

No. 744,135.

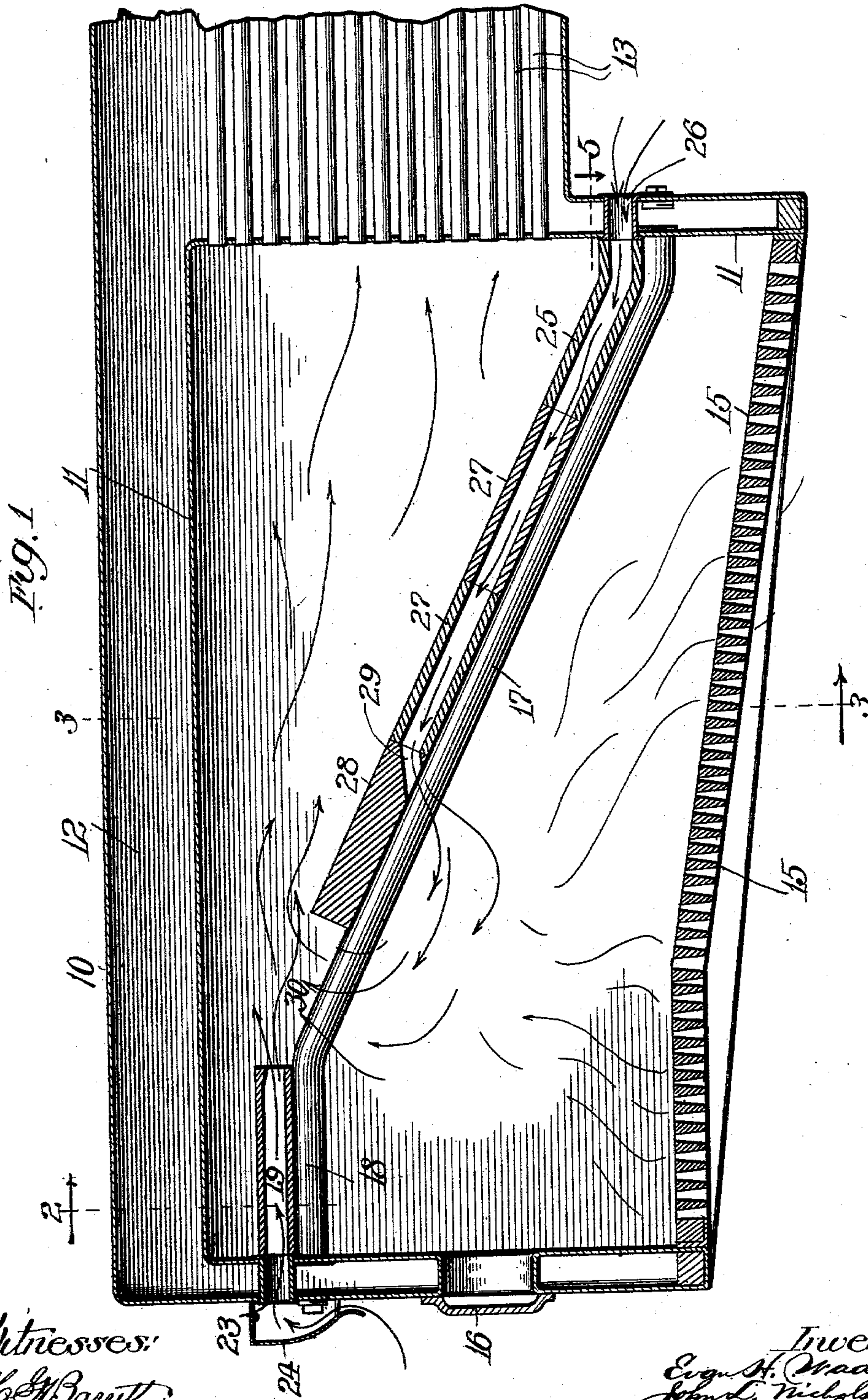
PATENTED NOV. 17, 1903.

E. H. WADE, J. L. NICHOLSON & S. C. SMITH.  
FURNACE.

APPLICATION FILED JAN. 30, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 3

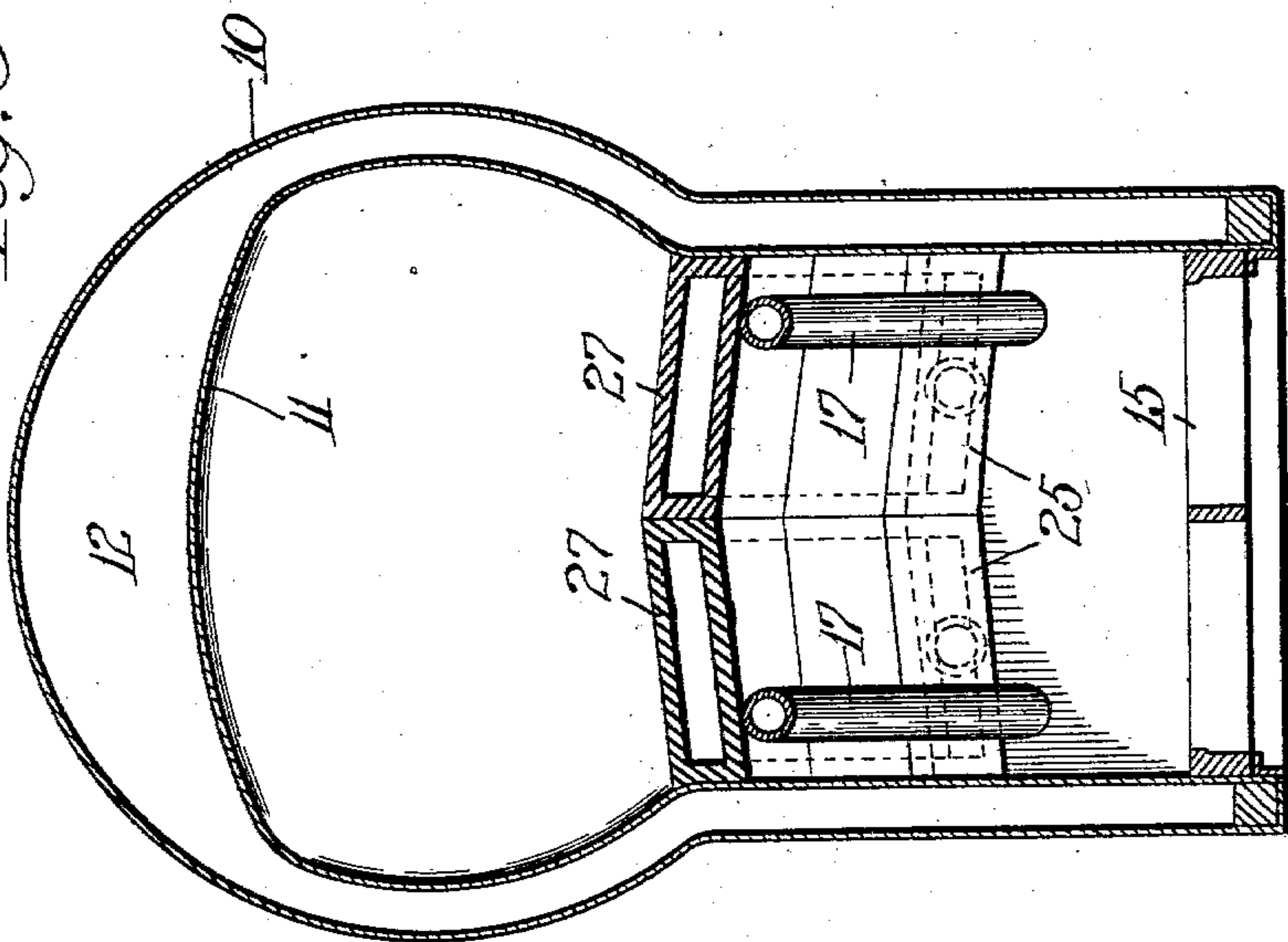


Fig. 5.

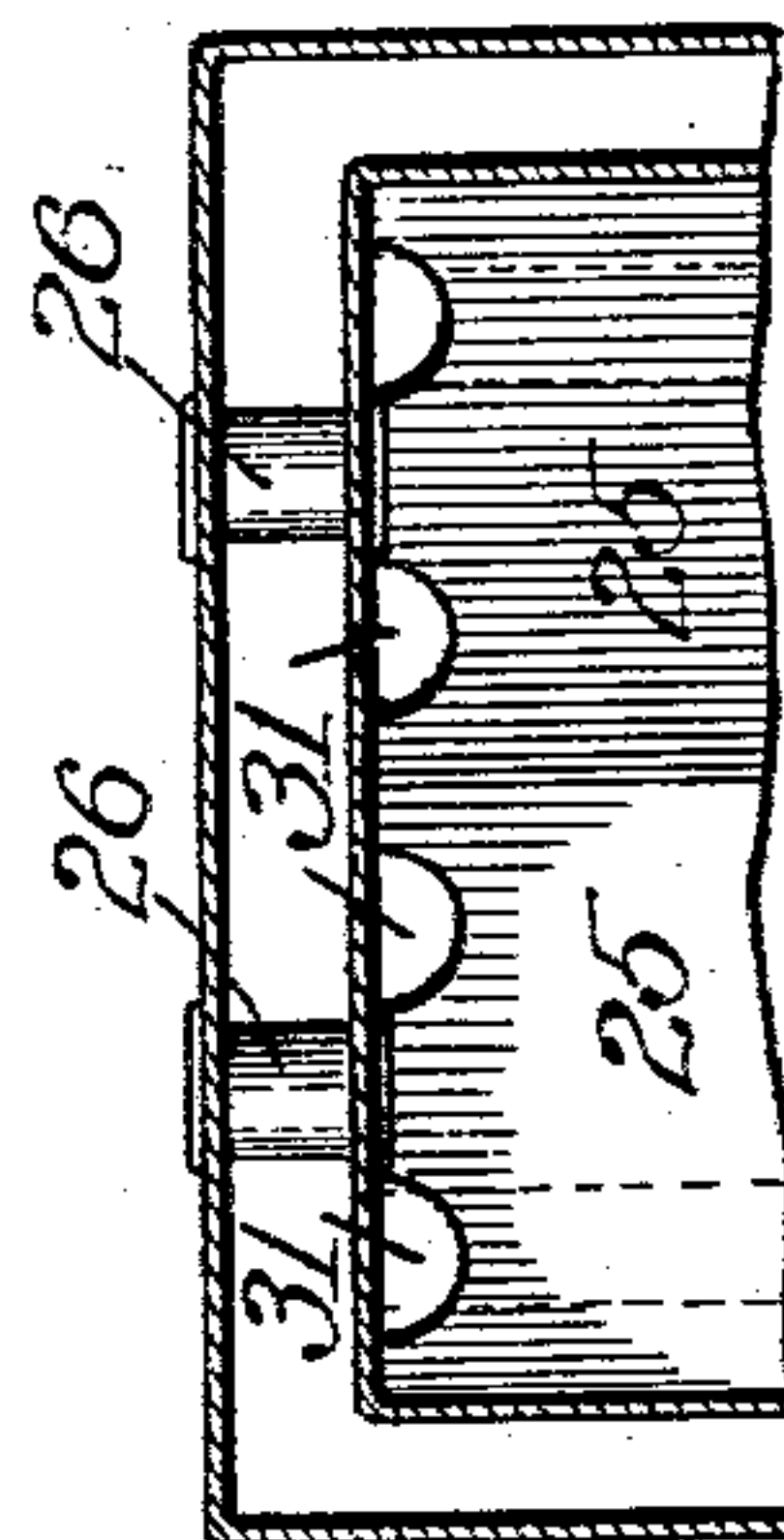


Fig. 2

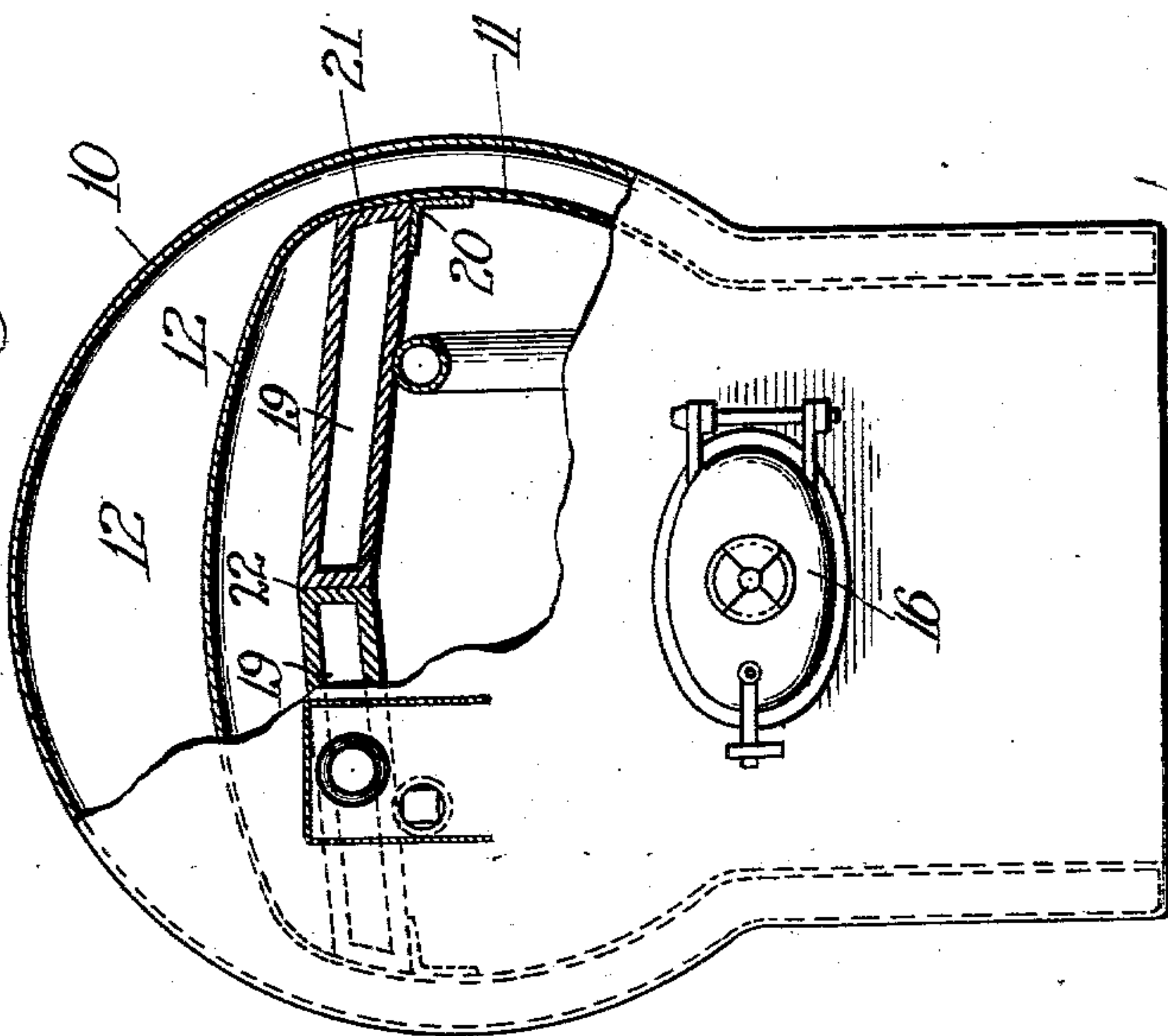
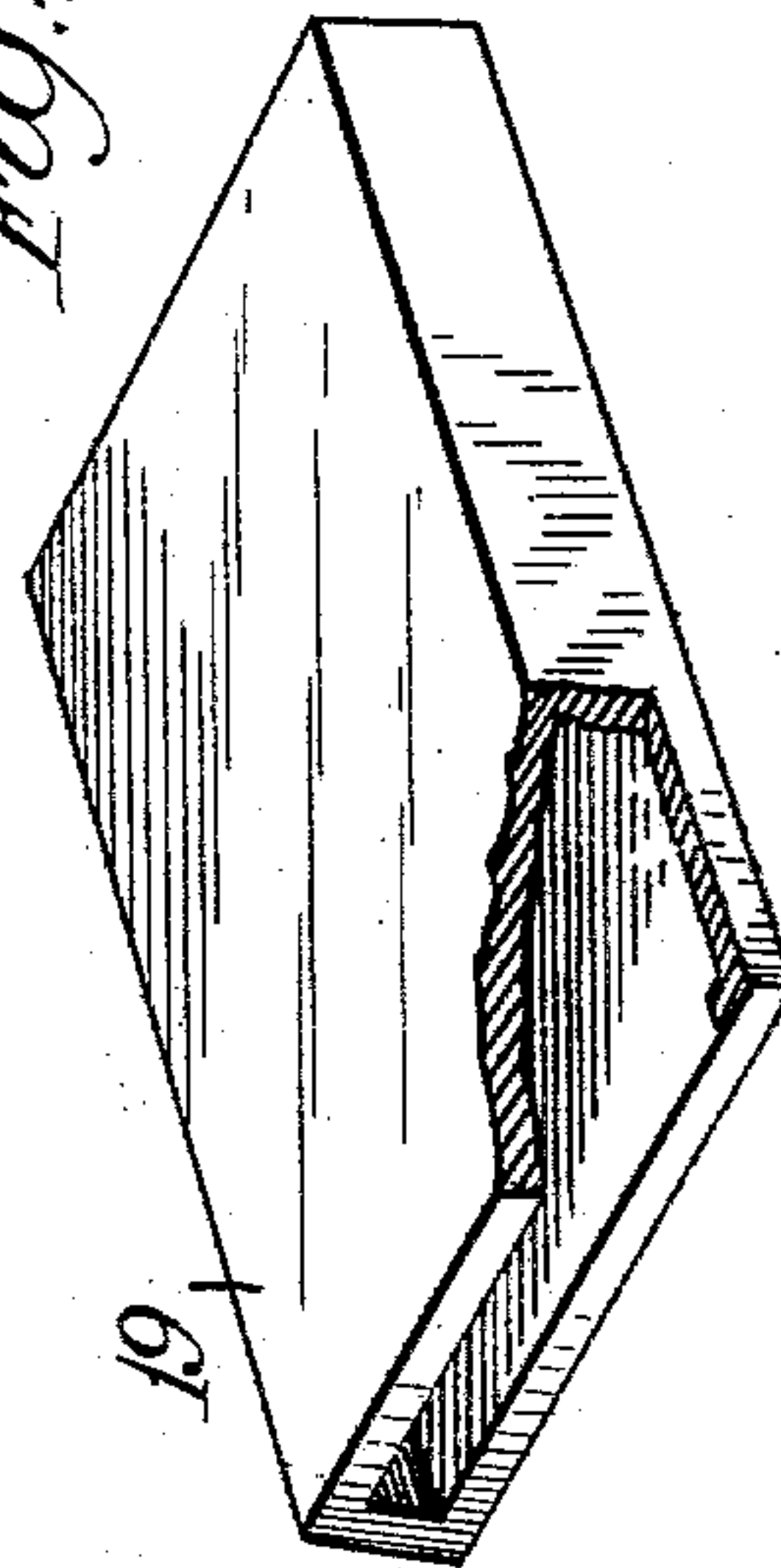


Fig. 4



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# UNITED STATES PATENT OFFICE.

EVAN H. WADE, JOHN L. NICHOLSON, AND SAMUEL C. SMITH, OF  
CHICAGO, ILLINOIS.

## FURNACE.

SPECIFICATION forming part of Letters Patent No. 744,135, dated November 17, 1903.

Application filed January 30, 1903. Serial No. 141,111. (No model.)

*To all whom it may concern:*

Be it known that we, EVAN H. WADE, JOHN L. NICHOLSON, and SAMUEL C. SMITH, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

Our invention is concerned with a novel construction in furnaces by which we are enabled to secure a more perfect combustion than has been possible with devices of this class as hitherto constructed.

To illustrate our invention we annex hereto two sheets of drawings, in which the same reference characters are used to designate identical parts in all the figures, of which—

Figure 1 is a central longitudinal section through the fire-box of a boiler containing our improvements. Fig. 2 is an elevation of the rear end of the boiler with a portion thereof in section on the line 2 2 of Fig. 1 looking in the direction of the arrow there shown. Fig. 3 is a section on the line 3 3 of Fig. 1 looking in the same direction as in Fig. 1. Fig. 4 is a perspective view of one of the hollow arch bricks or tiles that may be employed in carrying out our invention, and Fig. 5 is a detail plan view in section on the line 5 5 of Fig. 1.

The outer shell 10 is of the customary construction, and the crown-sheet 11, with its front and rear heads or casings, is secured therein in the customary manner. The space 12 between the two jackets is filled with water in the customary manner, and the smoke-flues 13, leading ultimately to the smoke-stack, (not shown,) serve to carry the smoke and other heated products of combustion off from the fire-box formed by the inside of the crown-sheet 11 and the grate 15. The customary door 16 is employed through which fuel can be thrown into the fire-box and upon the grate-bars. The two arch-tubes 17 are located in the fire-box in the manner clearly shown in Figs. 1, 2, and 3 and open into the water-legs of the water-space 12, so that the water can circulate through them and prevent the heat from burning them out too quickly. The structure thus far described is of the ordinary type.

Within the fire-box two hollow air-chambers are located, which communicate with the outside air and are formed in division plates or walls extending across the width of the fire-box, the rear wall projecting forwardly from the rear casing or head and the front wall projecting rearwardly from the front casing or head. The air-chambers open into the fire-box across its entire width at points respectively above and below the intermediate passage between the inner ends of the plates or walls. These hollow walls or plates are formed of any suitable material, and in the embodiment here disclosed we have shown them as composed of hollow bricks or tiles. The rear chamber is suitably formed by one or more hollow bricks or tiles 19, which rest upon the upper portions 18 of the tubes 17 and which are supported at their edges by the angle-strips 20 and have the sides 21 arranged at such an angle that they complement the angle formed by that portion of the sheet 11. When two tiles are employed, the inner sides 22 abut vertically against each other, the two tiles or bricks forming, in connection with the brackets 20, a self-supporting arched structure. As seen, these tiles are hollow and are connected at their rear ends with the atmosphere by the air-flues 23, which pass through the shell 10 and sheet 11. Air for supporting combustion freely enters the hollow chamber through the passages afforded by these flues and passes through the tiles 19 and is thence discharged across the width of the fire-box onto the rising gases in position to furnish the necessary oxygen to complete the perfect combustion of said gases. The air-flues 23 may be covered by the oil-can shelf 24, and as this extends down toward the door 16 the air entering will be heated somewhat even before entering the fire-bricks.

The front chamber is provided in a hollow wall, which rests upon the tubes 17, on the lower ends of which are placed a pair of hollow bricks or tiles 25, similar to the tiles 19, except that they are varied in shape, as is necessary to fit on the adjoining portions of the tubes 17 and between the somewhat differently shaped portions of the crown-sheet 11. These tiles 25 are likewise connected with



the atmosphere by the air-flues 26, passing through the shell 10 and sheet 11 and opening into the lower ends of said tiles. The hollow passage-ways formed by the tiles 25 are continued by the additional pairs of similar tiles or bricks 27, joined thereto and extending upward along the inclined portions of the tubes 17. The hollow passage thus formed is terminated by the pair of tiles 28, which are solid except for the short inclined passages 29, opening into the passages through the tiles 27 and serving to admit air downwardly into the fire-box for its entire width just before the gases and smoke pass upward through the passage 30, formed between the adjacent ends of the tiles 19 and 28.

The lower ends of the tiles or bricks 25 are provided with recesses 31, (not opening into the hollow portion, however,) through which any cinders or other solid material on the arch may fall back onto the grate. It will be apparent that such notches might be placed in the sides of the brick or tile 25 and 27.

The operation of our invention will now be apparent. In addition to the air passing up through the grate-bars and serving to release the gases and partially consume them in connection with the coal thereon, we by the employment of our invention secure the additional supplies of air at the two points where they are best adapted to furnish the necessary oxygen to complete the combustion of the gases arising from the bed of coals and at a point where the heat from the coals is sufficient to insure the proper ignition of the gases with the air. The hollow conduits conveying the air to these points being in contact with the flames and in the fire-box serve to heat the air before it is delivered for combustion, and this increases the efficiency of the device, as it is well known that cold air must be heated before its oxygen can ignite, and the cold air not coming in contact with the rising gases cannot chill them, and its passage through the hollow division-walls serves to warm it without chilling the rising gases below the ignition-point, as it does not come in contact with them until it is heated. The two oppositely-directed supplies of air, with the rising gases ascending through the passage, serve to form a vortex, as it were, in which the hot air and gases are so mixed that ignition and complete combustion are assured.

The air from the front chamber is deflected downwardly into the fire-box at or near the passage 30, so that it has been thoroughly heated in the chamber and does not tend to chill the gases and kill the fire, as it would if supplied to the fire-box without passing along this chamber a sufficient distance to enable it to be thoroughly heated. Also the air is discharged from an opening extending the entire width of the fire-box at a point where the initial supply of oxygen has been practically exhausted and where it best serves to revive the process of combustion. The air

from the rear chamber is supplied to the products of combustion after being properly heated and is diffused or spread across the entire width of the passage 30 by reason of the wall or plate being hollow for substantially its entire width. Moreover, it is diffused and distributed to the products of combustion after they have passed through the passage 30, so that the products will be mingled with sufficient fresh oxygen to insure complete combustion before they pass from the fire-box.

An important consideration is that by making the arch in the form of a hollow air-feeding wall or plate the arch is prevented from burning out, and its life is prolonged. Moreover, by this construction the intake end of the front chamber is arranged and disposed so as to cover and cut off a minimum area of the front head of the fire-box from the effect of the heat, and this result is particularly well realized because of the recesses 31, as shown in Fig. 5. This is an important consideration, as the front water-leg is located at this head, and it is essential to expose as much of the surface of the head as possible to the heat in order to allow the heat to act to the best advantage upon this water-leg.

The chambers formed within the front and rear hollow walls extend substantially across the width of the fire-box and are approximately of the same transverse area as the fire-box, so that the air in both chambers is exposed to the maximum area of the heated walls and also is supplied to the fire-box across its entire width, so as to be evenly distributed and diffused across practically its entire transverse area.

By constructing the division plates or walls hollow we are able to utilize them as the air-feeding devices instead of using separate tubes for this purpose.

While we have herein shown and described our invention as embodied in the forms which we at present consider best adapted to carry out its purposes, it will be understood that it is capable of modifications and that we do not desire to be limited in the interpretation of the following claims except as may be necessitated by the state of the prior art.

It will be apparent that the specific structures and the elements which we have shown for introducing heated air to the center of the fire-box may be varied and that numerous other changes may be made without departing from the spirit of our invention.

While we have shown and described our invention as applied to a boiler of the locomotive type, it will be understood that it is capable of being applied to any form of a boiler.

What we claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a device of the class described, the combination with the fire-box, of the grate-bars forming the bottom thereof, the door in one end thereof, the smoke-flues leading from the upper portion of the opposite end, air-



flues in the same end beneath the smoke-flues, and the hollow chamber connecting with said air-flues and extending toward the center of the fire-box and having a transverse downwardly-directed passage for delivering heated air thereto.

2. In a device of the class described, the combination with the fire-box having smoke-flues leading from the upper portion of its front head, air-flues through the rear head near the top and in the front head below the smoke-flues, a hollow wall connected with the front air-flues and extending upwardly and rearwardly from the front head to form a passage for heated air and having a downwardly-directed opening into the fire-box, a second hollow wall connected with the air-flues in the rear head and extending from the rear head toward the center of the fire-box and having an opening above the opening of the front wall, said walls forming an intermediate passage through which the smoke and gases ascend to reach the smoke-flues.

3. In a device of the class described, the combination with the fire-box, of the grate-bars forming the bottom thereof, the door at one end, smoke-flues leading from the upper portion of the opposite end, the arch-tubes extending horizontally from one end some distance above the door and inclined downwardly

to the other end beneath the smoke-flues, air-flues at the door end, a hollow wall extending inward horizontally and connected to air-flues and resting on the horizontal portion of the arch-tubes, air-flues in the other end beneath the smoke-flues, and a second hollow wall extending rearwardly and upwardly from and connected with said second air-flues and resting upon the lower portion of the inclined arch-tubes and forming a hollow passage to deliver heated air to the center of the fire-box adjacent the passage-way formed between the two walls.

4. In a device of the class described, the combination with the fire-box, of two transverse hollow chambers providing an intermediate passage and extending respectively from the front and rear heads of the fire-box and discharging across the transverse area of the box respectively below and above said intermediate passage, and air-flues connecting the chambers with the outside air.

In testimony whereof we affix our signatures in presence of two witnesses.

EVAN H. WADE.

JOHN L. NICHOLSON.

SAMUEL C. SMITH.

Witnesses:

JOHN H. McELROY,

ELIZABETH MOLITOR.