

No. 877,601.

PATENTED JAN. 28, 1908.

W. H. SHAFER.  
STEAM BOILER.

APPLICATION FILED JUNE 1, 1906.

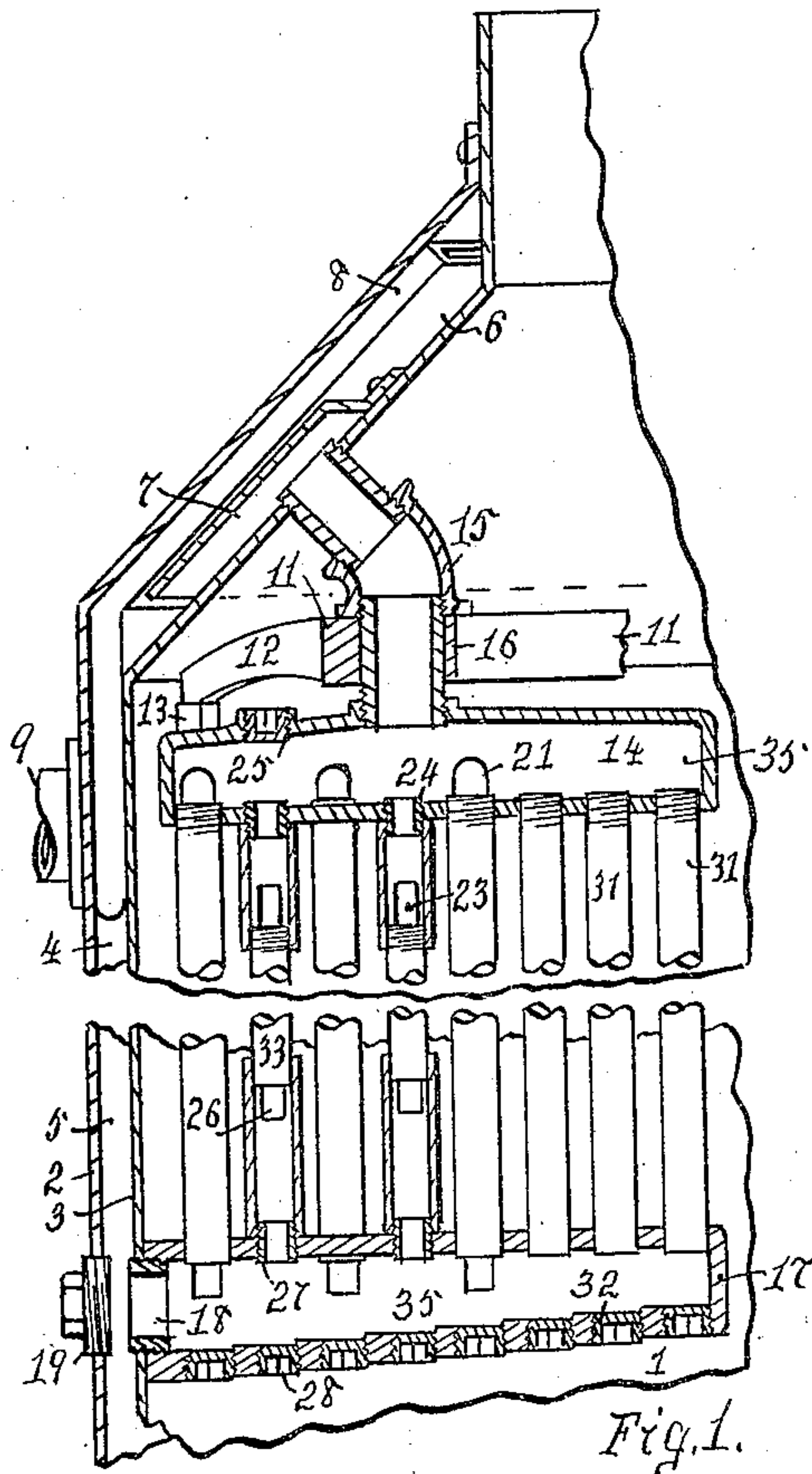


Fig. 1.

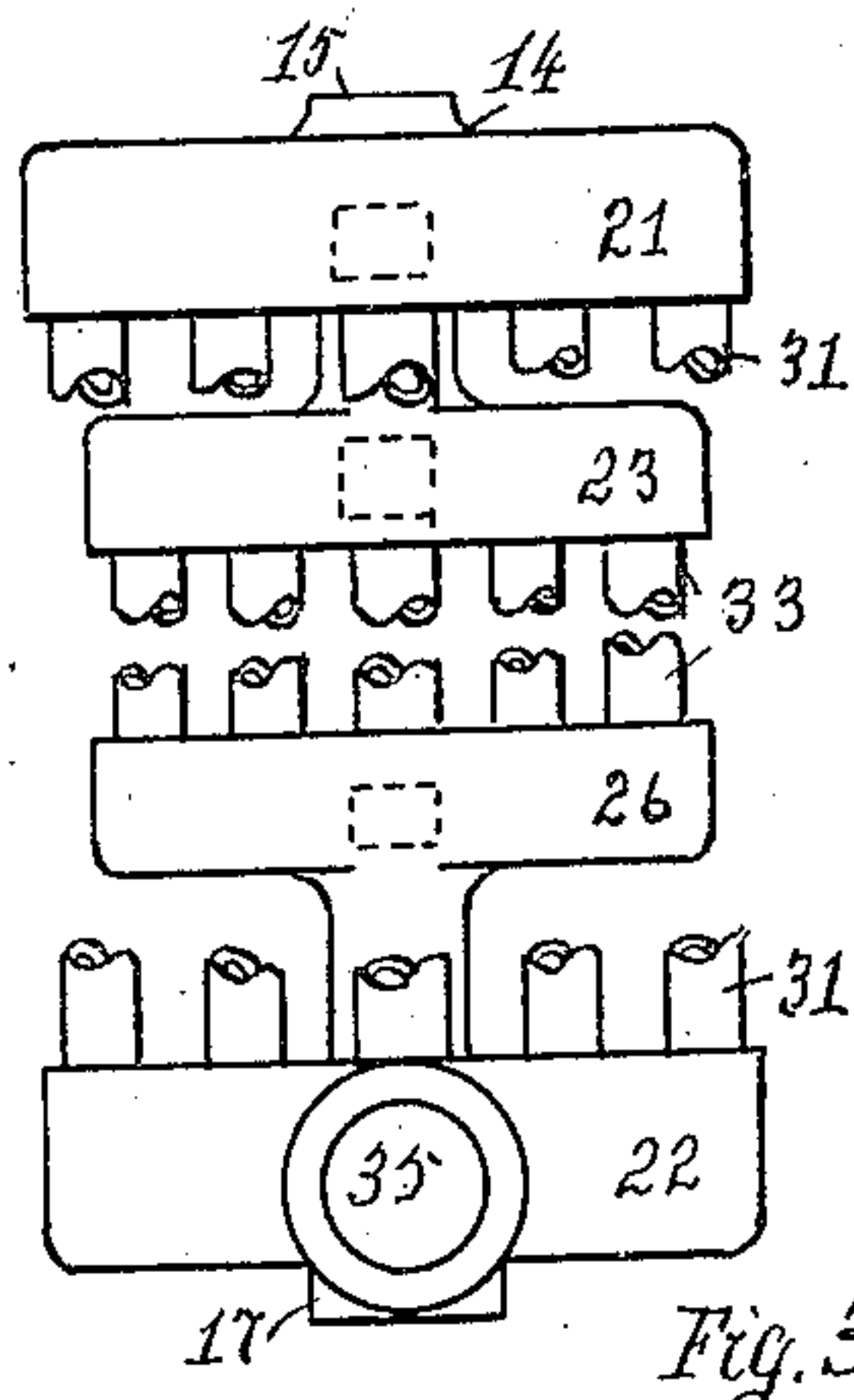


Fig. 3.

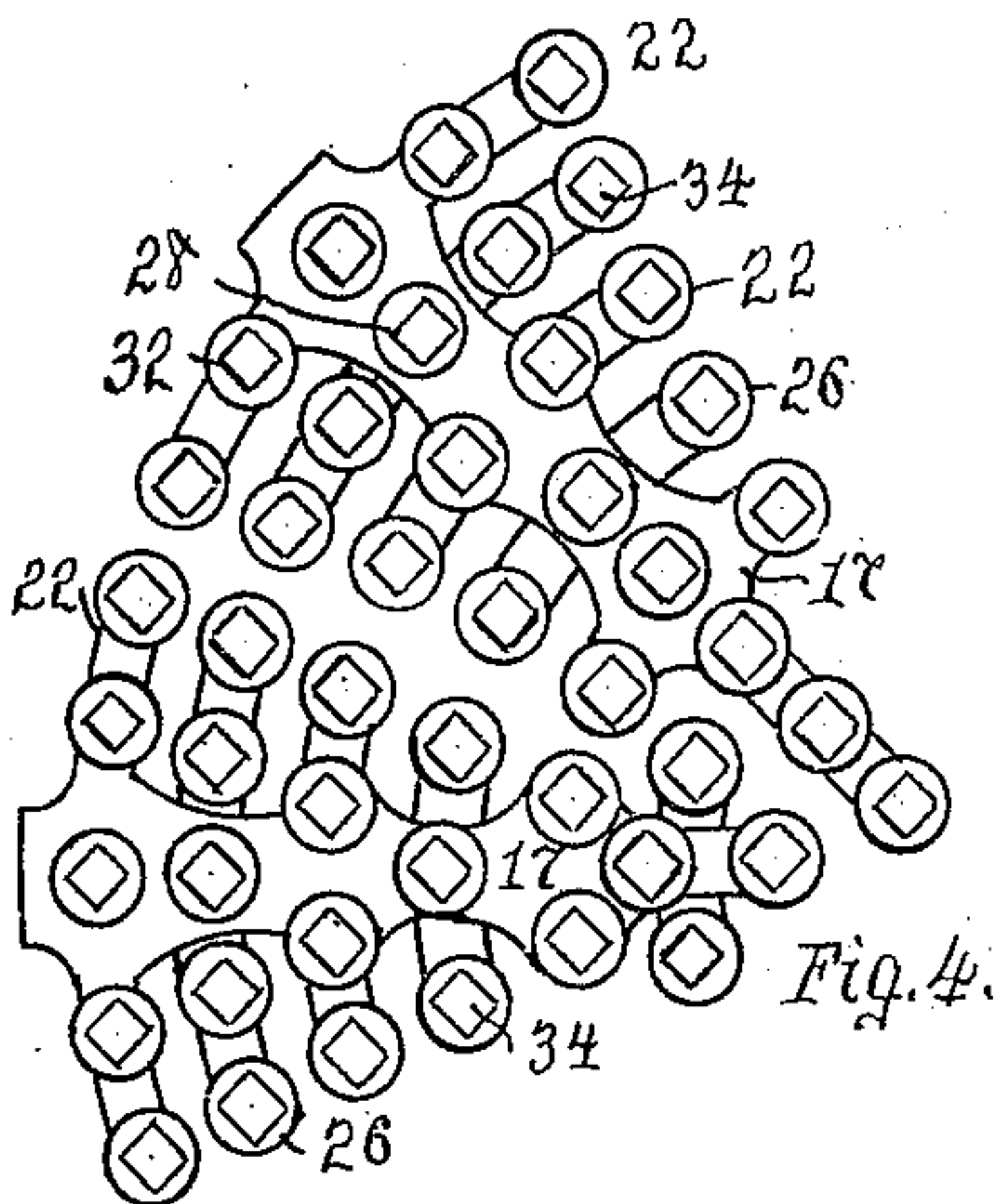


Fig. 4.

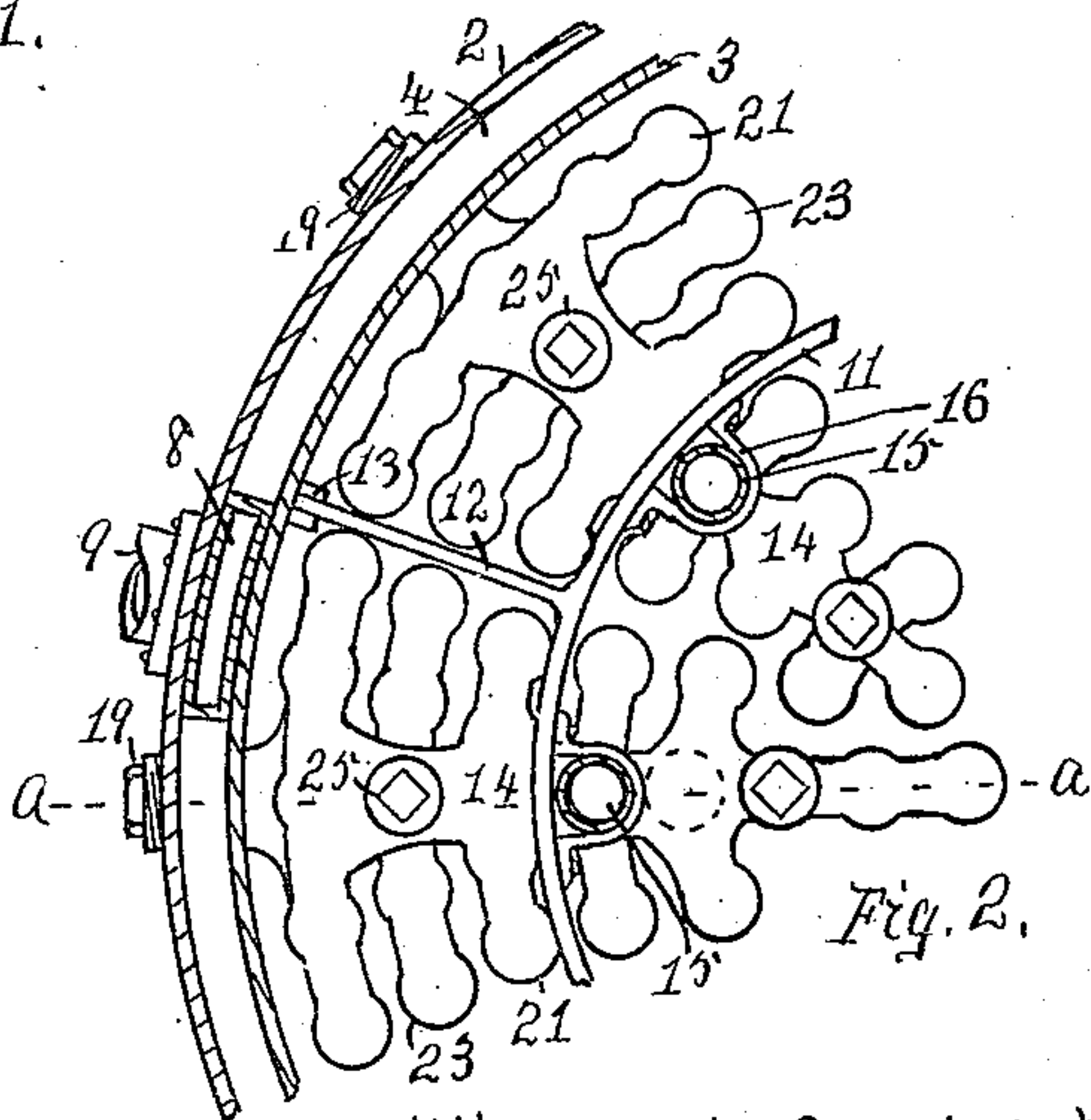


Fig. 2.

Witnesses.

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# UNITED STATES PATENT OFFICE.

WILLIAM H. SHAFER, OF CINCINNATI, OHIO.

## STEAM-BOILER.

No. 877,601.

Specification of Letters Patent.

Patented Jan. 28, 1908.

Application filed June 1, 1906. Serial No. 319,712.

*To all whom it may concern:*

Be it known that I, WILLIAM H. SHAFER, a citizen of the United States, residing at Cincinnati, Ohio, have invented a new and useful Improvement in Steam - Boilers, of which the following is a specification.

My invention relates to steam boilers of the water tube class adapted for the use of fire engines or other purposes, and the objects of my improvement are to provide a series of independently removable tube sections or groups of straight vertical tubes, each group forming a separate generating unit; to provide means for independently inspecting, cleaning or replacing the tubes of each group; to secure the manifolds alternately in different horizontal planes to reduce their chilling effect and for facilitating the passage of the hot gases between them and among the tubes whereby a more intimate chemical union may be obtained of the products of combustion than is possible within the restricted area allowable for combustion chambers in boilers of this class; to provide headers with passages graduated in size to meet the location and demands of the connecting tubes; to provide means for independently inspecting, cleaning or removing the headers; to provide a cone shaped annular dome adjacent to the chimney for superheating the steam; to provide a baffle plate within the dome for deflecting against its heated wall the entrained water discharged therein from the generating units that it may be converted into steam; to provide means for supplying the throttle pipe with dry steam from the top of the dome to prevent the overflow therein of foaming water from the boiler. These objects are attained in the following described manner as illustrated in the accompanying drawings, in which:—

Figure 1 is a vertical section on the line *a—*a** of Fig. 2 of the portion of a steam boiler embodying my improvement; Fig. 2, the plan of a couple of tube sections or groups; Fig. 3, the front elevation of a group of tubes or generating unit with parts broken away and showing the alternate manifolds in different horizontal planes, and Fig. 4, an inverted view of Fig. 2.

In the drawings, the cylindrical shell encircles the fire box 1 and consists of concentric walls 2 and 3 which inclose between them the annular steam chamber 4 and the water leg 5. Said walls are converged at the top to

form a cone shaped annular steam dome 6 in communication with the steam chamber. Said dome contains a cone shaped baffle plate 7 and is provided with a steam pipe 8 for the passage of the dry steam from the top portion of the dome to the throttle pipe 9.

A supporting ring 11 provided with radial projecting arms 12 is thereby removably supported within the upper portion of the shell on lugs 13 secured therein. A series of preferably eight radial top headers 14 are each provided with a discharge pipe 15 whereby they are removably secured to ring 11 by means of clamp straps 16. Said pipes 15 are removably secured in the inside wall of the dome and discharge the steam and entrained water from the headers against the baffle plate within the dome whereby it is deflected in a downward direction toward the steam chamber.

A series of radial bottom headers 17 register with the respective top headers 14 and are removably secured to the inner wall 3 and in communication with the water leg 5 by means of internal couplings 18 which are accessible through plugged openings 19 formed in the outer wall 2 in registration therewith. Said top and bottom headers are respectively provided with a series of similar manifolds 21 and 22 which register with each other and extend laterally therefrom. A series of manifolds 23 alternating with the manifolds 21 depend in a common horizontal plane from each of the top headers to which they are removably secured by means of internal couplings 24. Said couplings register with and are accessible through the respective plugged openings 25 and the openings for the discharge pipes 15 formed in the top headers. A similar series of manifolds 26 registering with manifolds 23 and alternating with manifolds 22 are in like manner removably secured to each of the bottom headers and in a common horizontal plane thereover by means of internal couplings 27 which register with plugged opening 28. A multiplicity of vertical tubes 31 of uniform length are removably threaded at one end in manifolds 21 and removably swaged at the other end in manifolds 22 in registration with plugged openings 32 therein. A series of shorter vertical tubes 33 of uniform length are in like manner removably secured at their opposite ends in corresponding alternating manifolds 23 and 26 and in registration with correspond-



ing plugged openings 34 formed in manifolds 26. The various plugged openings in the outer shell, headers and manifolds provide independent means of access for the inspection, or cleaning of the headers, the manifolds or vertical tubes, and for the removal or replacing of either of the bottom headers, alternating top or bottom manifolds or vertical tubes. The circulating channels 35 within the respective headers are graduated in size proportionate with the demand and location of the vertical tubes communicating therewith.

In operation, corresponding top and bottom headers together with the manifolds and tubes communicating therewith form separate and distinct removable units of circulation and generation between the water leg and the steam dome. Said dome intercepts and utilizes the heat in its passage from the top headers to the chimney opening to evaporate the entrained water from the headers and to superheat the steam therein above the baffle plate before it enters the steam pipe 8.

The units of circulation each consisting of corresponding top and bottom headers with their connecting tubes or either of the tubes may be removed or replaced through the furnace by the removal of the grates.

Having fully described my improvement what I claim as my invention and desire to secure by Letters Patent of the United States is:—

1. In combination, a radial header provided with transverse manifolds which are positioned alternately in different horizontal planes, a header registering therewith and provided with similar manifolds, and tubes communicating with the headers through corresponding manifolds.

2. In combination, a radial top header provided with transverse manifolds and with a discharge pipe, a radial bottom header provided with manifolds positioned alternately in different horizontal planes and communicating directly with the water leg of a steam boiler, and tubes connecting corresponding manifolds of the respective headers together.

3. In combination, top and bottom radial headers each provided with manifolds

alternately positioned in different horizontal planes, and tubes connecting corresponding manifolds of the respective headers together.

4. In combination, top and bottom headers each provided with transverse manifolds positioned in different horizontal planes, and vertical tubes connecting corresponding manifolds of respective headers together.

5. In a steam boiler, a separate and distinct unit of generation, consisting of top and bottom radial headers each provided with transverse manifolds alternating in different horizontal planes, and straight tubes connecting corresponding manifolds of the respective headers together.

6. In a steam boiler, an independently removable unit of generation consisting of radial top and bottom headers, each being provided with transverse manifolds positioned alternately in different planes, and tubes connecting corresponding manifolds of the respective headers together.

7. In combination, top and bottom headers each provided with transverse manifolds in different horizontal planes, vertical tubes connecting the headers together, and other vertical tubes connecting corresponding manifolds of the respective headers together.

8. In combination, top and bottom headers each provided with transverse manifolds in different horizontal planes, tubes connecting corresponding manifolds of the respective headers together, the manifolds of one header being provided with plugged openings in registration with the respective tubes.

9. In combination, a radial header provided with transverse manifolds in different horizontal planes, said manifolds being provided on one side with openings for the engagement of tubes therewith and on the other side with plugged openings in registration with the respective said former openings.

10. In combination, an annular dome in form the frustum of a cone, and a baffle plate secured therein and parallel with its sides.

WILLIAM H. SHAFER.

Witnesses:

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