

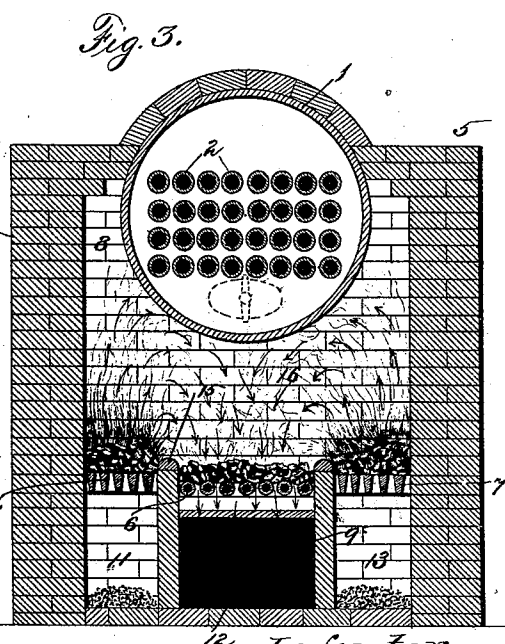
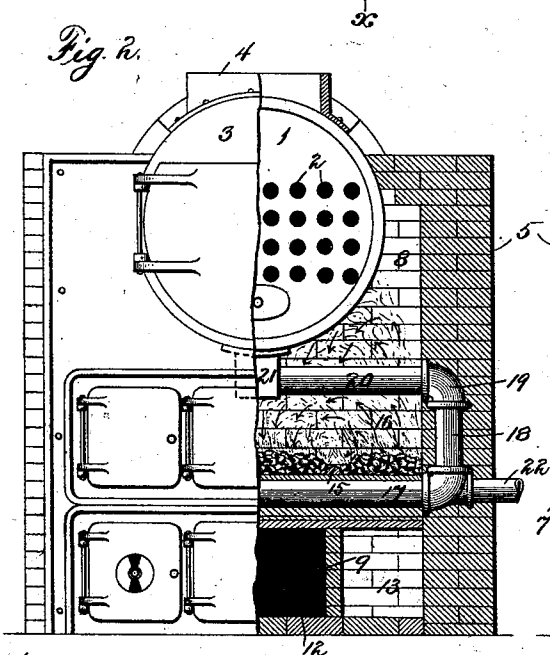
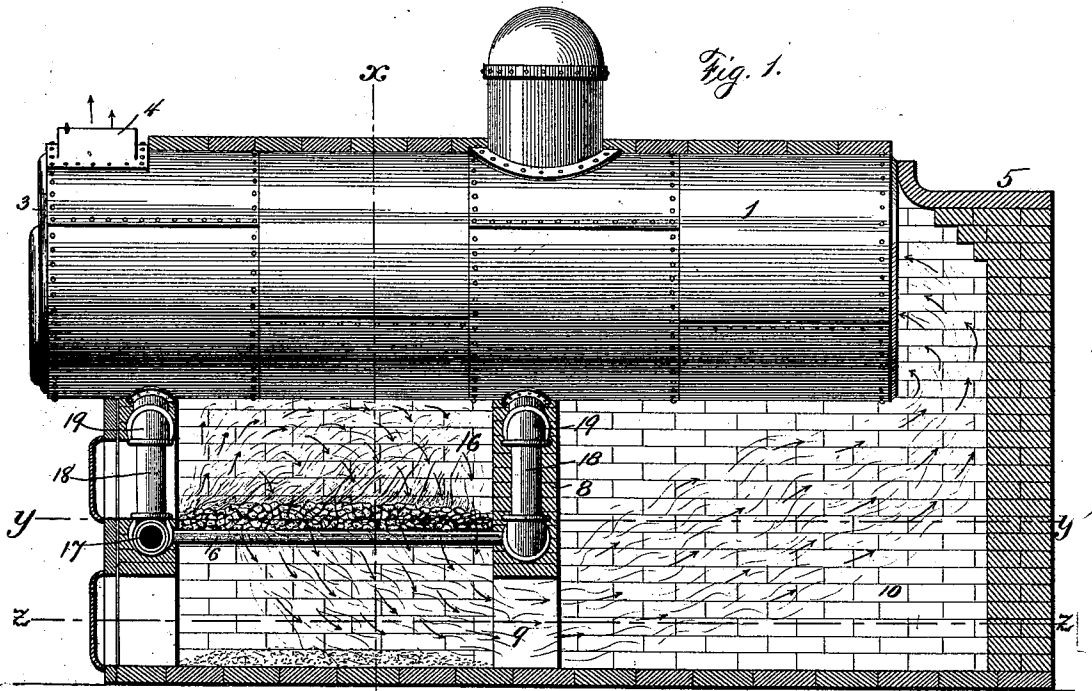
(No Model.)

2 Sheets—Sheet 1.

W. S. PLUMMER.  
SMOKELESS BOILER.

No. 514,869.

Patented Feb. 13, 1894.



Witnesses:  
*John Enders, Jr.*  
*W. J. Sanney.*

*Wm. S. Plummer*  
 Inventor  
 by *Higdon & Higdon, Solicitors*  
 Attorneys.

(No Model.)

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Fig. 4.

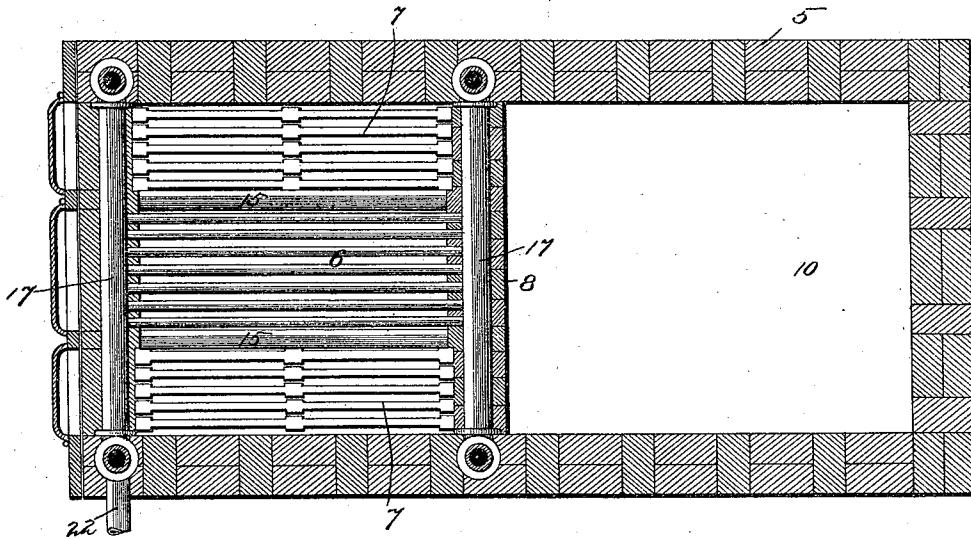
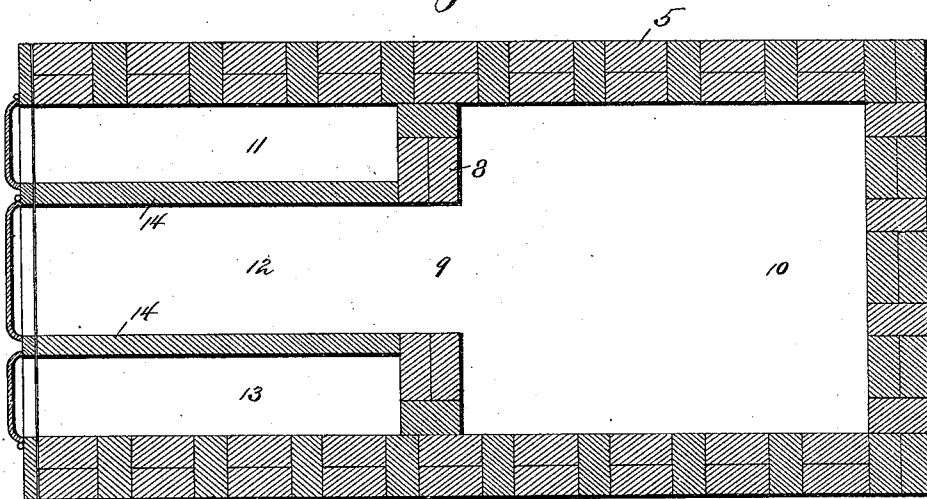


Fig. 5.



Witnesses:

John Anders Jr.  
W. J. Sankey

Inventor

William S. Plummer

by

Higdon & Higdon & Longard  
Attorneys

# UNITED STATES PATENT OFFICE.

WILLIAM S. PLUMMER, OF ST. LOUIS, MISSOURI.

## SMOKELESS BOILER.

SPECIFICATION forming part of Letters Patent No. 514,869, dated February 13, 1894.

Original application filed February 6, 1893, Serial No. 461,090. Divided and this application filed August 9, 1893. Serial No. 482,779. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM S. PLUMMER, of the city of St. Louis, State of Missouri, have invented certain new and useful Improvements in Smokeless Boiler-Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to "smokeless furnaces" of the class known as "down-draft" furnaces, and it may be said to consist in a novel and peculiar combination and arrangement of both the up-draft fire-grate and the down-draft water-grate, particularly adapted for use under steam-boilers.

My invention consists further in certain details of construction, as will be herein fully set forth and pointed out in the claims.

This application is a division of a prior application for the same subject matter filed by me February 6, 1893, Serial No. 461,090, allowed September 27, 1893.

In the drawings: Figure 1 is a sectional side elevation of a boiler-furnace embodying my invention. Fig. 2 is a sectional front elevation with parts broken away. Fig. 3 is a sectional transverse elevation of the same, the section being taken on the line  $x-x$  of Fig. 1. Fig. 4 is a sectional plan view of the same, the section being taken on the line  $Y-Y$  of Fig. 1. Fig. 5 is a similar view to the last, with the section taken on the line  $Z-Z$  of Fig. 1.

Referring again to the drawings: 1 indicates the boiler or other object to be heated. The boiler has the usual horizontal flues 2 and smoke-cap or breeching 3 communicating with the chimney or smoke-stack connection 4.

5 indicates furnace walls, which, in the case of a horizontal steam-boiler, are the same as usual, with the exception of the bridge-wall and the grate-setting and the bars near by the grates.

I may state again that my invention contemplates a novel combination of a down-draft water-grate 6 and one or more up-draft fire-grates 7. (See Fig. 3.) These different grates are relatively located with a series of solid grate-bars forming a separate fire-grate on each side of the water-grate. There is a

single bridge-wall 8 over all the grates, and this is distinguished from the usual bridge-wall in that it is fitted closely to the under side of the boiler or other object to be heated, so as to prevent any passage of products of combustion between it and said object, or in other words, it has an imperforate surface above the grates, but it is arched or otherwise supported across the space beneath the object to be heated, and in a plane below the plane in which the grates are located, so as to form what I term a fire-passage 9 centrally beneath the imperforate portion of said bridge-wall.

10 indicates an open space beneath the object to be heated, and in the rear of the grates, which may be of any desired area and shape, to be determined by the arrangement of the walls 5 and the floor of the furnace, the only essential construction being that said space or chamber 10 be open at the top so as to expose the boiler or thing to be heated to the direct action of the flames and heat issuing from said fire-passage 9 as is hereinafter stated.

The space beneath the grates, which would ordinarily correspond to the ash-pit of an ordinary boiler furnace, is divided longitudinally into three separate chambers 11, 12 and 13 respectively, which I denominate the two side ash-pits and the central combustion-chamber, 12 indicating said combustion-chamber.

14 indicates a series of short longitudinal parallel walls or partitions which are located beneath the grates, and which thus divide the space below the grates into separate chambers. These walls are preferably built of fire brick, and extend vertically a short distance above the upper surface of each grate, so as to form low longitudinal bridge-walls 15 in the combustion-chamber 16. These low bridge-walls project upward in said combustion-chamber a distance above the plane of the upper surface of said grates. The object of these low bridge-walls is to separate the grate surface into three distinct portions each extending longitudinally of the furnace, thus permitting each separate portion of the grate surface to be fired and cleaned separately and alternately without disturbing the fire on

either of the remaining portions. These low longitudinal bridge-walls 15 may be dispensed with in some cases if desired, as their function is mainly to direct the flame and heat upward toward the thing to be heated, prior to its entrance into the central combustion-chamber. The upper portions of these low bridge-walls are rounded or made apical in form, as shown, so as to prevent the lodgment of ashes and cinders thereon.

Located above each of the side ash-pits 11 and 13 is a series of grate-bars of a common solid variety forming an up-draft fire-surface 7, and located above the central combustion-chamber 12 is a series of tubes forming a down-draft fire-surface 6, at one side of each of said series of ordinary grate-bars. These grates are preferably constructed as here shown and described, but of course variations in them not amounting to invention may be made during the course of their construction and erection, without departing from my invention.

The central fire-supporting surface is here shown as consisting of a series of tubes having each end threaded or otherwise arranged and properly connected to a larger transverse tube 17 extending across the furnace and connected with the water or steam-space of the boiler.

I here show two large transverse tubes 17, one at the forward ends of the water-tubes 6 and one at their rear ends, and both connected to the water-space of the boiler by means of shorter vertical tubes 18, elbows 19, upper horizontal transverse tubes 20 and a three-way cast iron fitting 21, the said three-way fitting having its upper surface of such a contour as to make a tight joint with the under side of the boiler, and all of which may be constructed by a skilled mechanic without further description. The short vertical tubes 18 and the transverse tubes 17, also the elbows 19 are located or incased in and surrounded by the material of which the front and bridge-walls are composed, to shield the same from the intense heat of the fire to which they would otherwise be exposed. (See Fig. 1.) It will be observed that the tubes 17 extend completely across the furnace and are supported partially by the side-walls thereof.

From the above it will be seen that the water-tubed fire-surface is placed in communication with the water-space of the boiler at each end of said fire-surface, and at different points upon the outer surface of the boiler, so that circulation of water therein may take place in either direction.

I may state that I have found it to be advantageous to inject the feed-water through the forward transverse tube 17, and for this purpose I have shown a suitable connection 22. (See Figs. 2 and 4.) The front of the furnace is fitted with a feed-door directly opposite each fire surface, and each of the ash-pits is provided with a door, all of which doors may be of common construction. By means

of this arrangement each fire-surface may be separately supplied with fuel and cleaned independently of the others.

The method or mode of supplying fuel to the furnace will appear later on herein.

The operation is as follows: A fire is built in contact with all of the fire-surfaces and permitted to burn until glowing coals are produced thereon; then the side fire surfaces and the central fire-surface are supplied with fuel alternately, that is, so that there would be a glowing bed of coals upon the said central fire-surface always when fresh fuel is thrown upon either of said side fire surfaces, and so that the smoke from said side fire surfaces will be caused to pass downward through said bed of glowing coals carried by said central surface, said central surface being supplied with fresh fuel at times when said side surfaces have located upon them, or one of them at least, a glowing bed of coals. It will thus be observed that the central fire surface with its down-draft grate, acts not only to consume the smoke generated by itself, but it acts as a smoke-consumer for the products of combustion discharged by the fire surfaces located on each side and closely adjacent it, with the result that the smoke produced by all of the fire-surfaces, is consumed prior to its discharge into the smoke-stack or chimney of the furnace.

I do not broadly claim the construction of a down-draft grate located adjacent an up-draft grate in the same furnace for I am aware that prior to my invention the same had been used, but in a different relative location from that which I herein show and claim; a single down-draft grate having been then arranged only in the rear of an up-draft grate.

What I claim is—

1. A smoke consuming furnace having a single down-draft grate, and up-draft grates located on opposite sides of said down-draft grate, substantially as herein specified.

2. A smoke consuming furnace having a down-draft grate and up-draft grates located on opposite sides of said down-draft grate and each longitudinally of a single furnace and connected for operation, substantially as herein specified.

3. The improved smoke-consuming furnace, constructed with a single down-draft grate and two up-draft grates located one on each side of said down-draft grate and connected to discharge the products of combustion from the two side-grates down into and through the said down-draft grate, substantially as herein specified.

4. The improved smoke-consuming-furnace, constructed with two series of solid grate-bars 7 arranged one series at one side of the furnace and another series at the opposite side of the furnace, each series forming a separate up-draft fire-supporting surface extending longitudinally of said furnace, a central fire-supporting surface 6 composed of hollow grate-bars or tubes and arranged

5 closely adjacent and between said side-grates  
and also extending longitudinally of the fur-  
nace, two transverse tubes 17 arranged one  
at the forward ends of the water-tubes 6 and  
5 one at the rear ends thereof and to which the  
ends of said water-tubes are connected, two  
horizontal transverse-tubes 20 located one  
above each of said transverse-tubes 17, short  
vertical tubes 18 and elbows 19 located in the  
10 walls of the furnace and connecting said  
transverse-tubes 17 with said transverse-  
tubes 20, and three-way cast iron fittings 21  
applied to said tubes 20 and connecting the  
interior thereof with the interior of the boiler  
15 at points separated a distance apart, sub-  
stantially as herein specified.

5. The improved smoke-consuming furnace,  
constructed with a bridge-wall 8 fitted closely  
to the under side of the boiler so as to pre-  
vent passage of products of combustion be-  
tween itself and said boiler and supported  
20 across the space beneath said boiler to form  
a fire-passage 9 centrally beneath the said  
bridge-wall and below the plane of the fire-

grates of the furnace, a single down-draft 25  
located in vertical alignment with said cen-  
tral fire-passage grate, two up-draft grates  
located one at each side of said down-draft  
grates and all three grates longitudinally of  
the furnace, longitudinal parallel walls 14 30  
located beneath said grates and dividing the  
space thereat into three separate chambers  
11, 12 and 13 respectively, one of said cham-  
bers being directly beneath said down-draft  
grate, and one beneath each of said side- 35  
plates, said central-chamber being connected  
with the said central passage 9 beneath said  
bridge-wall a feed door opposite each grate,  
a door for each of said chambers and con-  
nections between said passage 9 and a chim- 40  
ney or stack, substantially as herein specified.

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

WILLIAM S. PLUMMER.

Witnesses:

A. A. BLANKEMMISTER,  
JNO. C. HIGDON.