

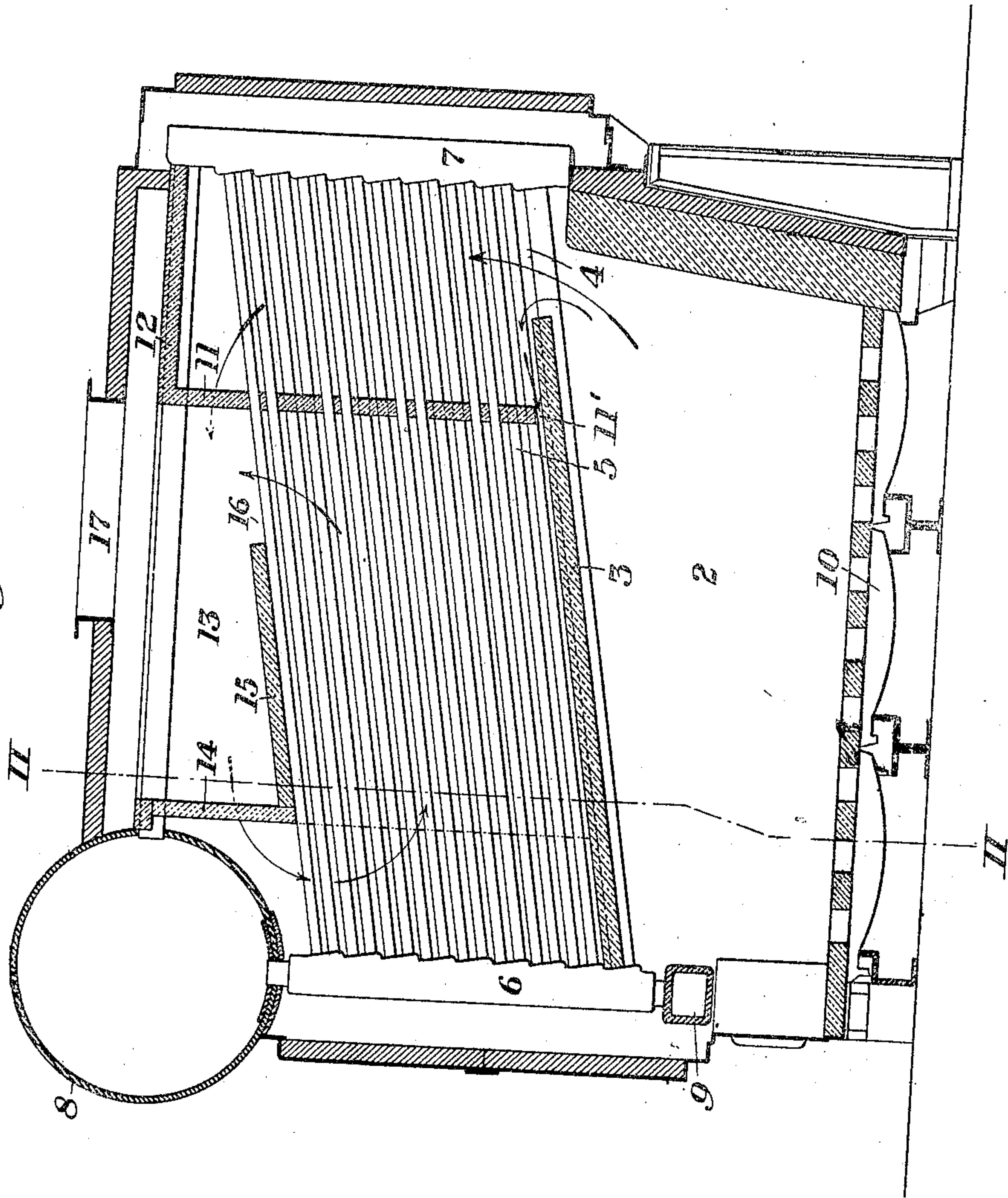
No. 897,322.

L. L. SUMMERS.  
WATER TUBE BOILER.  
APPLICATION FILED JAN. 30, 1906.

PATENTED SEPT. 1, 1908.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

R. A. Balderson,  
Wm. W. Swartz

INVENTOR

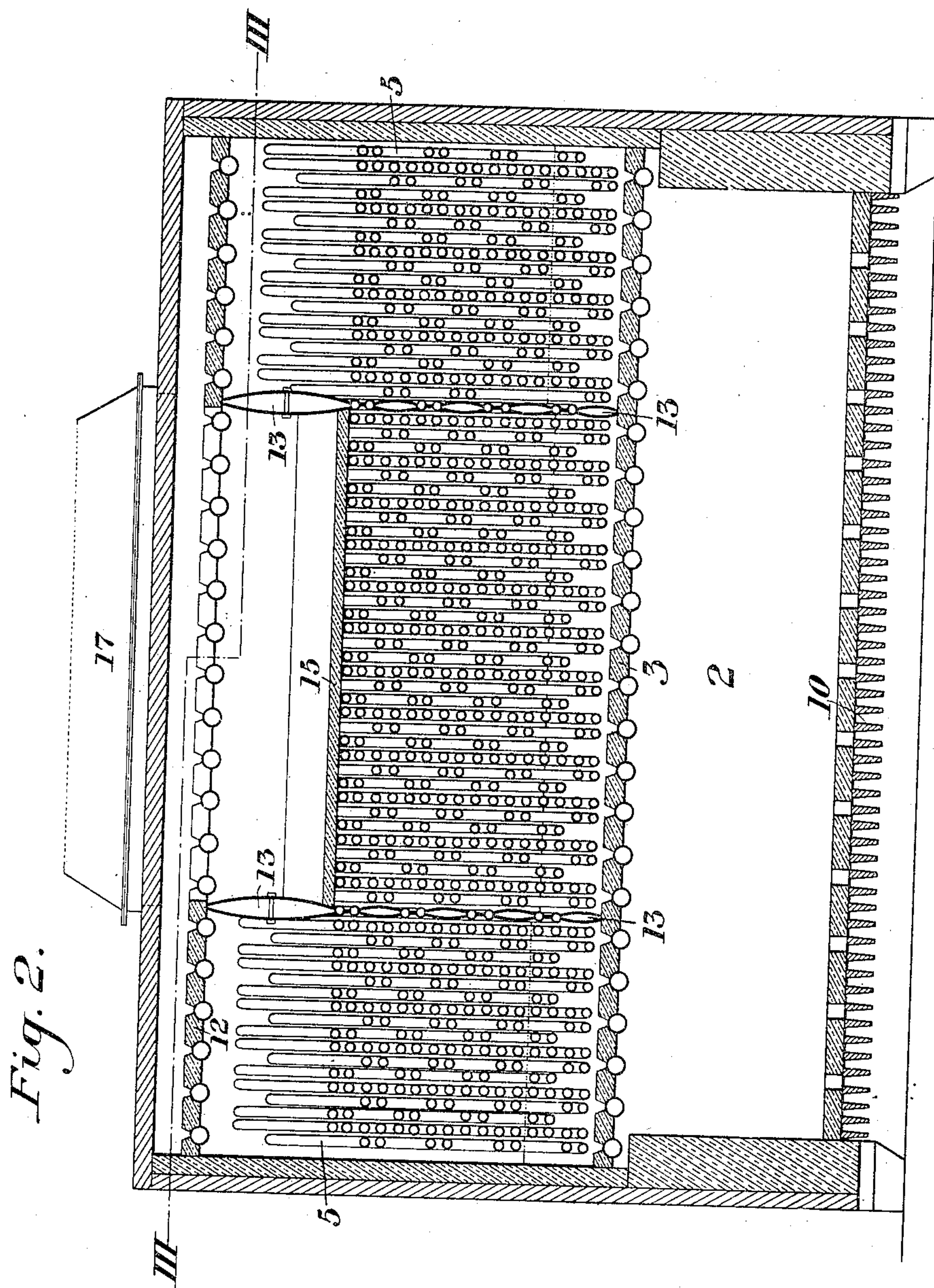
L. L. Summers,  
by Baker & Byrne  
his Attorneys.

No. 897,322.

PATENTED SEPT. 1, 1908.

L. L. SUMMERS.  
WATER TUBE BOILER.  
APPLICATION FILED JAN. 30, 1906.

4 SHEETS—SHEET 2.



WITNESSES

*R. A. Balderson*  
*Warren W. Swartz*

INVENTOR

*L. L. Summers*  
by *Balderson & Swartz*  
his Attorneys



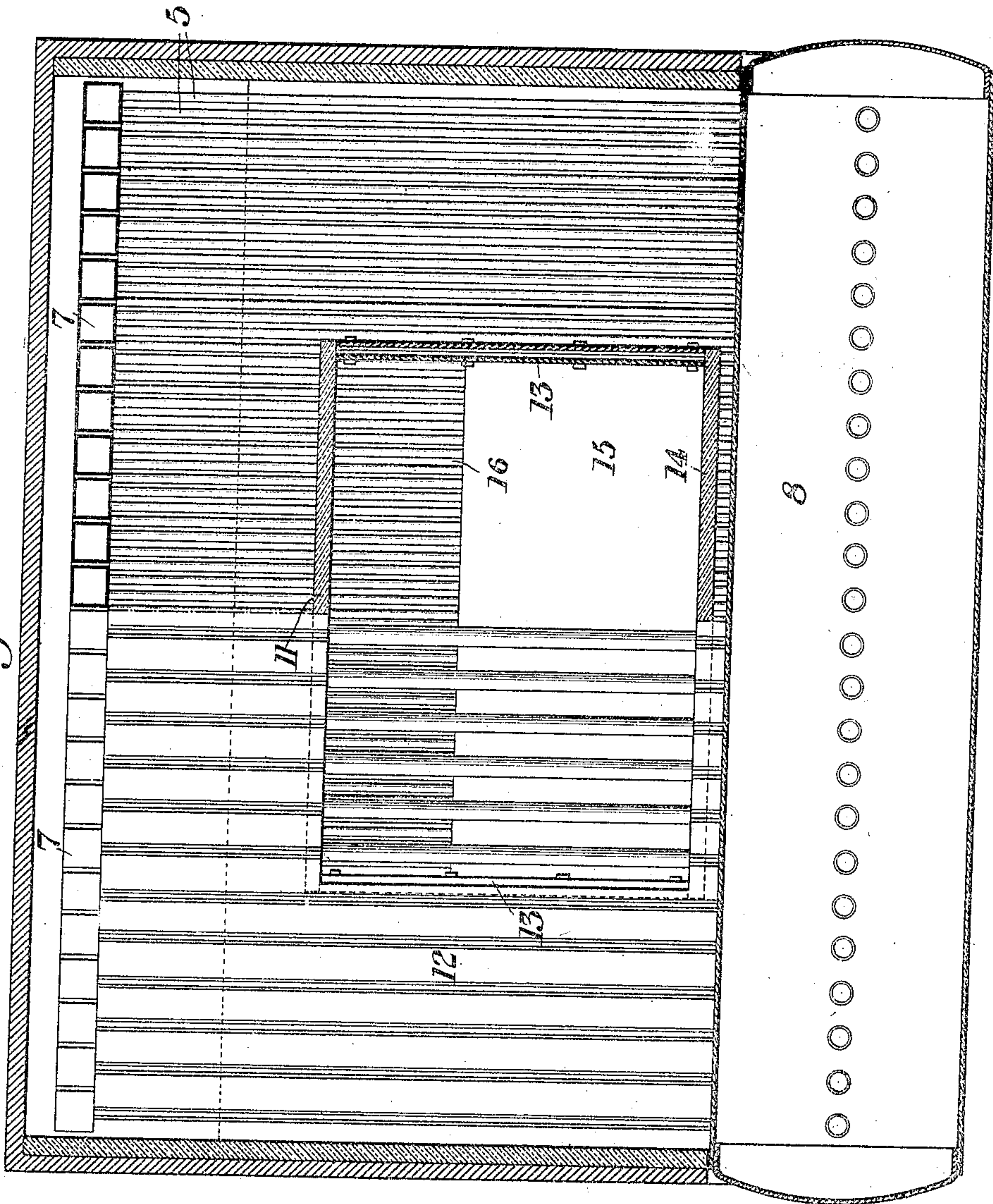
No. 897,322.

PATENTED SEPT. 1, 1908.

L. L. SUMMERS.  
WATER TUBE BOILER.  
APPLICATION FILED JAN. 30, 1906.

4 SHEETS—SHEET 3.

Fig. 3.



WITNESSES

R. A. Balderson  
Warren U. Swartz

INVENTOR

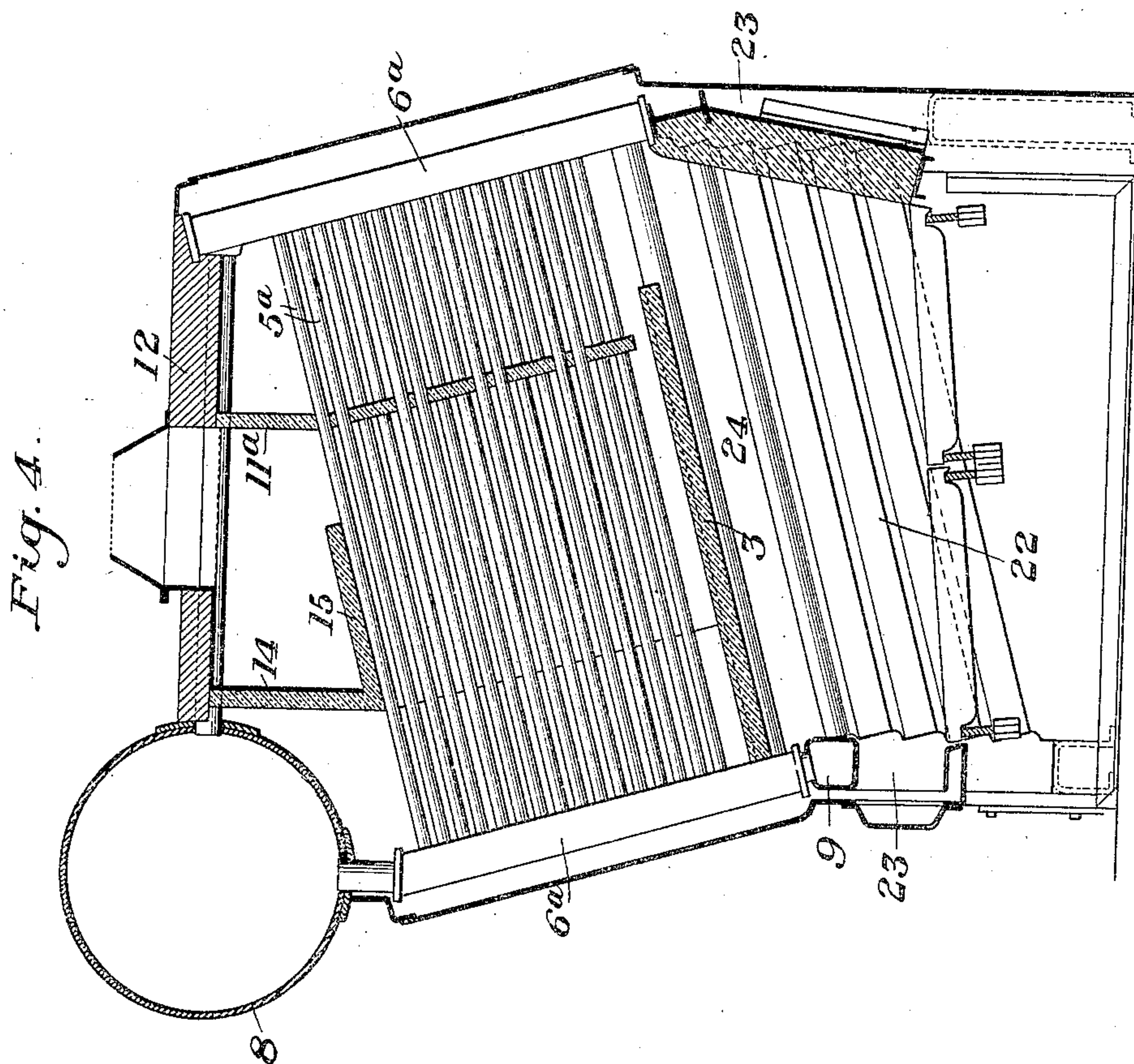
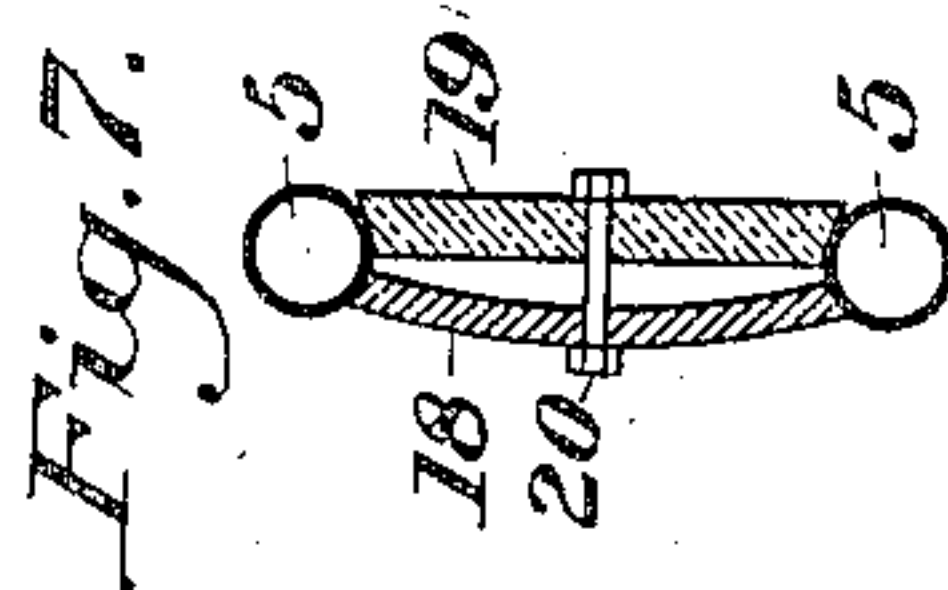
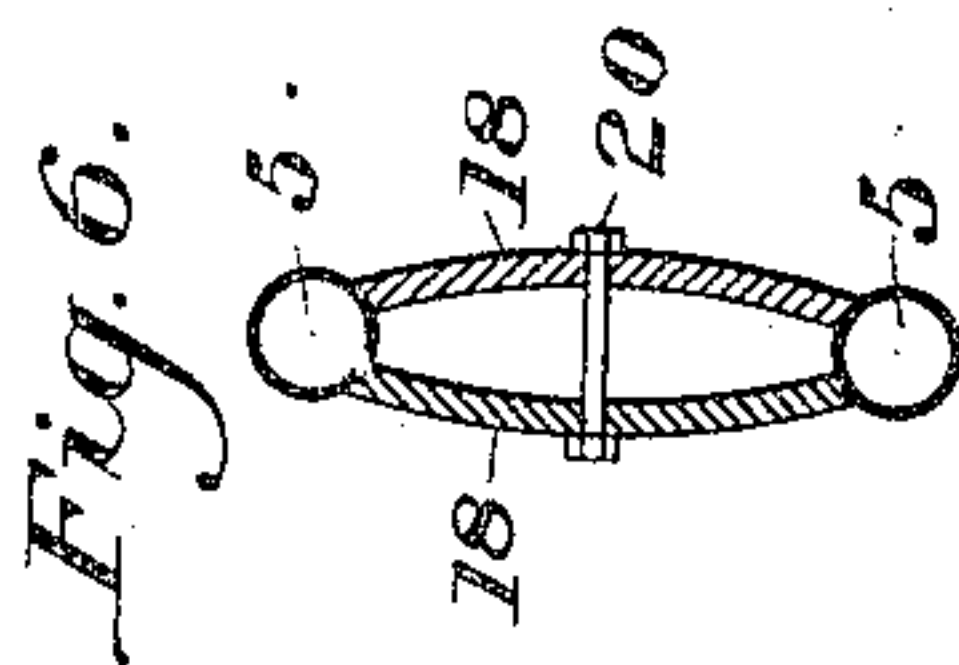
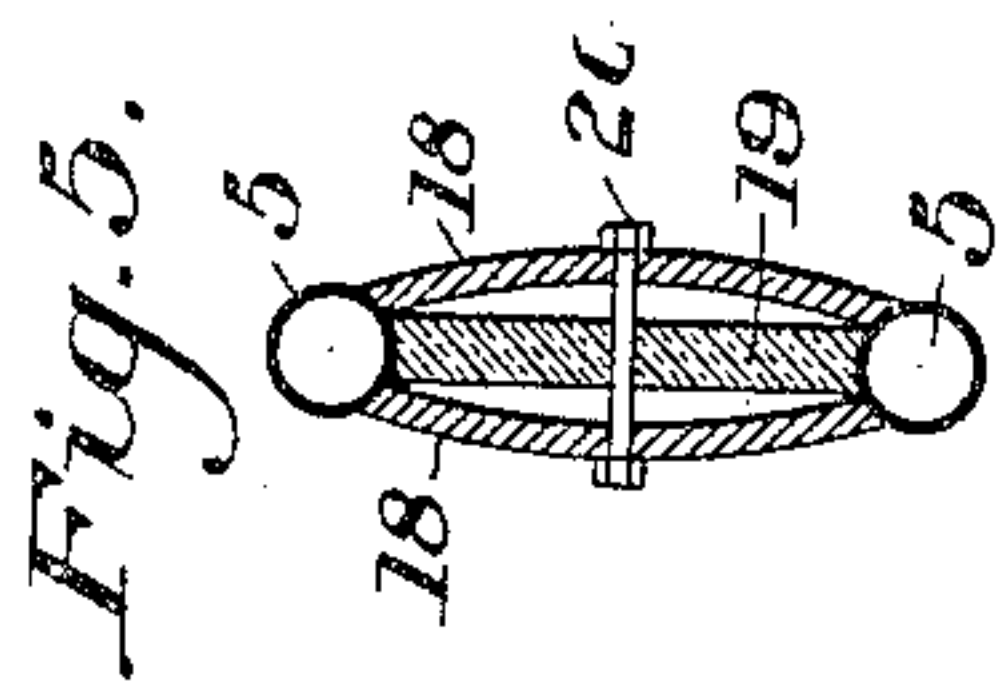
L. L. Summers  
by Behrwell & Byrnes,  
his Attorneys

No. 897,322.

PATENTED SEPT. 1, 1908.

L. L. SUMMERS.  
WATER TUBE BOILER.  
APPLICATION FILED JAN. 30, 1906.

4 SHEETS—SHEET 4.



**WITNESSES**

R. A. Balderson.  
Warren W. Swartz.

INVENTOR

L. C. Summers,  
by Baskwell & Byrnes  
his Attorneys



# UNITED STATES PATENT OFFICE.

LELAND L. SUMMERS, OF BARBERTON, OHIO, ASSIGNOR TO THE BABCOCK & WILCOX COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

## WATER-TUBE BOILER.

No. 897,322.

Specification of Letters Patent.

Patented Sept. 1, 1908.

Application filed January 30, 1906. Serial No. 298,618.

*To all whom it may concern:*

Be it known that I, LELAND L. SUMMERS, of Barberton, Summit county, Ohio, have invented a new and useful Improvement in Water-Tube Boilers, 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 of the drawings is a sectional side elevation of a water-tube boiler or generator embodying my invention; Fig. 2 is a transverse section on the line II—II of Fig. 1; Fig. 3 is a horizontal section on the irregular line III—III of Fig. 2; Fig. 4 is a sectional side elevation showing the invention applied to another form of boiler or generator; and Figs. 5, 6 and 7 are detail sectional views of different forms of longitudinal baffling which may be employed.

My invention relates more particularly to an improvement in that type of water tube generator in which the tubes are inclined upwardly and rearwardly from the front, with an enlarged furnace space at the rear of the furnace, and with a reverberatory arch or covering extending over a portion of the top of the furnace.

The object of the present improvement is to provide a free and unobstructed passage for the gases or products of combustion, and yet to divert or guide them in such a manner as to confine them to the spaces occupied by the tubes of the water tube generator, and more particularly to insure a maximum length of passage in contact with such tubes and also a maximum velocity of flow.

To this end my invention consists in the arrangement of baffling whereby the gases are forced to travel in a longitudinal direction parallel with the tubes, this passage being preferably from the furnace forwardly longitudinally with the tubes at each side of the generator, and thence rearwardly longitudinally through the central tubes, and thence up and outward through the breeching or opening to the chimney or stack. By thus confining the gases to a longitudinal and parallel movement with the tubes, the cleaning of the baffling and of the tubes is greatly facilitated, and countercurrents and eddies due to cross-impingement are avoided.

In the drawings, 2 designates the combustion chamber or furnace having the reverberatory arch or covering 3 extending over

the top of the same, but terminating short of its rear end so as to provide a transversely extending opening 4, through which the gases pass upwardly to the tubes.

5 designates the upwardly and rearwardly inclined tubes extending from the front headers 6 to the rear headers 7.

8 is a steam and water drum to which the headers 6 are connected in the usual or any suitable manner, and 9 is the usual mud drum.

10 is the furnace grate.

11 is a transversely arranged baffle, which extends vertically upward from the reverberatory arch or covering 3 to the horizontal top wall or plate 12. This baffling is placed a short distance forwardly of the forward edge of the opening 4, and is at the central portion of the generator only, leaving a free space at either side, as clearly shown in Fig. 3. Extending forwardly from the ends of the baffling 11 are longitudinal vertical bafflings 13, which extend forwardly to a point a short distance from the front end of the generator; and which extend upwardly from the reverberatory arch or covering 3 to the top plate or covering 12.

14 is a transverse baffle wall of the same length as the baffle 11, which extends from the top of the tubes to the top casing 12.

15 is a longitudinally extending baffle plate resting on top of the tubes between the vertical longitudinal baffles 13 and extending rearwardly from the lower end of the wall 14 towards the baffle 11, with the intermediate opening 16 through which the gases from the last pass escape and pass upwardly through the stack opening 17.

At the point where the vertical transverse baffling 11 joins the reverberatory arch or covering 3, it is desirable to leave a slight space or opening 11', for the purpose of permitting a slight leakage of the gases directly into the tube space which communicates with the stack, thereby tending to avoid any dead spaces in the corners or points of juncture of this baffling with the reverberatory arch or covering. This opening 11' may be made wide enough to permit all accumulated soot, ash, &c., to be blown into the furnace space by means of a steam lance or jet inserted at the front of the boiler. This permits all cleaning to be done from the front and enables the boilers to be placed more closely together.



From the arrangement of baffling shown and described, it will be seen that the gases from the furnace pass upwardly through the opening 4 and, by means of the baffle 11 are  
 5 diverted to the side of the generator so that they pass forwardly with the tubes at each side in the direction of their length. At the front the gases pass around the sides of and underneath the baffle wall 14, rearwardly  
 10 through the central tubes underneath the baffle plate 15 to the opening 16, and thence to the stack. In this manner the gases, throughout substantially their entire travel, pass in a direction parallel with the tubes.

15 The longitudinal bafflings 13 is preferably so arranged as to permit the substantial utilization of the heating surfaces of the lines of tubes where these bafflings are placed. Figs. 5, 6 and 7 illustrate three different forms of  
 20 such baffling. The construction shown in Fig. 5 consists of two convexed metal plates 18, whose edges are fitted to the adjacent tubes 5, and between which is placed a plate or piece 19 of fire-brick or other refractory  
 25 material, the whole being tied together by the bolts 20. In the construction shown in Fig. 6, the intermediate refractory member of baffling is omitted and the two metallic plates 18 used alone. This form may be  
 30 employed where the baffle is exposed to a medium temperature only. In the construction shown in Fig. 7, the baffling consists of one of the metal plates 18 and the refractory member 19, the latter being ex-  
 35 posed in use to the higher temperature. By employing baffling of these constructions, it will be apparent that insulation of the adjacent tubes is avoided and their heating surfaces are made largely available.

40 In Fig. 4 I have shown my improved arrangement of baffling applied to another form of generator, in which the headers 8<sup>a</sup>, between which extend the upper inclined tubes 5<sup>a</sup>, are placed at right angles to the  
 45 axes of the tubes, instead of vertically, as in the form first described. In this form the transverse baffling 11<sup>a</sup> is preferably placed substantially parallel with the headers. This type of boiler also employs a series of lower  
 50 tubes 22 extending between the headers 23 with an intermediate expansion chamber 24.

The arrangement of baffles is in all respects similar to that first described, as is also the circulation of gases effected thereby.

55 It will be obvious that my improved arrangement of baffling is applicable to other forms of water tube generators than those herein described, and that various changes may be made in the details thereof without  
 60 departing from the spirit and scope of my invention.

What I claim is:—

1. In a water tube generator having a reverberatory arch or covering extending  
 65 partially over its furnace, and having a

transverse opening at the rear forming an upward path for the gases, transverse and longitudinally arranged bafflings arranged to form forwardly extending longitudinal  
 70 side passes for the gases, and also a central rearwardly extending pass communicating at the front with the side passes and with the stack at the rear, substantially as described.

2. In a water tube generator of the class described, a reverberatory arch or covering  
 75 extending partially over the furnace, an upward passage for the gases between the end wall of the furnace and the reverberatory arch or covering, a transverse vertical baffle or bafflings extending upwardly and  
 80 entirely across the tubes in a vertical direction, but leaving clear spaces at each side, and subsequent longitudinal baffles or baffling arranged to cause the gases to follow a  
 85 path parallel with the tubes of the generator, substantially as described.

3. In a water tube boiler having a reverberatory arch or covering extending partially over the furnace, with an upward pass  
 90 for the gases at the uncovered portion of the furnace, a transverse baffle, and subsequent longitudinal baffles arranged to form lateral forwardly extending gas passes and a central rearwardly extending gas pass, a space  
 95 being provided between the lower edge of the transverse baffle and the said arch or covering for communication with the said central pass, substantially as described.

4. A water tube boiler having front and rear headers connected by longitudinal water  
 100 tubes, a furnace below said tubes, a horizontal baffling or reverberatory arch extending over the furnace from one end for a portion of its length and located at or near  
 105 the bottom of the series of tubes, a vertically extending cross baffle at the flue end of the horizontal baffle arranged to give an upward pass to the gases transversely of the tubes, said vertical baffle extending only a  
 110 part of the width of the series of tubes, and longitudinal bafflings arranged to give forward and back passes for the gases longitudinally of the tubes before passing to the stack, substantially as described.

5. A water tube boiler having front and  
 115 rear headers connected to inclined water tubes, a horizontal baffle or roof extending from one end of the furnace short of the other end and leaving a flue at said other end, a vertical cross baffle extending up-  
 120 wardly from the flue end of the roof, said vertical baffle occupying the central portions of the tubes and terminating short of the sides of the series of tubes, and longitudinal baffles extending from its side edges for-  
 125 wardly and causing the gases to divide and flow longitudinally of the tubes in one direction and thence unite and flow backwardly longitudinally of the tubes to an outlet flue, substantially as described.



6. A water tube boiler having front and rear headers connected by water tubes which are inclined rearwardly and upwardly, a horizontally extending roof or baffle extending from the front end of the furnace and terminating short of its rear end forming a rearwardly enlarging combustion chamber with an upwardly opening flue at its rear end, a vertical transverse baffle extending upwardly from the rear portion of the roof and extending only a part of the width of the series of tubes, and a longitudinal baffle arranged to direct the gases in forward and back passes longitudinally of the tubes before passing to the outlet flue, substantially as described.

7. A water tube boiler having front and rear headers connected by inclined water tubes, a horizontal baffle extending from one end of the furnace for a portion of its length

and located near the bottom of the series of tubes, a vertical cross baffle at the flue end of the horizontal baffle, said vertical baffle extending completely to the roof in a vertical direction but only a part of the width of the series of tubes in a horizontal direction, and longitudinal vertical baffles extending from the vertical baffle and causing the gases to flow longitudinally of the tubes through two passes, the gases dividing in one of said longitudinal passes and being united in the other, substantially as described.

In testimony whereof, I have hereunto set my hand.

LELAND L. SUMMERS.

Witnesses:

JAS. P. SNEDDON,

WALTER J. LUCAS.