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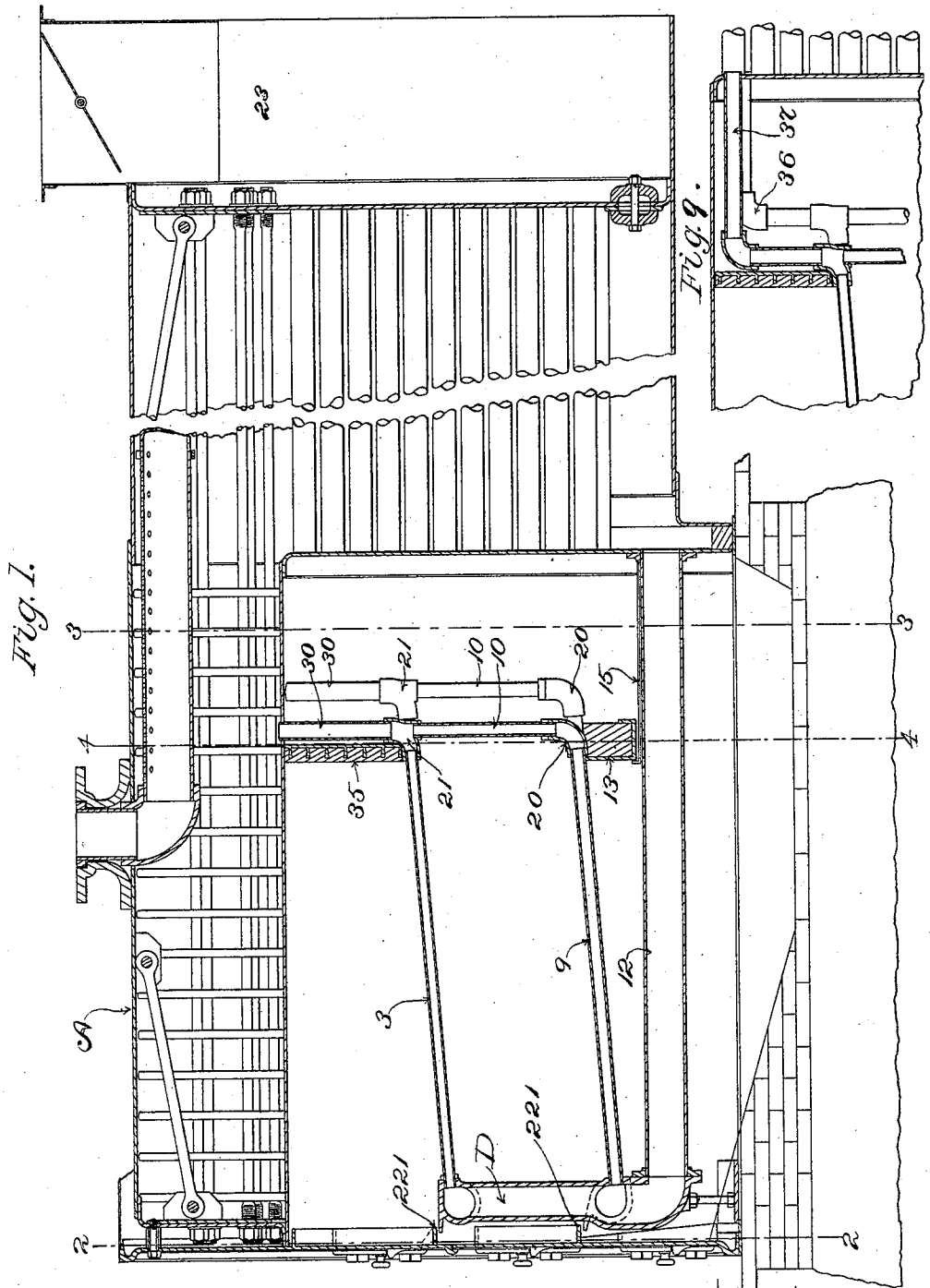
E. B. PARKHURST.

BOILER FURNACE.

No. 576,686. Patented Feb. 9, 1897.



Witnesses.
Oscar F. Mill
Robert Wallace.

Inventor.
Edward B. Parkhurst
by Macleod Calvert & Randall
his Attorneys

(No Model.) 6 Sheets—Sheet 2.

E. B. PARKHURST.

BOILER FURNACE.

No. 576,686. Patented Feb. 9, 1897.

Fig. 3.

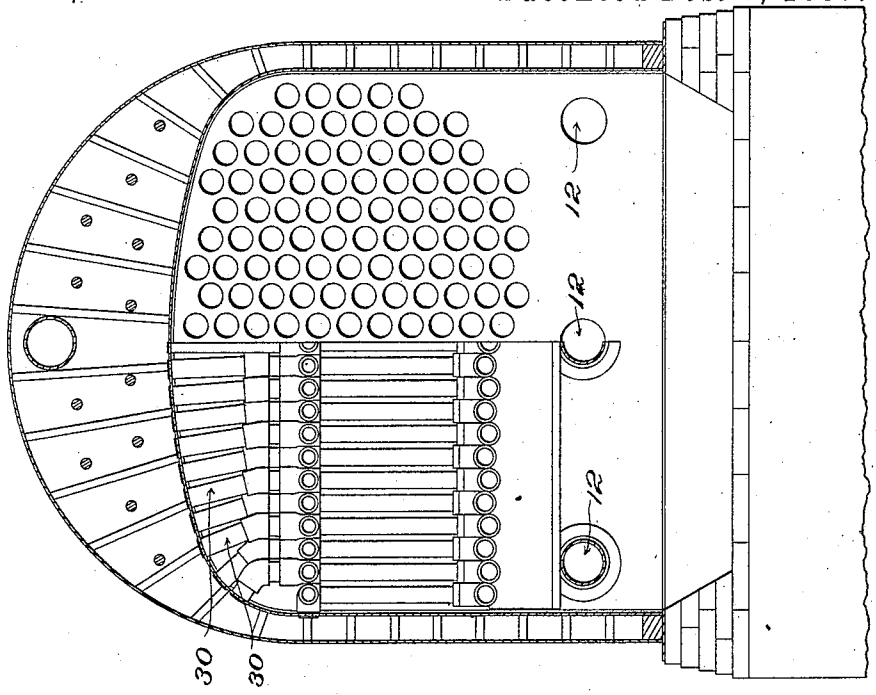
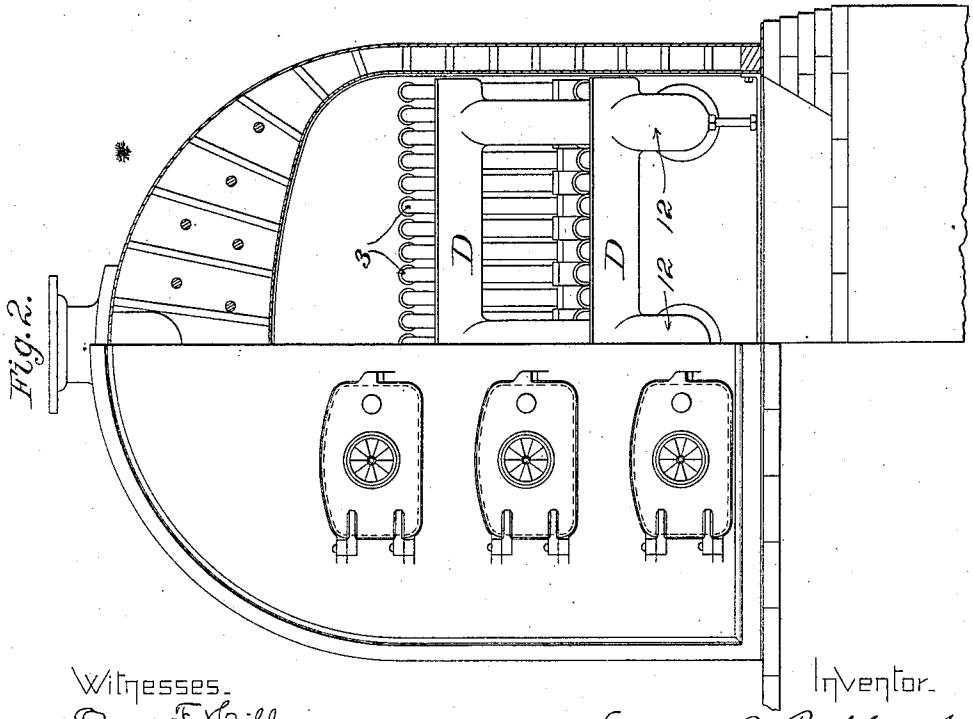


Fig. 2.



Witnesses.
Oscar F. Hill
Robert Wallace

Inventor.
Edward B. Parkhurst
by Macleod Calvert Kendall
his Attorneys

(No Model.) 6 Sheets—Sheet 3.

E. B. PARKHURST.

BOILER FURNACE.

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Fig. 4

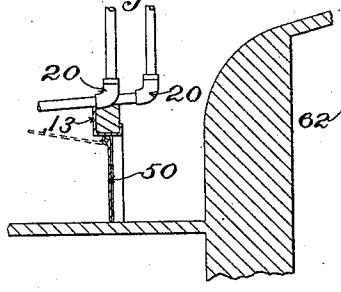


Fig. 5.

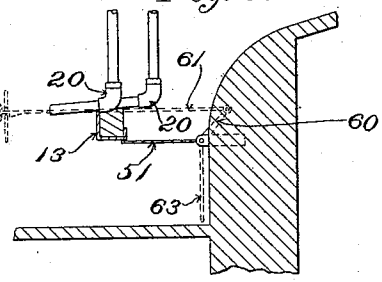


Fig. 6.

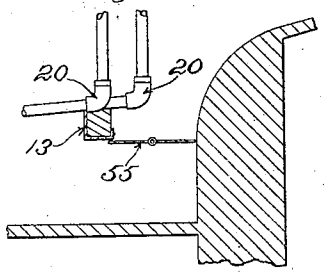


Fig. 7.

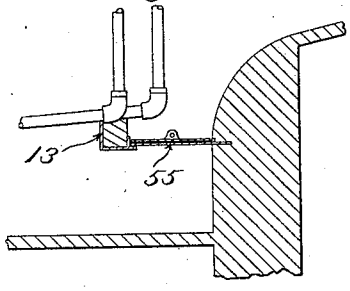
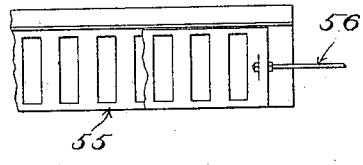


Fig. 8.



Witnesses.
Oscar F. Hill
Robert Wallace.

Inventor.
Edward B. Parkhurst
by Macleod Calver & Randall
his attorneys

(No Model.) 6 Sheets—Sheet 4.

E. B. PARKHURST.

BOILER FURNACE.

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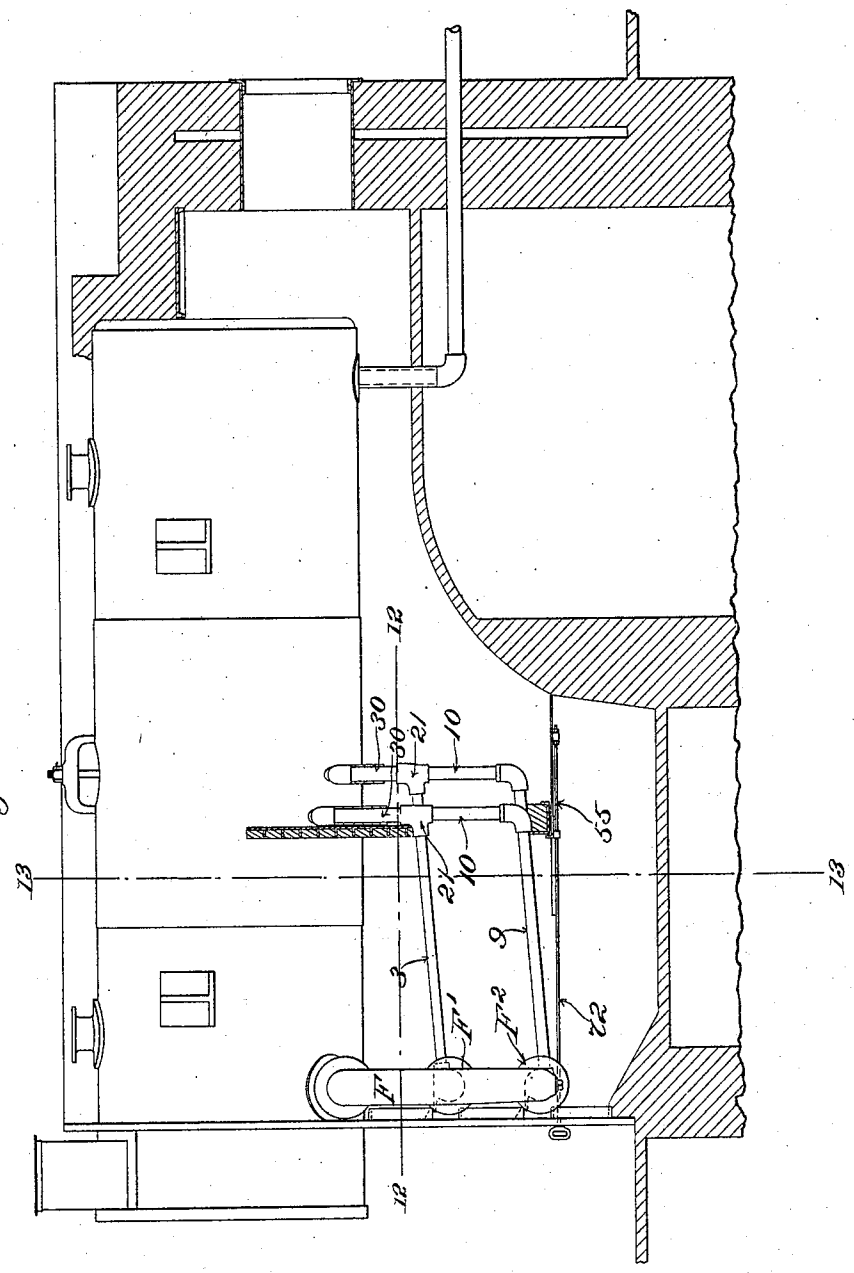
Fig. 10.



Witnesses.
Oscar F. Hill
Robert Wallace.

Inventor.
Edward B. Parkhurst
by Macleod Calvert Randall
his Attorneys

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E. B. PARKHURST.

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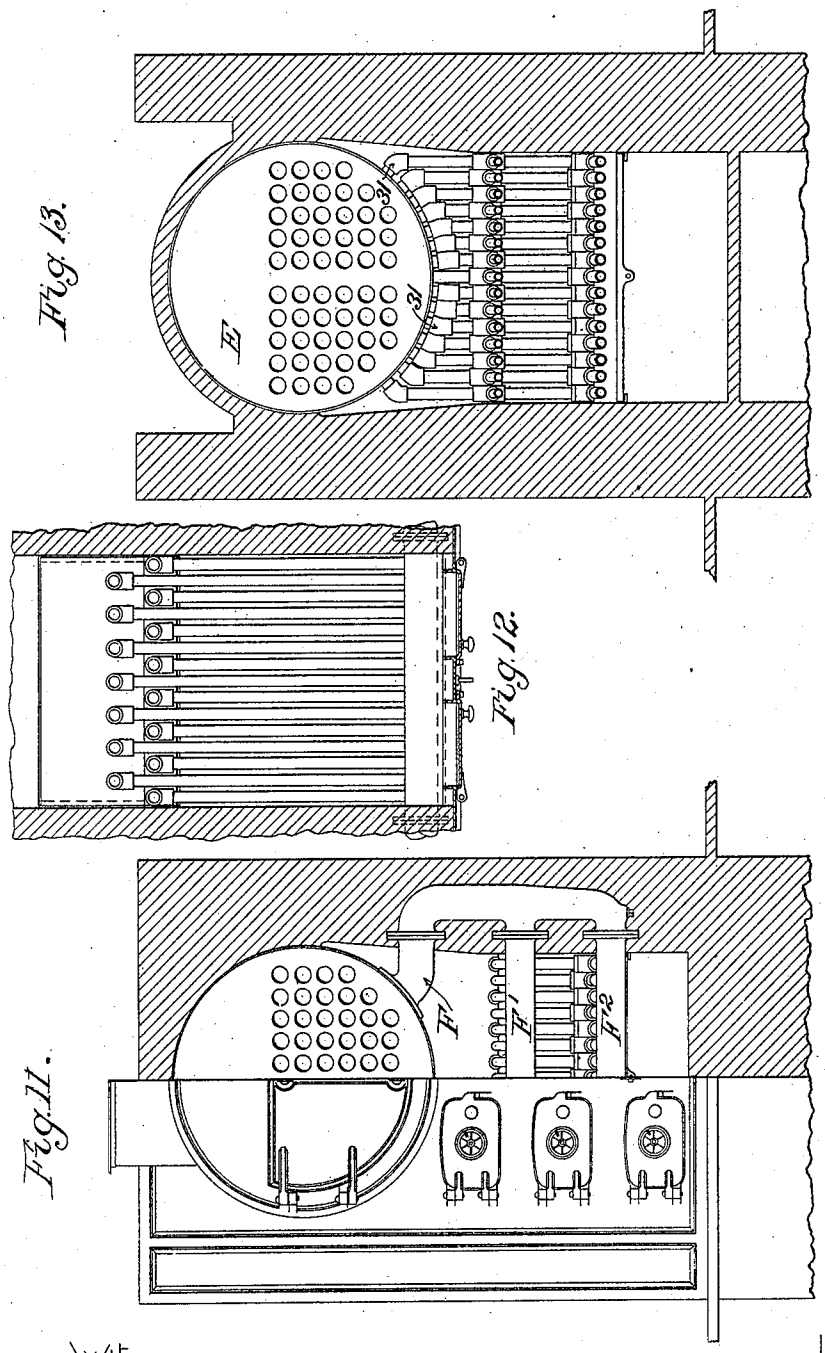

Witnesses.
Oscar F. Hill
Robert Wallace.

Inventor.
Edward B. Parkhurst
by Macleod Calvert Randall
his Attorneys

(No Model.) 6 Sheets—Sheet 6.

E. B. PARKHURST.

BOILER FURNACE.

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Fig. 15.

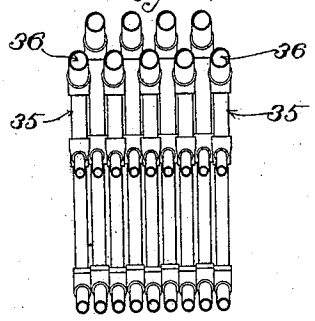
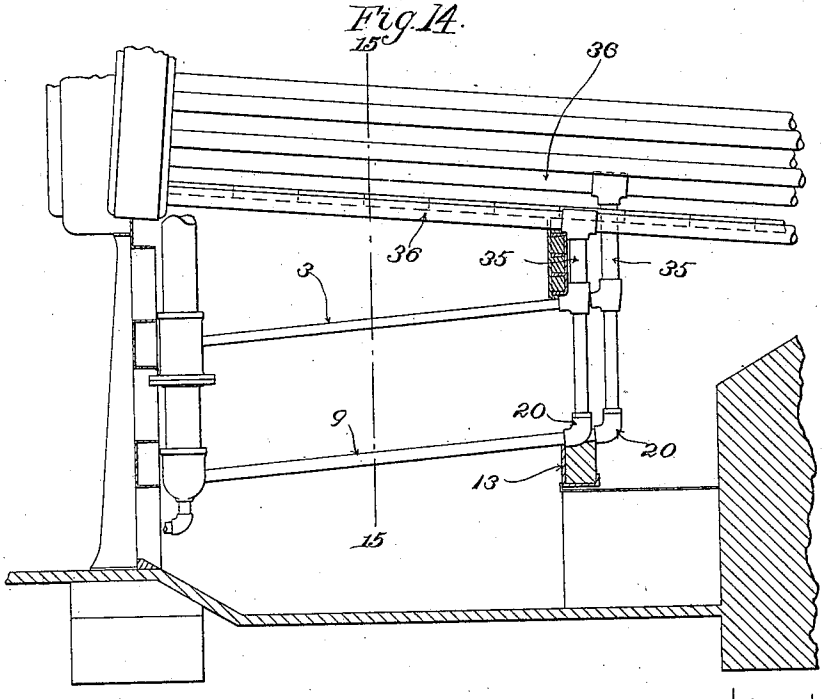


Fig. 14.



Witnesses.
Oscar F. Hill
Robert Wallace.

Inventor.
Edward B. Parkhurst
by MacLeod Calver & Randall
his Attorneys

UNITED STATES PATENT OFFICE.

EDWARD B. PARKHURST, OF WOBURN, MASSACHUSETTS.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 576,686, dated February 9, 1897.

Application filed April 23, 1896. Serial No. 588,780. (No model.)

To all whom it may concern:

Be it known that I, EDWARD B. PARKHURST, a citizen of the United States, residing at Woburn, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Boiler-Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention has for its object to provide an improved boiler-furnace which shall be of high efficiency in forming steam, and also economical in the consumption of fuel; and it consists in a boiler-furnace constructed as hereinafter set forth, and the novel features of which are particularly pointed out and clearly defined in the claims at the end of this specification.

In the following description reference is made to the accompanying drawings, in which—

Figure 1 is a vertical central lengthwise section showing a horizontal boiler and its internal furnace embodying my invention. Fig. 2 is a front elevation with one-half in section, the section being on the line 2 2, Fig. 1. Fig. 3 is a vertical section, the right half being on line 3 3, Fig. 1, and the left half being on line 4 4 of said figure. Figs. 4, 5, 6, and 7 are details showing modifications, reference to which is hereinafter made. Fig. 8 is a detail of the slide-damper employed in the modification shown in Fig. 7. Fig. 9 is a detail hereinafter referred to. Figs. 10, 11, 12, and 13 show a modification in which the furnace is outside of the boiler. Fig. 10 is a side elevation. Fig. 11 is a front elevation, partly in section. Fig. 12 is a horizontal section on line 12 12 of Fig. 10, and Fig. 13 is a vertical section on line 13 13 of Fig. 10. Fig. 14 is a modification showing my invention applied to a water-tube boiler. Fig. 15 is a section on line 15 15 of Fig. 14.

A represents a horizontal boiler of common form having what is frequently termed an "internal" fire-box or furnace. An upper series of grate-bars is shown at 3. Each of such bars consists of a tube, and a series of said tubes placed side by side, as shown, Fig. 2, forms the upper grate. The grate bars or tubes 3 are slightly inclined, the rear ends thereof being somewhat higher than the forward ends thereof, as shown, Fig. 1. The said rear ends of said grate-tubes are connected each with a connection 30, the upper ends of said connections entering the crown-sheet and thus connecting with the water-space of the boiler above the crown-sheet. The forward ends of said grate-tubes 3 enter a manifold D, which is of the shape shown, Figs. 1 and 2, and which is supported upon feet 4, which latter rest preferably upon the metal strip or plate 5, extending across the floor of the ash-pit from side to side thereof. The water-box D crosses the front of the furnace horizontally and consists of two portions, namely, an upper portion 6, into which the forward ends of the upper grate-bars 3 enter, as previously described, and a lower portion 7, into which the forward ends of the lower grate-bars 9 enter. The upper and lower portions 6 and 7 of said water-box or manifold are connected by vertical portions 8, preferably three in number, so spaced as to leave openings between the said vertical portions opposite the tubes of the lower grate to permit the placing of fuel on said grate. The lower grate-bars 9 preferably are placed parallel with the upper grate-bars, as shown, and the rear ends of said lower grate-bars are connected by means of bent connections or elbows 20 with vertical connecting-pipes 10, the upper ends of which enter the three-way elbows 21, by means of which the rear ends of the upper grate-bars are connected with the radial connections 30. The radial connections 30 may therefore be considered as extensions of the vertical connecting-pipes 10.

The lower grate-bars preferably are set close together, and it is therefore undesirable to locate the vertical connections 10 in the same transverse plane, since if they were so located there would not be sufficient space between them to accommodate the draft from the upper and lower grates. To avoid placing these connections in the same plane, I make each alternate lower grate-tube 9 somewhat longer than the other tubes of the series forming the lower grate, so that the connections 10 will occupy two transverse planes, the connections for the shorter grate-tubes

being in one plane and those for the longer ones being in another plane—that is, the vertical connections of the longer grate-tubes are set in a line a short distance behind the one formed by the connections of the shorter grate-tubes, as will be clear from Fig. 1. To facilitate the connection of these longer tubes of the lower series and their vertical connections 10 with the boiler-space above the crown-sheet, the corresponding grate bars or tubes of the upper grate are also correspondingly extended, and the radial connections 30 for these longer grate-tubes are also set rearwardly of the radial connections for the shorter upper grate-tubes, as will be clear. By this arrangement sufficient spaces are obtained between the vertical connections 10 to permit the combined draft of the upper and lower grates to pass rearwardly between said connections.

To prevent the draft from the upper grate passing between the connections 30, I place a partition or wall 35, of fire-brick or similar heat-resisting material, across the furnace in front of the said connections 30 and between the rear ends of the upper grate-tubes and the crown-sheet. This partition may be of any well-known material and may be constructed in any well-known manner. By the employment of a bent connection or elbow to join the rear end of each of the lower grate-bars 9 with its vertical connection 10 a saving in cost is effected over the employment of a manifold or water-box at the rear ends of the lower grate-bars, and in like manner the employment of the three-way elbows 21 and the radial connections 30 in place of a water-leg or similar device is of considerable advantage in saving expense in construction, as also in the cost of cleaning and repairs, while at the same time a better and more rapid circulation of the water through the grate-tubes is obtained. The bent connections or elbows 20 and 21 are also preferable to a mainfold or water-leg, in that they do not afford an opportunity for the collection of sediment.

The vertical connections 10 between the rear ends of the lower grate-bars 9 and the three-way elbows 21 are important in increasing the circulation of the boiler, since the water in these vertical pipes 10 is exposed to the fiercest heat of the fire, and a rapid circulation is thus insured. The water-box or manifold D is supplied with water from the coolest water in the boiler, preferably by means of supply-pipes 12, which latter connect the lower portions of said manifold with the lowest portion of the boiler at the rear of the ash-pit or fire-chamber. The water circulates from the coolest portion of the boiler through the supply-pipes 12, of which there are preferably three, as shown, Fig. 2, to the manifold or water-box D, thence either through the lower grate-bars 9 and vertical connections 10 to the radial connections 30, or through the upper grates 3 to the said radial connections 30, and thence through said connections 30 to the hottest water above the crown-sheet.

For the purpose of causing the draft to pass upwardly through the lower grate and of preventing it from passing below and behind the said grate I provide a supporting-piece 13, which is of the L shape in cross-section shown, Fig. 1, and which extends across the furnace from side to side of the ash-pit and is secured at each end thereof to the side of the ash-pit in any well-known manner. I fill the interior of this support 13 with fire-brick or other fire-resisting material, and thus form a durable partition across the furnace below the bent connections 20 and between said connections and the supply-pipes 12, there being only sufficient space between the said supply-pipes and the bottom of the supporting-piece 13 to accommodate a damper 15, which is formed, preferably, from sheet-iron or the like. The damper 15 is arranged to slide on top of the said supply-pipes 12 and between said pipes and the supporting-piece 13. The said damper 15 extends from side to side of the furnace and rearwardly to the rear wall of the ash-pit and serves in connection with the supporting-piece 13 to prevent the draft from passing below and behind the lower grates. The draft is therefore forced to pass upwardly through the said lower grate and between the vertical connections 10. As ashes and the like will collect on the damper 15 the construction above described is provided to permit the said damper to be slid forward toward the front of the furnace by the use of a poker or similar device, the front edge of said damper being provided with a projection or eye by means of which it may be drawn forward by the aid of the poker. As the damper is drawn forward the ashes or other material which have collected upon it will be forced off and will drop into the ash-pit, from whence they may be readily removed.

At 221 are shown projections which preferably are integral with the front plate of the furnace and which extend slightly over the front edge of similar projections on the manifold or water-box D. The projections 221 are located just below each fuel-door and serve to prevent any fuel from getting into the space in front of the manifold or water-box D.

The stack or flue is shown at 23 and may be of any well-known construction.

In the drawings various other parts of the boiler are shown which I do not deem it necessary to describe, inasmuch as their construction is familiar to all skilled in the art.

At Fig. 9 a modification is shown in which the upper ends of the radial connections 30 instead of entering the crown-sheet direct are connected by means of bent connections 36 with horizontal connections 37, which enter the tube-sheet at the rear of the furnace, as shown. By this construction an extension

of the heating-surface is obtained, while the rapidity of the circulation is not interfered with.

The closure device, consisting of the supporting-piece 13 and damper 15, above described, by means of which the draft is prevented from passing below and behind the lower grate, may be variously modified.

In Figs. 4 to 8, inclusive, I have shown several forms of the closure device above described for preventing the draft of the lower grate from passing below and behind said grate. In Fig. 4 the supporting-piece 13 is employed in substantially the same manner as in Fig. 1 and as previously described. In the modification shown in the said figure, however, the presence of supply-pipes 12, passing underneath the said supporting-piece 13, is not contemplated, such supply-pipes being otherwise located, thus leaving the entire space below the supporting-piece 13 down to the floor of the ash-pit free. The form of damper employed, however, may be such as is shown in said figure at 50. This damper is pivoted at its upper edge in any suitable manner to the under side of the support 13. When closed, it occupies a substantially vertical position, and it may be opened or swung up into the dotted-line position shown for the purpose of cleaning out that part of the ash-pit which is located rearwardly of it.

In the modification shown, Fig. 5, the damper 51 occupies when closed a horizontal position, being pivoted at its rear edge in any well-known manner and being provided with an arm 60, (indicated in dotted lines,) with which a slide-rod 61 is connected, which projects forwardly to the front of the furnace and is provided with a handle 62, by means of which the said rod may be drawn forward when it is desired to swing the damper down into the vertical position indicated by the dotted lines 63. By this contrivance the damper may be readily operated to allow ashes and the like which collect thereon to drop down into the ash-pit.

The modified construction shown, Fig. 6, differs only in the method of constructing and operating the damper. In this construction the damper 55 is pivoted centrally at each end by means of a rod to which the damper is secured, the rod being journaled at each side of the furnace and at one end being extended and being provided outside the furnace with a handle, whereby the damper may be swung through a quarter of a revolution in order to dump the ashes which may have collected thereon into the ash-pit.

Fig. 7 shows another modified form which in place of the damper 55, employed in the form previously described, employs a slide-damper, which is shown in plan view at Fig. 8, and which is composed of a stationary slotted plate secured between the brickwork at the rear of the furnace and the lower rear edge of the support 13 and a correspondingly-slotted sliding part provided with a handle 56, which projects to the outside of the furnace, so that the damper-slide may be reciprocated in order to allow the ashes thereon to drop through to the ash-pit.

I prefer to make the upper grate-tubes 3 of smaller diameter than the lower grate-tubes 9, without, however, increasing the number, the axis of each upper grate-tube being preferably, though not essentially, in the same vertical plane as one of the lower grate-tubes, thereby giving a wider opening between the peripheries of the upper tubes than between the lower tubes. By this construction the coarser pieces of fuel will remain on the upper grate until reduced by burning, while the finer pieces will fall through the openings onto the lower grate.

In the modification shown in Figs. 10 to 13 I have shown my invention as applied to a boiler having no internal fire-box, the furnace being entirely outside of the boiler. The upper and lower grate-tubes are connected with the radial connections 31 in similar way to that already described for connecting the grate-tubes with the radial connections 30. In the former case, however, the connections 30, being within the boiler, radiated outwardly, while in the modified form shown in Figs. 10 to 13 the connections 31 radiate inwardly, passing through the shell E and connecting with the water-space of the boiler. The water-box consists of the upright portion F, leading into the boiler, and two horizontal portions $F' F^2$, one upper and lower, into which, respectively, the upper and lower grate-tubes enter.

A modified form of the damper 55, previously described, is employed in Fig. 10, consisting of a slide 71, operated by a handled rod 72 from the front of the furnace.

In the modification shown in Figs. 14 and 15 the upright connections 35, which correspond with the connections 30, Fig. 1, are entered directly into the tubes 36.

What I claim is—

1. A boiler-furnace having an upper water-grate composed of a series of tubes connected at their rear ends with the water-space of the boiler by independent connections for the respective tubes, a water-box or manifold with which the front ends of said grate-tubes are connected, a lower water-grate composed of a series of tubes connected at their front ends with a water-box or manifold, a series of vertical connections whereby the rear ends of the said lower grate-tubes are connected with the water-space of the boiler, and supply-pipes connecting said water-box or manifold with the water-space of the boiler, said upper series of tubes being of smaller diameter than the lower series, and with wider spaces between their peripheries than the lower series substantially as set forth.

2. A boiler-furnace having an upper water-grate composed of a series of tubes connected at their rear ends with the water-space of the

boiler by independent connections for the respective tubes, a water-box or manifold with which the front ends of said grate-tubes are connected, a lower water-grate composed of a series of tubes connected at their front ends with the said manifold, a series of vertical connections whereby the rear ends of the said lower grate-tubes are connected with the boiler connections of the upper grate-tubes, and supply-pipes connecting said water-box or manifold with the water-space of the boiler, said upper series of tubes being of smaller diameter than the lower series, and with wider spaces between their peripheries than the lower series substantially as set forth.

3. A boiler-furnace having upper and lower water-grates and suitable connections therefor with the water-space of the boiler, and having a movable closure device located at the rear of the lower water-grate tubes for closing the space between the rear ends of said lower water-grate tubes and the adjacent surface of the furnace-chamber, whereby the draft of the lower grate is prevented from passing below and behind said grate and is caused to pass upwardly through the same, said closure device being made movable in order to permit of cleaning behind the same substantially as set forth.

4. A boiler-furnace having an upper and a lower series of tubular water-grates, the upper series being of smaller diameter than the lower series, and with wider space between their peripheries than the lower series, substantially as set forth.

5. A boiler-furnace having an upper and a lower series of tubular water-grates, the intervals between the axes of the upper grate-tubes being the same as the intervals between the axes of the lower grate-tubes, and the diameter of the upper grates being less than the diameter of the lower grate-tubes, substantially as set forth.

6. A boiler-furnace having an upper water-grate composed of a series of tubes connected at their rear ends with the water-space of the boiler by independent connections for the respective tubes, a water-box or manifold with which the front ends of said grate-tubes are connected, a lower water-grate composed of a series of tubes connected at their front ends with the said manifold, a series of upright connections whereby the rear ends of the said lower grate-tubes are connected with the boiler connections of the upper grate-tubes, and supply-pipes connecting said water-box or manifold with the water-space of the boiler, the intervals between the axes of the upper grate being the same as the intervals between the axes of the lower grate-tubes, and the diameter of the upper grate-tubes being less than the diameter of the lower grate-tubes, substantially as set forth.

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

EDWARD B. PARKHURST.

Witnesses:
WILLIAM A. COPELAND,
ROBERT WALLACE.