

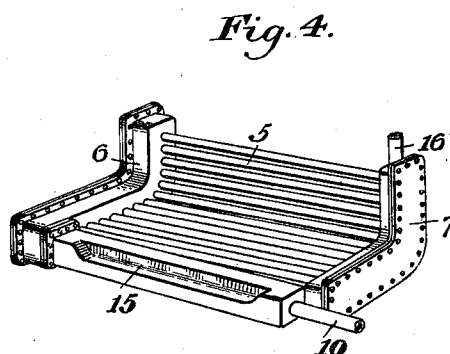
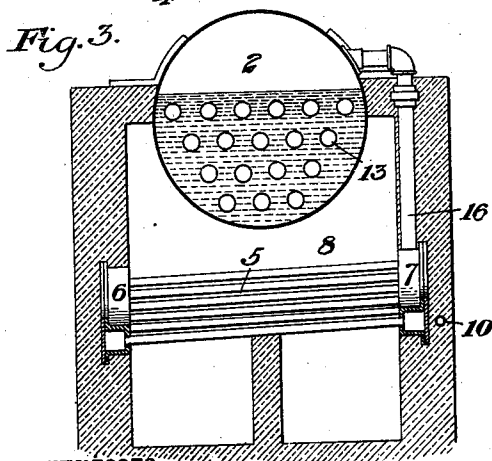
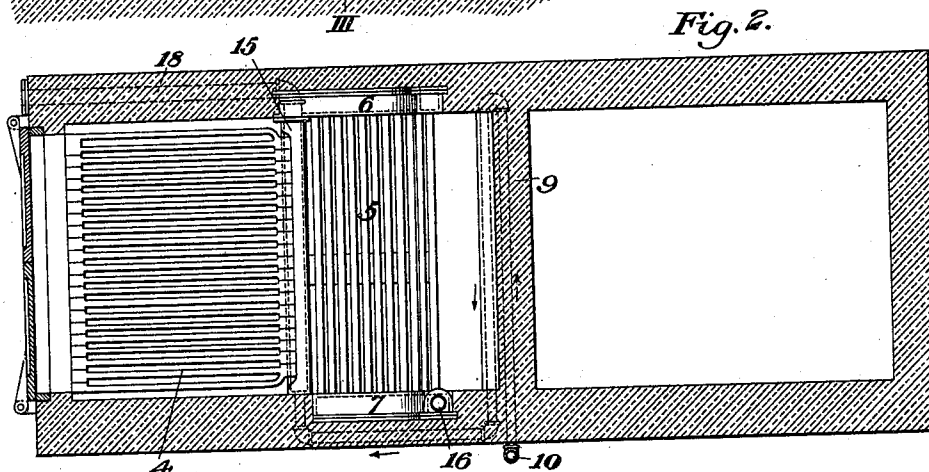
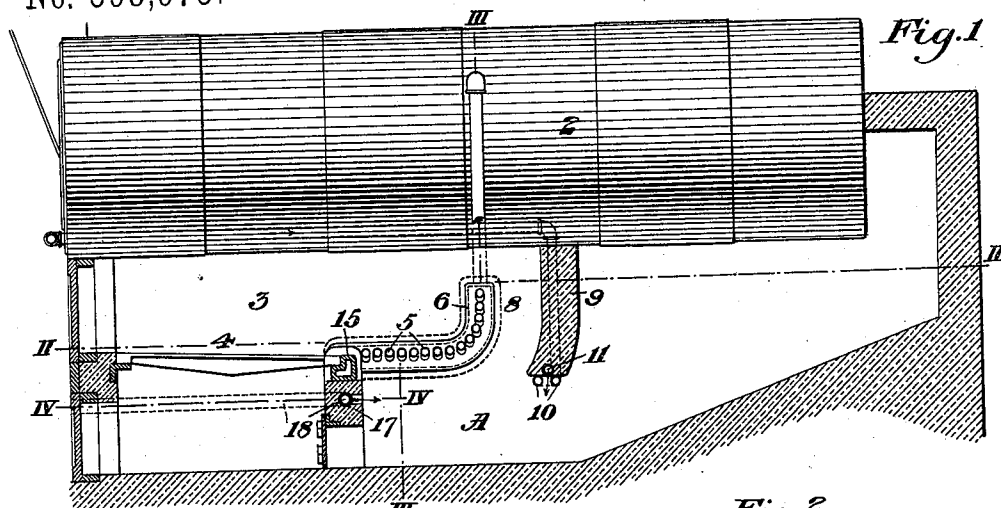
(No Model.)

2 Sheets—Sheet 1.

W. H. BRADLEY.  
WATER HEATER AND SMOKE CONSUMER.

No. 598,973.

Patented Feb. 15, 1898.



WITNESSES  
S. P. Simpson  
F. E. Harpell

INVENTOR  
William H. Bradley  
by James K. Bakewell  
his Attorney

(No Model.)

2 Sheets—Sheet 2.

W. H. BRADLEY.  
WATER HEATER AND SMOKE CONSUMER.

No. 598,973.

Patented Feb. 15, 1898.

Fig. 5.

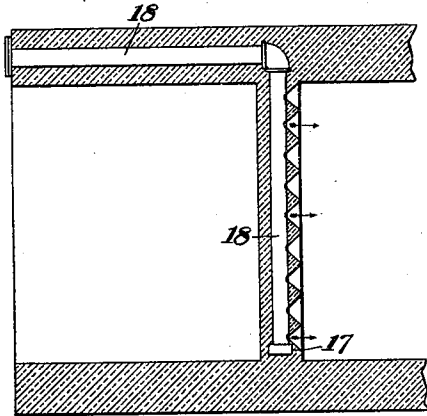


Fig. 6.

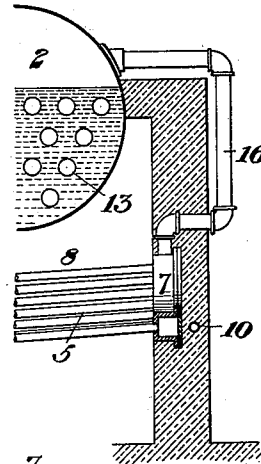


Fig. 7.

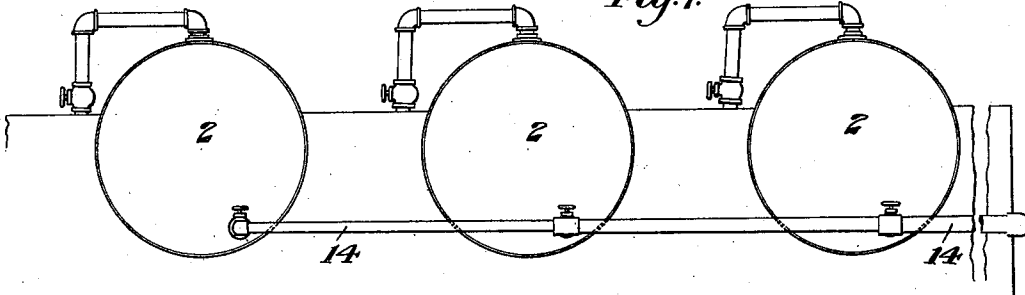
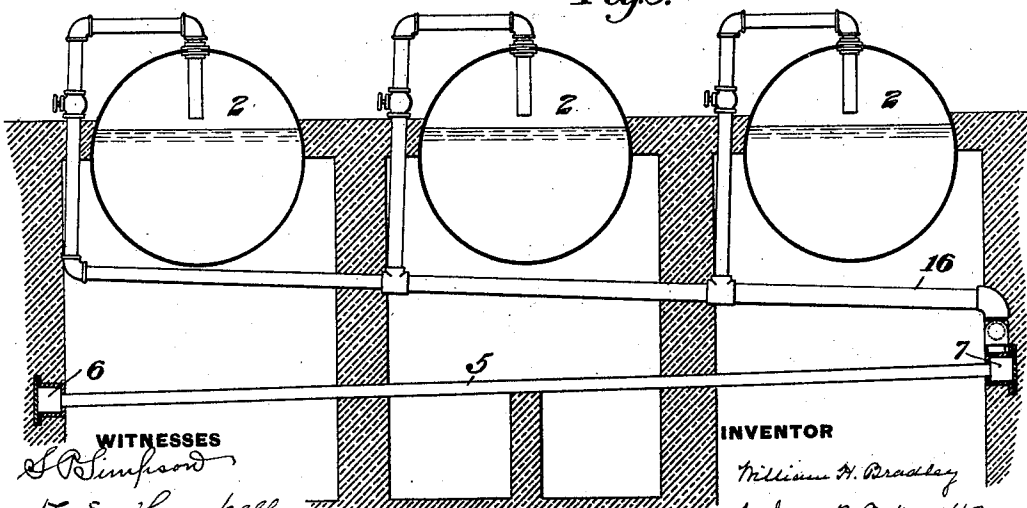


Fig. 8.



WITNESSES

*S. Simpson*  
*F. E. Caspell*

INVENTOR

*William H. Bradley*  
*by James K. Rakewell*  
*his Attorney.*

# UNITED STATES PATENT OFFICE.

WILLIAM H. BRADLEY, OF BELLEVUE, PENNSYLVANIA.

## WATER-HEATER AND SMOKE-CONSUMER.

SPECIFICATION forming part of Letters Patent No. 598,973, dated February 15, 1898.

Application filed June 11, 1897. Serial No. 640,281. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM H. BRADLEY, of Bellevue, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Water-Heaters and Smoke-Consumers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical sectional view of my improvement on the line I I of Fig. 2. Fig. 2 is a horizontal sectional view on the line II II of Fig. 1. Fig. 3 is a vertical sectional view on the line III III of Fig. 2. Fig. 4 is a detached view of the bars 5 and side chambers 6 and 7. Fig. 5 is a horizontal sectional view on the line IV IV of Fig. 1. Fig. 6 is a vertical sectional view of a modification. Figs. 7 and 8 are views showing my improvement as applied to a series of boilers.

My invention relates to an improvement in water-heaters and smoke-consumers in furnaces in connection with steam-boilers; and it consists in a novel construction and arrangement of water-tubes and air-conduits whereby a rapid and continuous circulation of water is maintained through the water-heating tubes and a thorough combustion of smoke, and a consequent addition to the heat and an abatement of the smoke nuisance, is insured.

I will now describe my invention, so that others skilled in the art may employ the same.

In the drawings, 2 represents the steam-boiler, and 3 the fire-chamber, having a forward set of longitudinal grate-bars 4 and a rear set of transverse grate-bars 5, which latter set of bars are formed of water-tubes communicating with the side chambers 6 and 7, which are built in the side walls of the furnace, and these tubes 5 are arranged in a horizontal and then a vertical row, forming a bridge-wall 8, having interstices at the rear of the fire-chamber. In the rear of the vertical row of tubes 8 and at a short distance therefrom, so as to leave a space, is a hanging wall 9, built solidly of masonry and having the exposed water-tubes 10, between which may be the protected air-tube 11, having suitable perforations for the passage of air. In the rear

of the wall or deflector 9 is the flue 12, through which the products of combustion and flame pass under the boiler to the rear thereof, where they enter the usual boiler-flues 13. Leading from the boiler at or near the bottom thereof is the water-pipe 14, which opens into one of the water-tubes 10, which is bent and returns, forming the second of the tubes 10, which extends thence from the wall 9 in the side wall of the furnace to the water-chamber 15, which is located at the intersection of the grate-bars 4 and 5 and on which the ends of the grate-bars 4 rest. This water-chamber opens into the side-wall water-chamber 6, which through the water-tubes 5 and 8 communicates with the side-wall water-chamber 7. Leading from the side-wall water-chamber 7 is a water-conduit 16, which extends to and opens into the upper part of the boiler 2. Below the water-chamber 15, at the intersection of the bars 4 and 5, is a wall of masonry 17, in which is an air-conduit 18, having jet-orifices opening toward the wall 9.

The operation is as follows: The coal is fed to the grate-bars 4, where slow combustion takes place until the fuel is coked, when it is pushed back on the hollow grate-bars 5, where a red or glowing fire is maintained, fresh fuel being fed to the grate-bars 4. At the same time air is caused to pass through the air-conduits 18 and 11 and to pass into the combustion-chamber A through the jet-orifices in these pipes. As the gases and smoke arise from the green fuel on the grate-bars 4 they pass over or through the glowing fire on the hollow grate-bars 5 and 8 and through the interstices between the bars or over the bars 8, where they are deflected downward by the wall 9, so that all the smoke and gas passes into the chamber A, where, meeting the jets of air from the pipes 18 and 11, fierce combustion takes place below the water-tubes 5, 8, and 10 and the flames from which extend under the rear part of the boiler to the boiler-flues. This arrangement of walls and air-passages causes almost perfect combustion of the smoke and gases, and also produces an intense heat about the water-conduits 5, 8, and 10, which rapidly raises the temperature of the water in the pipes and causes a constant and rapid circulation of the water from

the lower part of the boiler through the water-heating chambers and conduits to the upper part of the boiler.

In some cases by properly spacing the grate-bars 5 so as to leave interstices of the proper size the air-pipes 11 and 18 may be omitted. I prefer, however, to use these devices.

In Fig. 5 the pipe 10 is shown located partly outside of the side wall.

In Figs. 6 and 7 a series of boilers is shown, in which case the hollow grate-bars 5 and 8 are continuous, extending beneath the entire series of boilers between the side-wall chambers 6 and 7, while the conduit 14, leading to the chamber 6, communicates with the bottom of each of the boilers, and the conduit 16 leads from the chamber 7 to the upper part of each of the boilers by branch pipes 20, each of which is one-third in diameter of the diameter of the pipe 16.

The advantages of my invention will be apparent to those skilled in the art. It insures an almost perfect combustion of the smoke, the very rapid heating of the water, and a great saving of fuel.

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

1. The combination of grate-bars for the slow combustion of green fuel; a set of hollow water-tubes extending horizontally and upwardly, the forward tubes forming grate-bars and the rear upwardly-extending tubes forming a bridge-wall having interstices; a hanging deflecting-wall, in rear of the bridge-wall; an air-conduit, having jet-orifices, situate below and in front of the hollow water-conducting grate-bars; and water-conduits leading from the boiler to the hollow grate-bars and from the grate-bars to the boiler, substantially as and for the purpose specified.

2. The combination of water-chambers situate in the side walls, a series of water-tubes extending horizontally and upwardly between the side chambers, the forward sections of which tubes constitute grate-bars and the rear upwardly-extending sections thereof forming a bridge-wall; a hanging-wall deflector, in rear of the bridge-wall; a water-pipe at the base of the hanging wall, which pipe communicates with one of the side chambers; an air-conduit having jet-orifices in proximity to the hollow grate-bars; and water-conduits leading from the boiler to the water-heating tubes and from one of the side chambers to the boiler, substantially as and for the purpose specified.

3. The combination of the forward grate-bars; the rear grate-bars which constitute a bridge-wall having interstices; the hanging wall or deflector, in rear of the bridge-wall; and an air-conduit, having jet-orifices situate below and in front of the rear grate-bars, substantially as and for the purpose specified.

4. A boiler-grate comprising the two side-chambers having upwardly-projecting rear

ends, a transverse chamber connecting the forward ends of said side chambers, and a series of transverse tubes connecting the horizontal and the upwardly-extending branches of the side chambers, the upwardly-extending tubes forming a bridge-wall, substantially as described.

5. The herein-described boiler-grate comprising the side chambers extending horizontally rearward and then upwardly, the transverse tubular chamber connecting the forward ends of the side chambers and constructed to support the rear end of a front or main grate, the tubes connecting both the horizontal and the vertically-extending portions of the side chambers, the upwardly-extending section of the grate thus forming a bridge-wall, and the boiler connections, substantially as described.

6. The combination of the forward grate-bars, the rear grate-bars, which constitute a bridge-wall past which the gases are adapted to flow or pass and extend at right angles to the line of the forward grate-bars, and a hanging wall or deflector at a distance from the bridge-wall, so as to leave a space between the bridge-wall and the hanging wall whereby the gases passing said bridge-wall will strike the hanging wall and be diverted downwardly into the flue; substantially as described.

7. The combination of the forward grate-bars, the rear grate-bars, which constitute a bridge-wall past which the gases are adapted to flow or pass, and a hanging wall or deflector at a distance from the bridge-wall, said wall having one or more water-tubes on its lower edge whereby the gases passing said bridge-wall will strike the hanging wall and be diverted downwardly into the flue; substantially as described.

8. The combination of the forward grate-bars, rear grate-bars, composed of hollow tubes having interstices between the tubes and forming a bridge-wall, a hanging wall at a distance from the bridge-wall, and one or more water-tubes on the lower face of the hanging wall, all of said tubes and tubular grate-bars being connected with a tube leading from the bottom of the boiler and with a return-pipe leading to the top of the boiler; substantially as described.

9. The combination of the forward grate, rear tubular grate-bars extending upwardly at their rear ends to form a water-tube bridge-wall through the interstices in which the gases are adapted to flow, and a closed wall dividing the ash-pit transversely at the juncture of the forward and rear grate-bars; substantially as described.

In testimony whereof I have hereunto set my hand.

WILLIAM H. BRADLEY.

Witnesses:

E. W. ARTHUR,  
F. E. HARPELL.