(No Model.) 4 Sheets—Sheet 1.

A. WORTHINGTON.

BOILER.

No. 381,870. Patented Apr. 24, 1888.

FIG. 1.

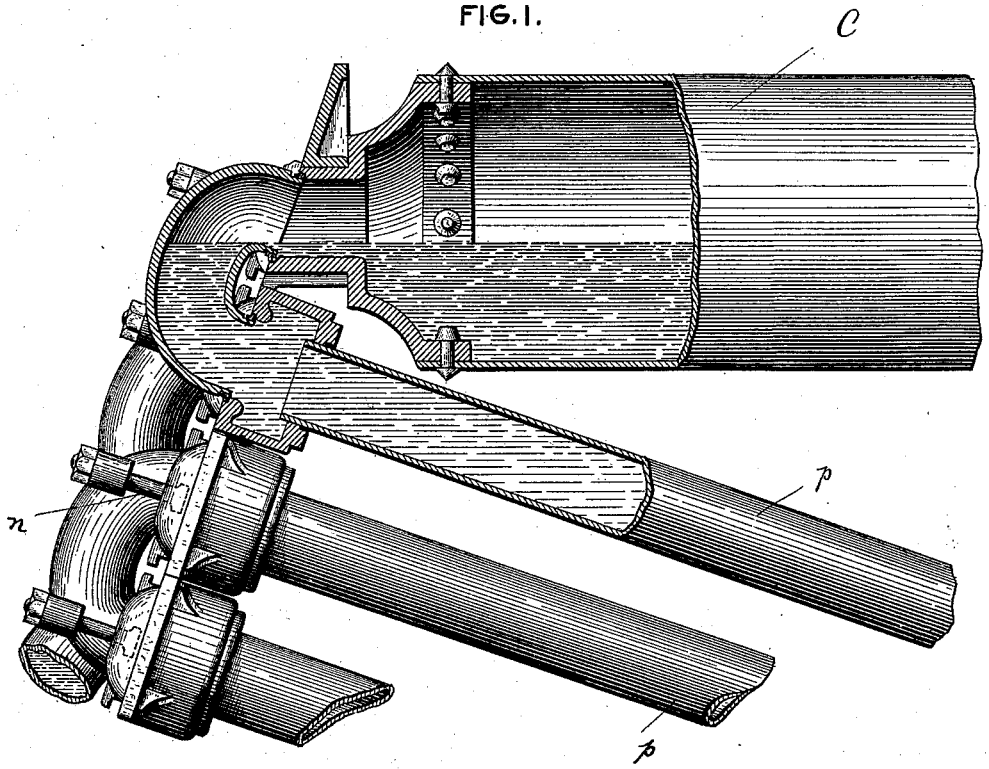
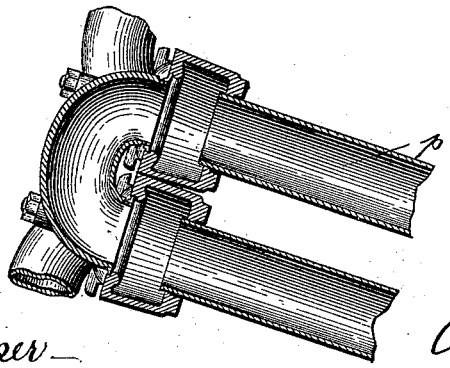


FIG. 2.



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(No Model.) 4 Sheets—Sheet 2.

A. WORTHINGTON.

BOILER.

No. 381,870. Patented Apr. 24, 1888.

FIG. 1A

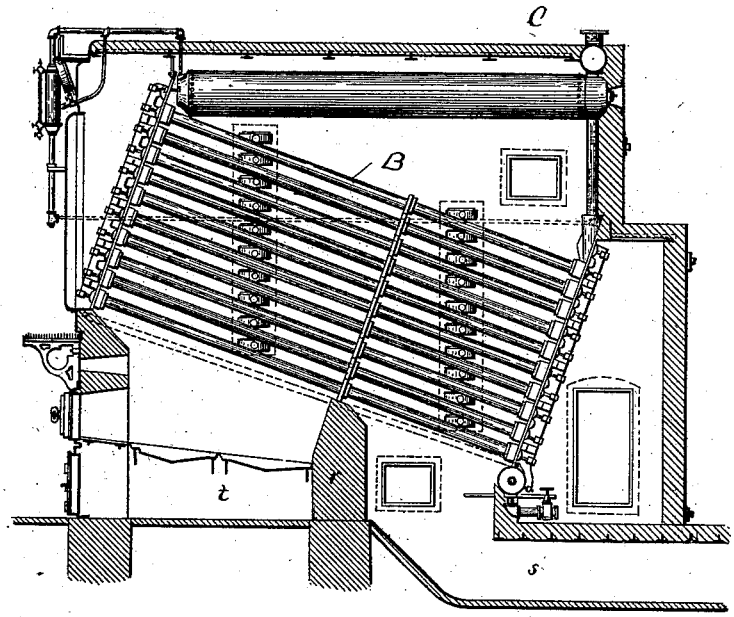
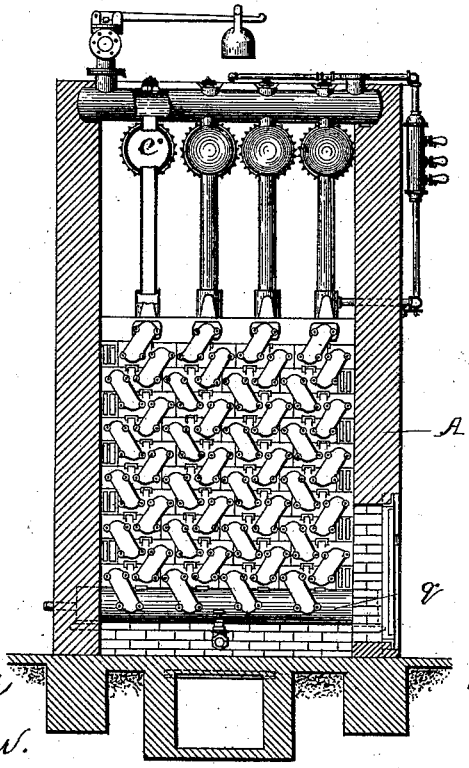


FIG. 2A



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BOILER.

No. 381,870. Patented Apr. 24, 1888.

Fig. 3.

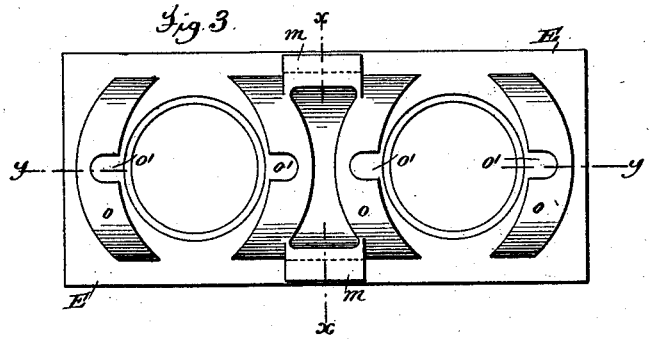


Fig. 4.

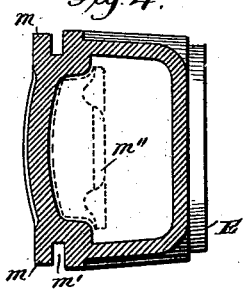


Fig. 5.

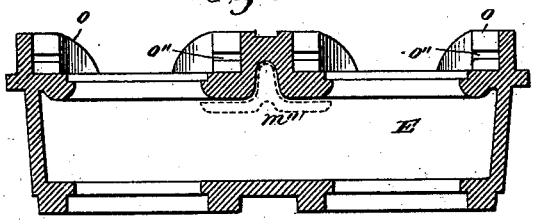


Fig. 6.

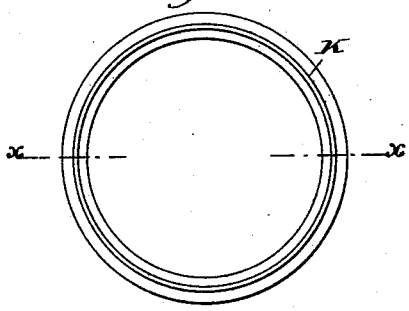


Fig. 7.

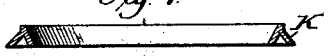


Fig. 8.

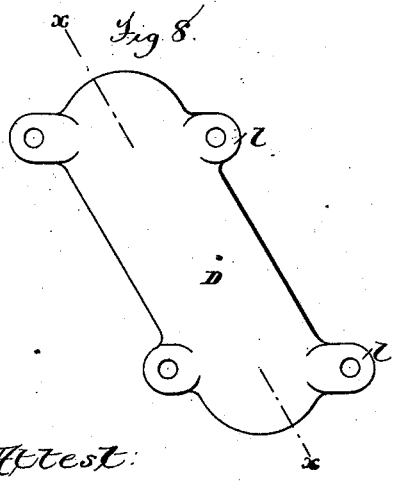
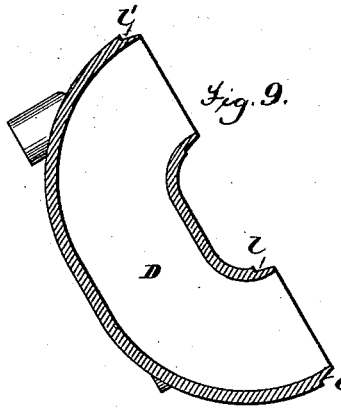


Fig. 9.



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Atty.

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A. WORTHINGTON.

BOILER.

No. 381,870. Patented Apr. 24, 1888.

Fig 10.

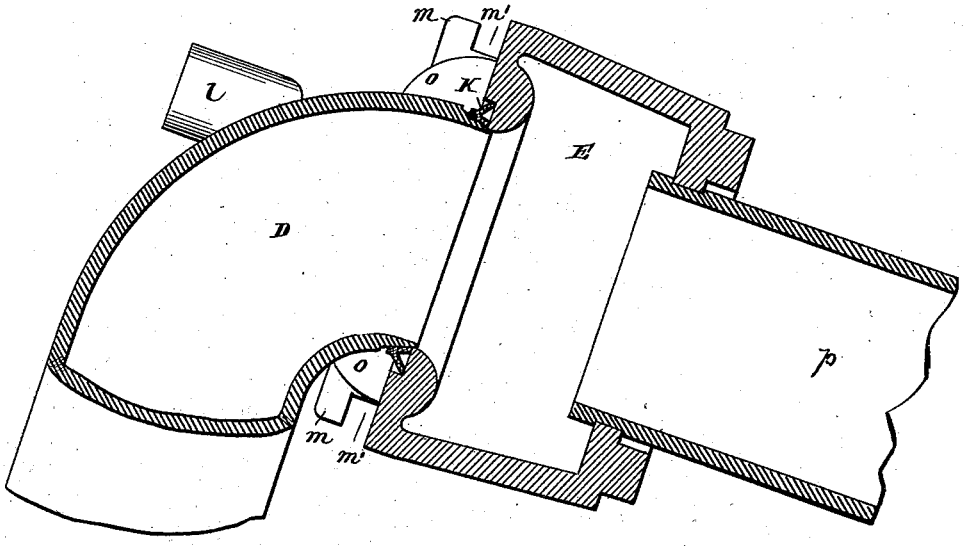


Fig 12.

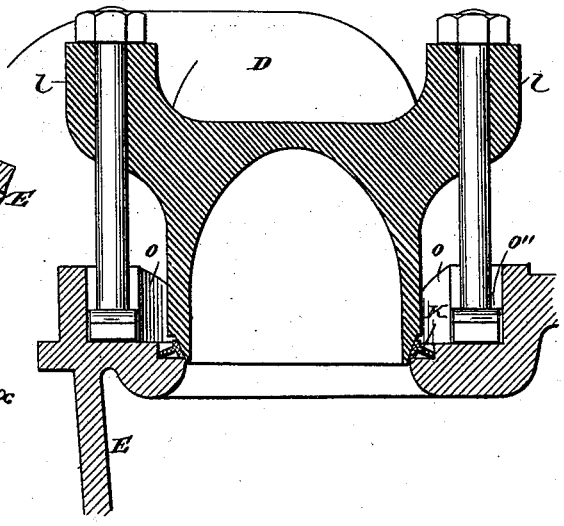
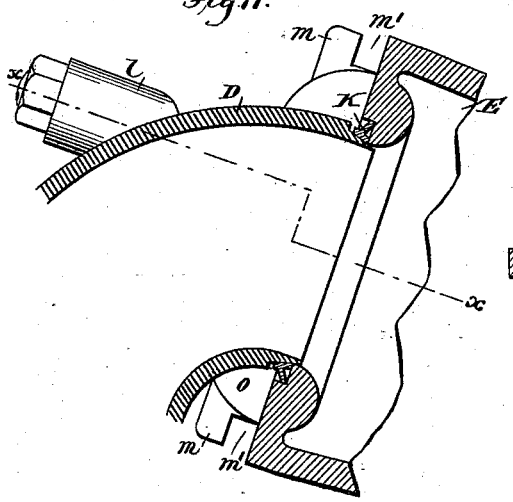


Fig 11.



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UNITED STATES PATENT OFFICE.

AMASA WORTHINGTON, OF BROOKLYN, NEW YORK.

BOILER.

SPECIFICATION forming part of Letters Patent No. 381,870, dated April 24, 1888.

Application filed October 12, 1886. Serial No. 216,060. (No model.)

To all whom it may concern:

Be it known that I, AMASA WORTHINGTON, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Boilers, of which the following is a full, clear, and exact description.

My improvement relates to the construction of water-tube boilers, or boilers comprising a nest of tubes to contain the water from which steam is to be generated, the products of combustion passing through the interstices for the purpose of heating the water; and it relates more particularly to novel means for connecting the tubes together.

The purpose of my invention is to produce a means for connecting the tubes together in such a way as to provide for the expansion and contraction of the tube-surface, and at the same time prevent displacement; and to this end it consists in the novel construction of the header, hereinafter more fully described.

My invention further consists in the details of construction and combination of parts, hereinafter more fully set forth and claimed.

In the drawings, Figure 1[A] is a view in elevation of the interior of a furnace, showing a boiler constructed in accordance with my invention; Fig. 2[A], a rear elevation of the interior of a furnace, showing the rear tube-connections. Fig. 1 is a view in elevation, partly in section, of the forward end of the steam-drum and some of the water-tubes, showing the mode of connecting the same together. Fig. 2 is a section of the front end of a pair of water-tubes, showing details; Fig. 3, a front elevation of a header detached; Fig. 4, a cross-section of a header on the line *x x*, Fig. 3; Fig. 5, a section taken on the line *y y*, Fig. 3; Fig. 6, a plan view of the soft-metal ring or washer; Fig. 7, a section of the same on the line *x x* of Fig. 6; Fig. 8, a front elevation of the bend-connection; Fig. 9, a section taken on the line *x x*, Fig. 8; Fig. 10, an enlarged sectional view showing the header and bend adjusted together; Fig. 11, a similar view showing the header and bend secured together; and Fig. 12, a section on the line *x x* of Fig. 11, showing details.

A represents a furnace-wall, *t* the ash-pit, and *s* the smoke-flue, of a boiler-furnace, all being of common construction.

The boiler B is supported in an inclined position upon the supports *r*, provided therefor in the construction of the furnace, the rear end of said tubes resting upon the mud-drum *q*.

In the upper part of the furnace, above the water-tubes, are the steam-drums C, the forward ends of which are connected to the water-tubes, as hereinafter described, and the rear ends to the steam-dome and downtakes, which latter connect with the rear end of the water-tubes in a manner described in another application for a patent filed by me of even date herewith, Serial No. 216,063.

The tubes *p*, constituting the water passage of the boiler B, are preferably arranged in pairs, which are connected together in vertical and horizontal series by means of headers and bends, of which the following is a description:

The header comprises a shell, E, Figs. 3, 4, and 5, made of cast metal and having openings in its opposite sides for the reception of the bends and tubes, respectively. The interior of the shell constitutes a water-space, affording communication by means of the bends between the tubes in vertical and horizontal series. Upon the outer face of the header are cast lugs *o*, having a central horizontal recess, *o'*, (shown in Fig. 3,) and a transverse recess, *o''*, (shown in Fig. 5,) the purpose of which recesses is to receive the head and shank of a T-bolt, *n*, (shown in dotted lines in Fig. 1,) for securing the header and bend together, as hereinafter described. At a central point on the outer side of the header are cast projecting lugs *m*, parallel with the face of the header, leaving grooves *m'* to receive a lock-plate, whereby the several plates in vertical series may be secured against outward displacement. To offset the additional strain exerted upon the header at the central portion, I prefer in casting the same to follow the process illustrated in dotted lines in Figs. 4 and 5, which consists in using at this point a metal core, *m''*, which will cause the metal to cool at the center before the remainder of the header, and thus be chilled.

The bend or connection comprises a short tube, D, in the form shown in Fig. 9, having a bore of uniform diameter throughout and provided with projecting ears *l*, for the reception of the screw-threaded T-bolt *n*. The ends of the bend D are beveled or chamfered, as

shown. To connect the water-tubes together by means of the headers and bends described, the ends of each of a pair of tubes are inserted and suitably secured in the aperture formed upon the inner side of the header, and one end of the bend is inserted into one of the apertures formed on the other side of the header, the other end of the bend being inserted into a similar aperture provided in the header in a horizontal series above or below. In order to assure a perfect joint between the header and bend, I interpose a soft-metal or bronze ring, *k*, of inverted-V shape in cross-section, Figs. 6 and 7, which impinges against the outer face of the header, surrounding the opening, which may be recessed for convenience, and against the chamfered part of the bend, and constitutes a washer. Before adjusting the washer upon the header the T-bolts *n* are inserted into the recesses *o' o''* of the lugs *o*. The washer is then adjusted, the bend inserted, the bolt *n* passing through the ears formed on the bend, and a nut is then applied and screwed home.

The attachment between the steam-drum C and lower end of the uppermost series of the tubes is accomplished in practically the same manner, except as to certain preferred details more fully described in another application filed by me of even date herewith, Serial No. 216,063.

The connection of the tubes at the rear of the boiler is accomplished in practically the same way as that described of the tubes at the forward end of the boiler.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a means for connecting the tubes of water-tube boilers in horizontal and vertical series, the header E, comprising a shell having openings on its opposite sides for the bends and tubes, respectively, and provided with a projection, *m*, and recesses *m'*, for the reception of a lock-plate, substantially as described.

2. The means herein described for securing together the headers and bends of a water-tube boiler, which consists in the lugs *o*, formed upon the header, provided with inward-opening recesses *o'* and transverse recesses *o''*, T-bolts *n*, the head and part of the shank of which are inserted in the recesses *o' o''*, projecting perforated ears *l* upon the bend to receive the bolt *n*, and screw-nuts, substantially as described.

In testimony whereof I have hereunto set my hand this 7th day of October, A. D. 1886.

AMASA WORTHINGTON.

Witnesses:
THORNE S. WALLING,
DOUGLAS DYRENFORTH.