

No. 716,875.

Patented Dec. 30, 1902.

T. DUNLAP.  
WATER TUBE BOILER.

(Application filed June 19, 1901.)

(No Model.)

Fig. 1.

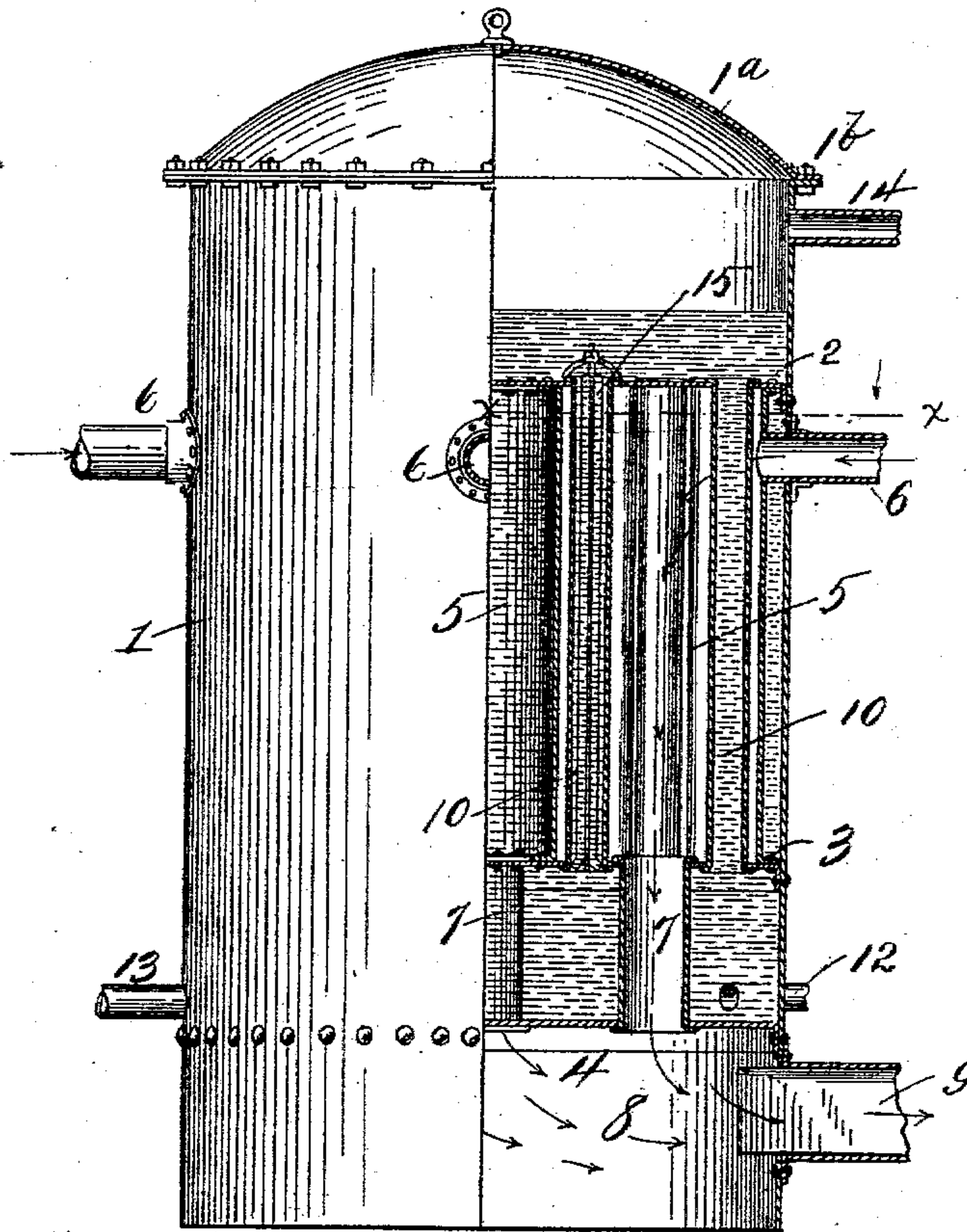


Fig. 3.

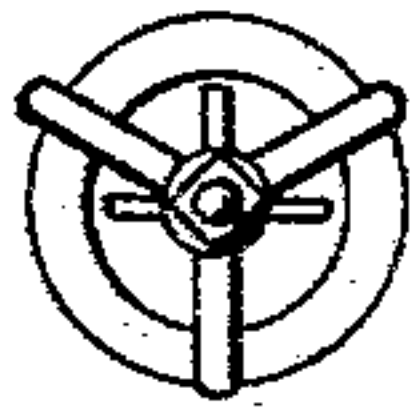


Fig. 4.

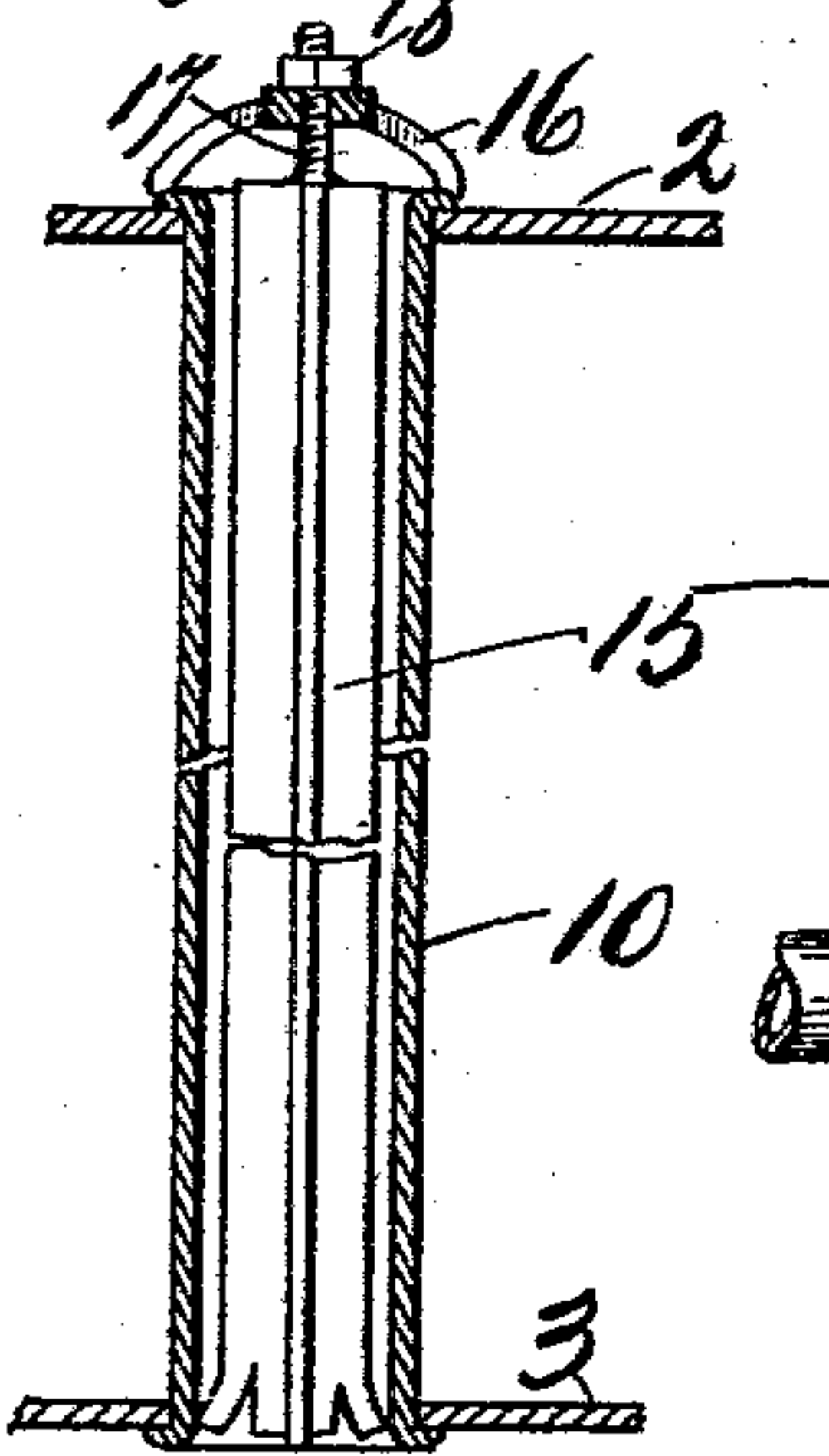
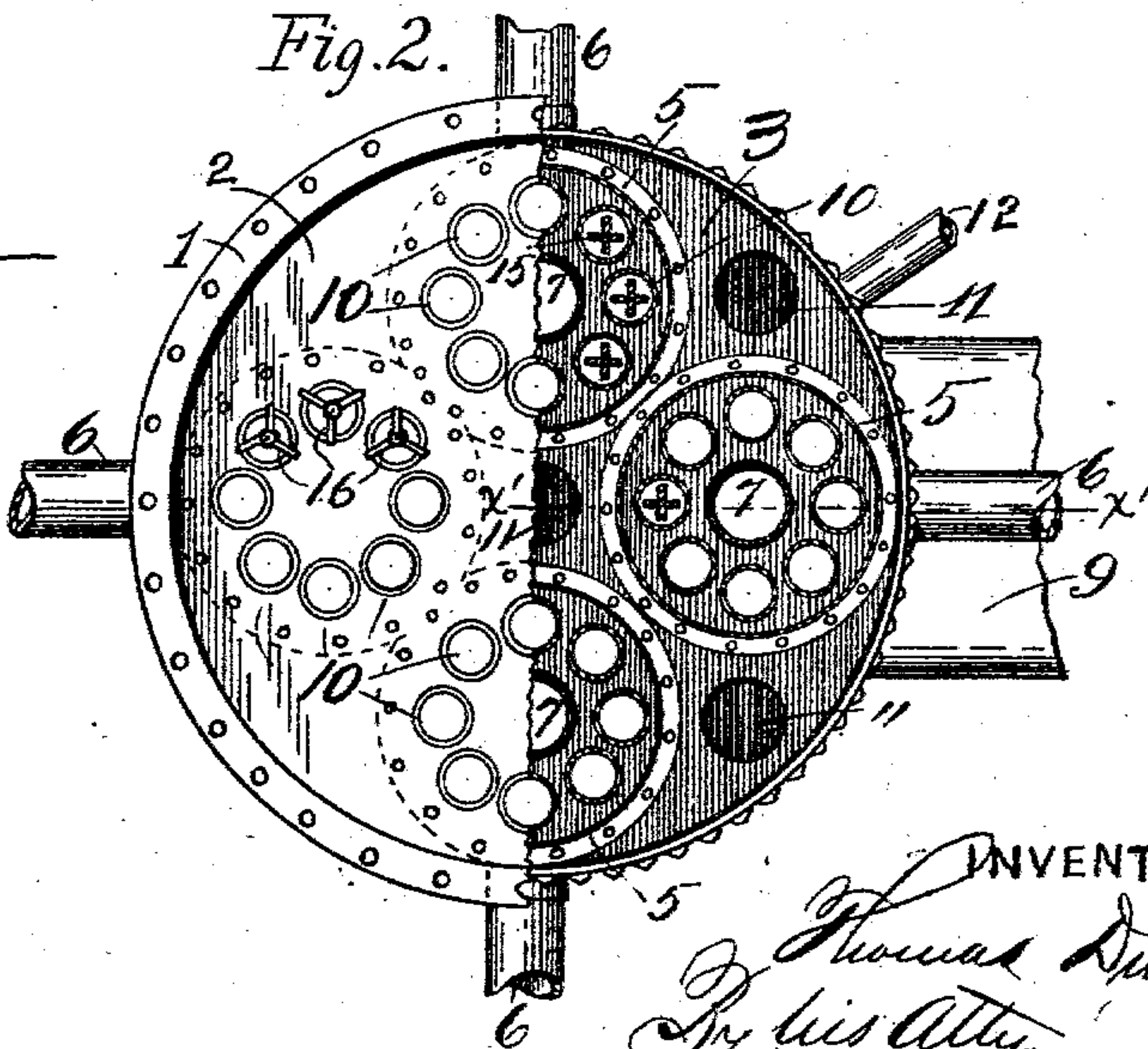


Fig. 2.



WITNESSES:

David C. Walter  
L. E. Bonni

INVENTOR:

Thomas Dunlap.  
By his Atty.  
Mason Hall



# UNITED STATES PATENT OFFICE.

THOMAS DUNLAP, OF TOLEDO, OHIO.

## WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 716,875, dated December 30, 1902.

Application filed June 19, 1901. Serial No. 65,091. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS DUNLAP, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have  
5 invented certain new and useful Improvements in Water-Tube Boilers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it ap-  
10 pertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

One of the most serious difficulties encountered in the use of water-tube boilers is the  
15 formation of crust and scale upon the water-surfaces of the tubes, especially those tubes which are exposed to the more intense heat of the furnace. The inefficiency and rapid  
20 deterioration and final destruction of an incrustated tube are well understood. Experience has shown that for some reason new boiler-tubes will for a long time resist the ac-  
25 tion of scale-forming matter and will remain clean, while an old tube which has once become incrustated with scale will, no matter how thoroughly it may be cleaned, again quickly  
30 become incrustated, thus demonstrating that the scale-forming matter in the water has a much greater affinity for an incrustated or partially-incrustated surface than for a clean surface.

My invention is designed to take advantage of the fact here stated and to protect the tubes  
35 of boilers from incrustation by supporting within the tube and out of contact therewith a body of some material or substance which has an affinity for scale-forming matter—such, for instance, as a bar or tube of iron  
40 which has been previously coated or incrustated with scale-forming matter. These bars or tubes are designed to be readily removable, so that they may be cleansed and returned quickly and with little labor.

45 My invention also relates to certain details of boiler construction hereinafter pointed out.

I attain the objects above referred to by means of the devices and arrangement of parts hereinafter described, and shown and  
50 illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of a boiler em-

bodiment of my invention, one half being in central vertical section on line  $x'x'$ , Fig. 2; Fig. 2, a top plan view of the same with the cover  
55 removed, one half being in horizontal section on line  $xx$ , Fig. 1; Fig. 3, a top plan view of one of the tubes hereinafter referred to, showing a means for supporting the scale-accumulator hereinafter referred to; and Fig. 4 is a  
60 side elevation, in central vertical section, of the same.

Like numerals of reference indicate like parts throughout the drawings.

In the drawings, 1 is the cylindrical shell  
65 of a vertical boiler. Within the shell are three horizontal partitions or flue-sheets 2, 3, and 4, secured at their margins to the inner wall of the shell.

5 5 are fire-chambers of cylindrical form, 70 the tops of which are formed by the top flue-sheet 2, the bottoms being formed by the middle flue-sheet 3. These fire-boxes may be of any desired number, according to the transverse area of the boiler. In the example  
75 illustrated in the drawings four fire-boxes are shown arranged at equidistant intervals and as large as the interior of the shell will admit. Into each of the fire-boxes 5 near its  
80 top leads a pipe 6, designed for the admission of a liquid or gaseous fuel. Each of these pipes is provided with a suitable valve (not shown in the drawings) for controlling the flow of fuel. From the bottom of each  
85 of the fire-boxes leads a central down-pipe 7 through the bottom flue-sheet 4. The products of combustion from the fire-boxes pass downwardly through the tubes 7 into the chamber 8 beneath the flue-sheet 4, thence  
90 out through conduit 9 to the smoke-stack or chimney.

Passing through each of the fire-boxes vertically and communicating with the chamber above the flue-sheet 2 and with the chamber between the flue-sheets 3 and 4 is a series of  
95 water-tubes 10. These tubes are arranged in a circle near the wall of each of the fire-boxes and on their exterior are exposed to the direct action of the fires. In the upper and the middle flue-sheet are large openings 11 to fa-  
100 cilitate the circulation of water between the lower water-chamber, the upper steam and water chamber, and around the fire-boxes.

My boiler is provided with a feed-water pipe



12, blow-off pipe 13, and steam-pipe 14, together with the usual valves and appliances commonly found in steam-boilers.

In each of the water-tubes 10 is supported  
5 a body of metal 15, which for illustration I have shown as a bar of iron formed in transverse section as a cross. This piece may, however, be cylindrical, tubular, or of any other desired form in cross-section. This bar is  
10 suspended from a bridge or spider 16, which bestrides the upper opening of the tube, the bar having a threaded bolt 17, which projects through an opening in the bridge or spider. The bolt at its upper end is provided with a nut  
15 18. At bottom the bar 15 is split and flared outwardly, so that a mere knife-edge contacts with the bottom flange of the tube, thus holding the bar in vertical position and preventing its coming in contact with the interior of its  
20 tube. Each of these bars before it is placed in position is incrustated with scale, which may be accomplished in a variety of ways—as, for instance, by depositing the bars in the hottest part of a boiler in which water strong in  
25 scale-forming matter is used. After a time scale will be deposited upon the bars, and the bars will then be fit for use in preventing incrustation upon new tubes.

My boiler is provided with a top or cover 1<sup>a</sup>,  
30 the shell and the cover being connected by bolts 1<sup>b</sup>, engaging meeting flanges on the two parts. When the bolts and nuts are removed,

the top may by suitable hoisting devices be removed. Now each one of the vertical tubes will be exposed, and the bars are readily accessible for inspection, cleaning, and repairs. 35 It will be seen that each one of the pieces 15 may be quickly removed and that with two interchangeable sets of scale-collectors the boiler need not at any time be long out of 40 service.

It will be seen that the boiler here shown is of compact form, affording large heating-surfaces and extensive steam-liberating area, that the tubes and fire-boxes are readily accessible for cleaning and repairs, and that the 45 incrustation of the tubes is reduced to a minimum. My boiler may be used singly or in battery.

Having described my invention, what I 50 claim, and desire to secure by Letters Patent, is—

In a steam-boiler, a water-tube, a bar of metal which has been independently incrustated with scale, and means for removably supporting said bar within the tube and 55 without contact within the interior surface thereof.

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

THOMAS DUNLAP.

Witnesses:

F. M. DOTSON,  
L. E. BROWN.