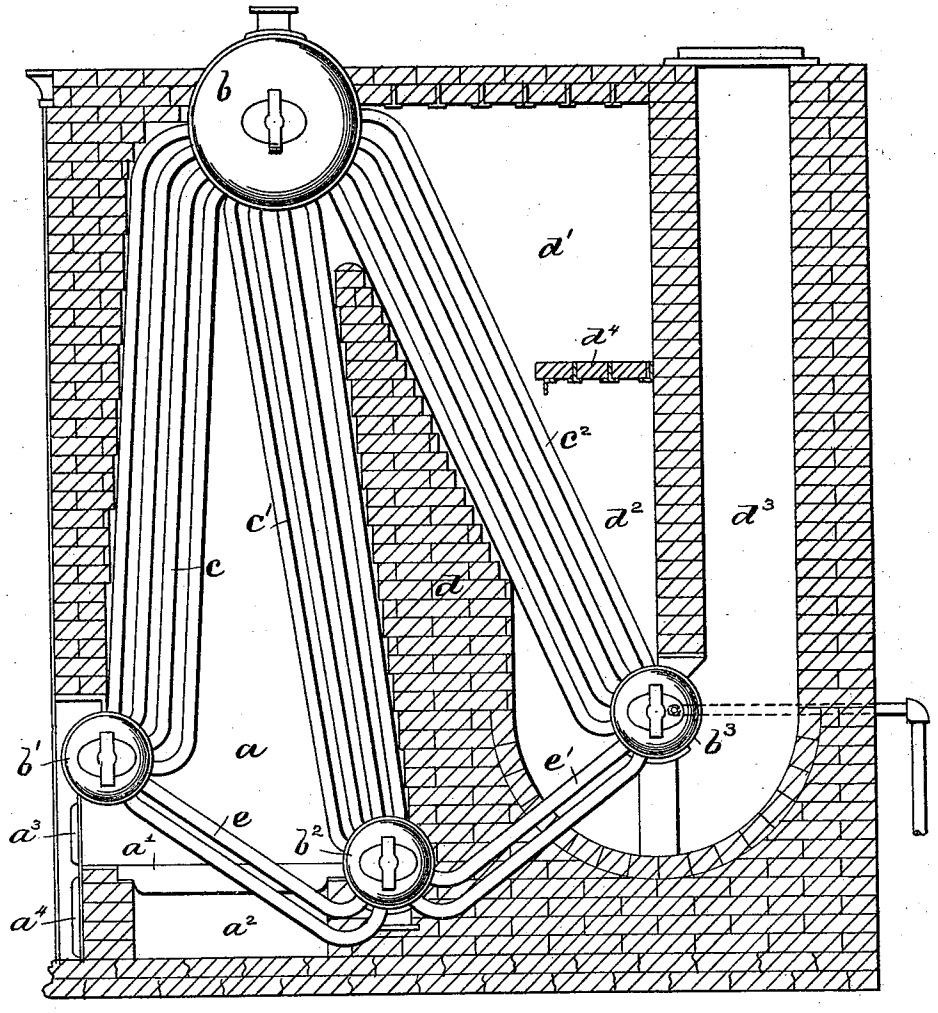
Fig. 2.



WITNESSES:

G. M. Gridley

Chas. I. Welch

INVENTOR

James F. Casey

BY Paul N. Whitney

ATTORNEY

UNITED STATES PATENT OFFICE.

JAMES F. CASEY, OF CHATTANOOGA, TENNESSEE, ASSIGNOR TO THE CASEY & HEDGES MANUFACTURING COMPANY, OF SAME PLACE.

WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 544,285, dated August 13, 1895.

Application filed June 6, 1895. Serial No. 551,846. (No model.)

To all whom it may concern:

Be it known that I, JAMES F. CASEY, a citizen of the United States, residing at Chattanooga, in the county of Hamilton and State of Tennessee, have invented certain new and useful Improvements in Water-Tube Boilers, of which the following is a specification.

My invention relates to water-tube steam-boilers, and the object of my invention is to provide a water-tube boiler in which a positive circulation is produced and in which the products of combustion are caused to circulate in such a manner as to utilize the heat-units therein to the best possible advantage. I attain these objects by the constructions shown in the accompanying drawings, in which—

Figure 1 is a front elevation with some of the parts broken away to more clearly illustrate the inner construction. Fig. 2 is a side elevation of the same with the outer casing shown in section.

Like parts are represented by similar letters of reference in both views.

In the said drawings, a represents the fire-box; a', the usual grate-bars therein, and a^2 the ash-pit, suitable doors a^3 a^3 being provided for the furnace or fire-box, and draft-doors a^4 a^4 for the ash-pit in the usual manner.

The boiler proper consists of a series of circulating-tubes which are connected to four drums b b' b^2 b^3, one of these drums b being a steam and water drum. The other drums b' b^2 b^3 are water-drums. The water-tubes, which connect the water-drums b' b^2 b^3 with the upper or steam-drum b, are arranged in series, as shown at c c' c^2. The water-drum b' is arranged immediately above and at the front of the fire-box a and takes the place of the usual lining for the furnace-front, thus protecting the furnace-front and at the same time utilizing the heat which would otherwise come thereon. From the drum b' there is extended a series of tubes c along the inner side of the front wall of the furnace. These tubes, of which any number may be employed, extend at intervals along the entire length of the respective drums b and b' in series, as shown, although this number may be varied as desired.

The drum b^2 is placed immediately in the rear of the fire-box and preferably slightly below the main body of the fire. Tubes c', arranged in series similar to those c, connect this drum with the steam-drum b. Immediately behind the drum b^2, or series of tubes c', is a bridge-wall d, which extends upwardly to within a short distance of the upper or steam drum b. The lower drum b^2 is preferably placed slightly in the rear of the upper drum b, so that the tubes extend upwardly and forwardly at an angle to where they join the upper steam-drum b, the bridge-wall being preferably correspondingly shaped.

To the rear of the bridge-wall d is a combustion-chamber d', from which the products of combustion are conducted downwardly through the passage d^2, thence upwardly through the uptake d^3 to the stack, a deflecting-plate d^4 being placed at the bottom of the deflecting-chamber d' to deflect the products of combustion against the series of tubes c^2, which extend from the drum b^3 to the drum b in the rear of the bridge-wall, the drum b^3 being located at a point where the passage d^2 enters the uptake d^3.

Each of the series of pipes c c' c^2 has the end section or series arranged within the wall of the furnace, so as to be protected from the heat of the furnace and thus furnish the means for causing a circulation from each of the drums b' b^2 b^3 to and from the drum b. In addition to this there is also a series of pipes at each end of each of the lower drums connecting said drums one with the other, as shown at e and e'. These pipes are also arranged at the ends of the respective drums and within the walls, so as not to be subjected to the intense heat of the furnace.

The water to feed the boiler is introduced into the drum b^3, which is located at the point where the products of combustion leave the furnace. The products of combustion from the furnace a pass upwardly through and around the respective tubes c and c' and are concentrated at a point immediately below the drum b, where an intense heat will be produced. The water from the water-drums will be circulated rapidly up to this point, where it will be converted into steam and pass into the steam-drum b along with such water as is circulated therewith. As the heat products pass into

the chamber d', they will have parted with a proportion of their heat. Here they will be brought into contact with the series of pipes c^2, which emanate from the water-drum b^3, into which the cold water is introduced. The heat imparted to these tubes will be sufficient to cause an upward circulation of water from the drum b^3; but the water will be naturally much cooler at the lower ends of said tubes than at the top, so that as the heat products are conveyed downwardly they meet a colder and colder surface to impart their heat-units to, until just before passing into the uptake they are brought into contact with the bottom of the drum b^3, into which the cold feed-water will be caused to circulate by reason of the introduction of feed-water at this point. The feed-water introduced into the drum b^3 being colder than any water in the boiler will naturally find its way to the lowest part of the boiler and passing along the bottom of the drum b^3 will circulate through the pipes e' to the bottom of the drum b^2 and from thence through the pipes e to the drum b', the feed water introduced being thus distributed through the various water-drums in which a circulation will always be maintained through the respective tubes connecting said drums with the steam-drum b. The result of this construction is that the circulation of water in the boiler is in practice opposite to the circulation of the heat-units in the furnace—that is to say, the products of combustion will come in contact with that portion of the boiler containing the hottest water in the hottest part of the furnace, and as the heat-units are given up the products of combustion will be brought into contact with the cooler portions of the boiler until they finally pass out of the furnace in contact with the coolest portion thereof, so that theoretically it is possible to utilize all of the heat-units which are above the temperature of the feed-water which is introduced into the boiler.

It will be seen from the above description that not only is the heat utilized to the greatest possible degree, but that the circulation of the boiler will be absolute while the heating-surface is extremely large.

Having thus described my invention, I claim—

1. In a steam boiler, the combination with a single collecting or steam drum, of three water drums, two of said drums being arranged at the front and rear respectively of the furnace, and the third water drum being arranged in a passage separated from said furnace by a bridge wall, as described, and circulating pipes from each of said water drums to said steam drum whereby the products of combustion in leaving the furnace are brought into contact with the coolest portions of the boiler, substantially as specified.

2. A boiler consisting essentially of three water drums and a single steam or collecting drum, circulating pipes connecting each of said water drums with said steam drum, some of said pipes being arranged within the furnace wall, as described, and two of said water drums being arranged at the front and rear respectively of the boiler furnace, a bridge wall between said furnace and the rear water drum, and circulating pipes connecting the respective water drums, substantially as specified.

3. The combination with a furnace, a bridge wall in the rear thereof, and a downwardly-extending passage from said furnace in the rear of said bridge wall, a steam drum arranged at the top of said furnace, and three water drums, one arranged at the front of said furnace, one at the rear of said furnace, and one in the passage leading from said furnace to the uptake, a feed water connection to the rear drum, and circulating pipes connecting the respective water drums, and a series of tubes connecting each of said water drums to the collecting or steam drum, substantially as specified.

4. The combination with three water drums, the center drum being arranged below the two side drums, one of which is located in the front of the furnace, and the other located in a passage leading from said furnace, a steam drum at the top of said furnace, a bridge wall separating said furnace from said passage, circulating pipes from each of said water drums to said steam drum, one or more of which are located in the walls of said furnace, and a circulating pipe from one of said water drums to the other, and means for introducing feed water into the rear water drum, substantially as specified.

In testimony whereof I have hereunto set my hand this 1st day of June, A. D. 1895.

JAMES F. CASEY.

Witnesses:
CHAS. D. GORDON,
J. F. JOHNSTON.