No. 864,323. PATENTED AUG. 27, 1907.

R. C. MONTEAGLE.

WATER TUBE BOILER.

APPLICATION FILED MAR. 16, 1906.

3 SHEETS—SHEET 1.

Fig. 1.

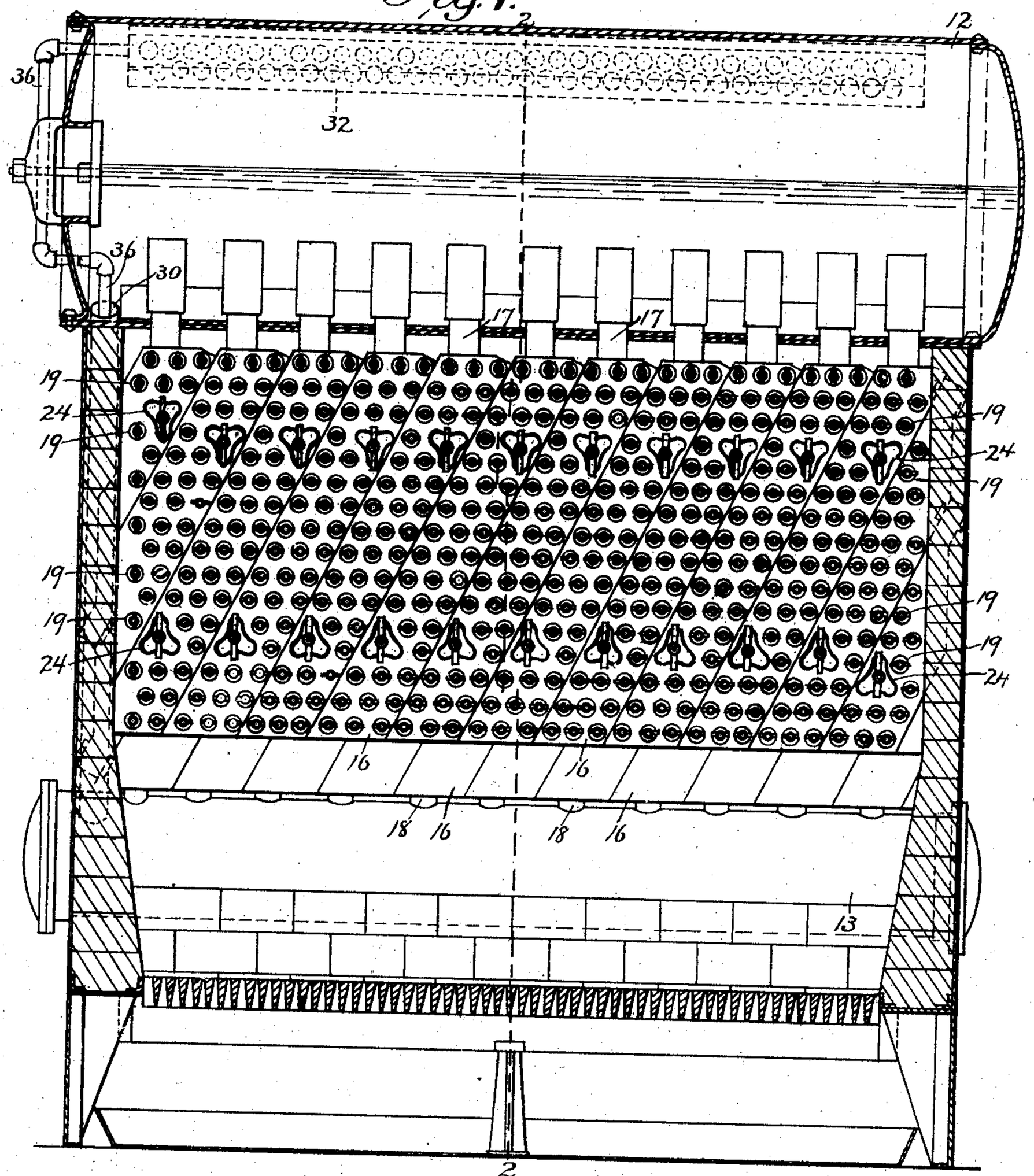


Fig. 6.

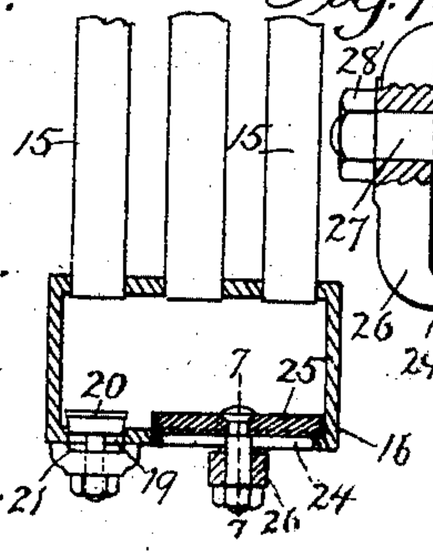


Fig. 7.

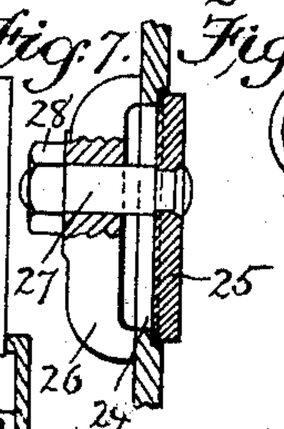


Fig. 8.

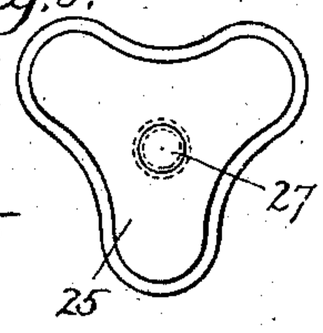
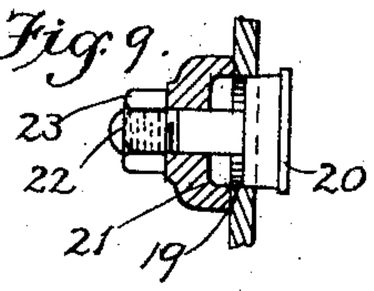


Fig. 9.



Witnesses.

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3 SHEETS—SHEET 2.

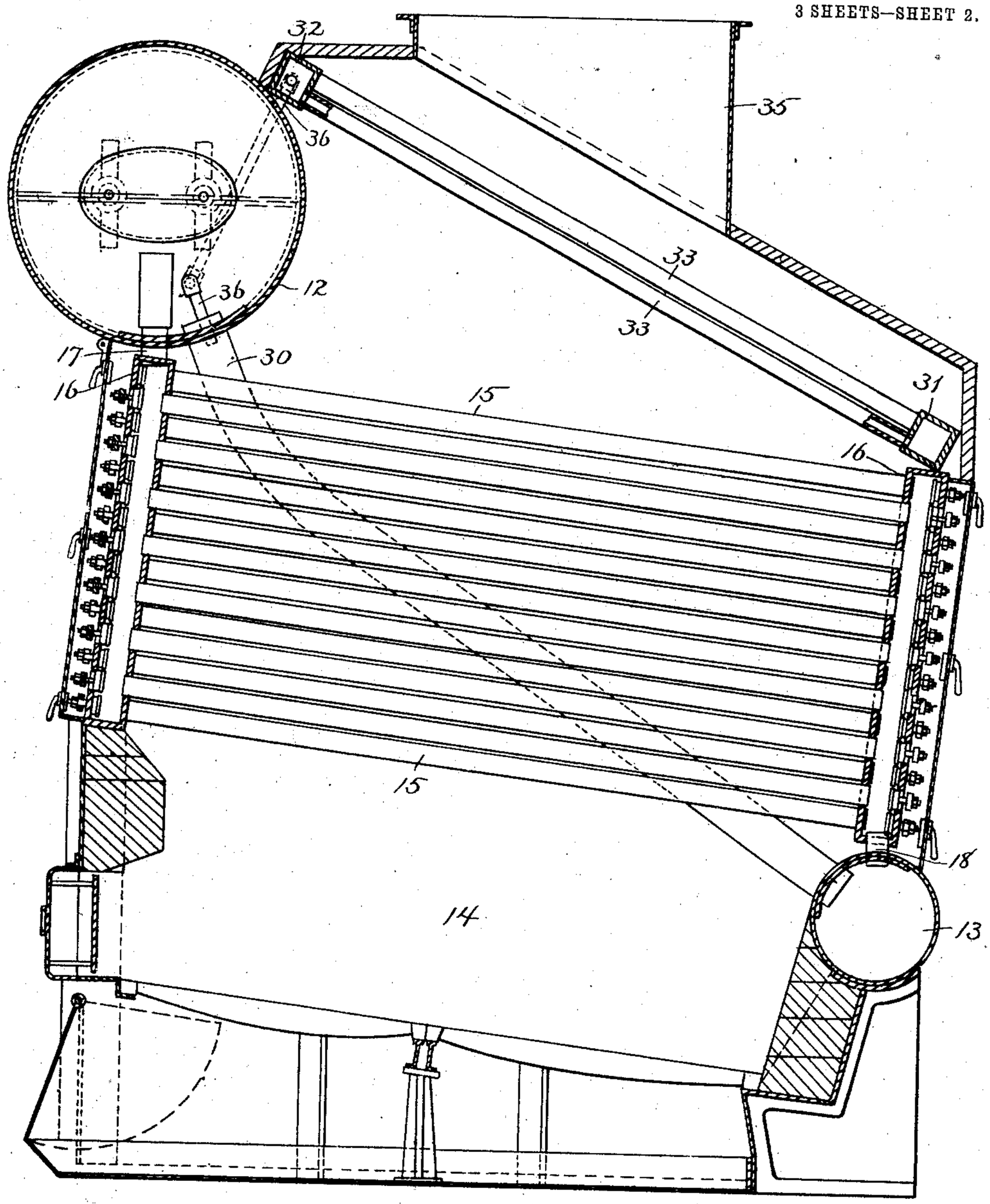

Fig. 2.

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3 SHEETS—SHEET 3.

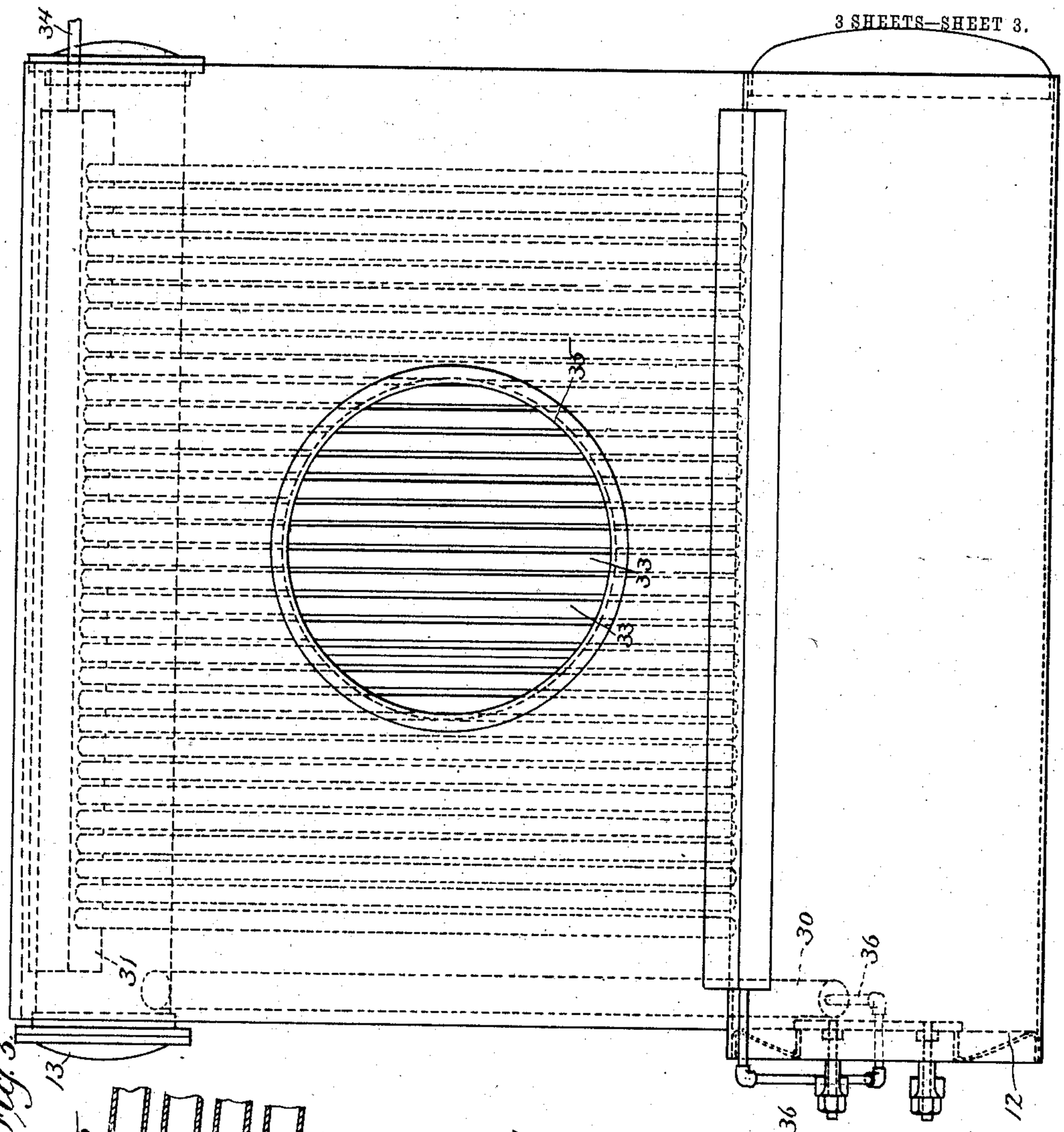

Fig. 3.

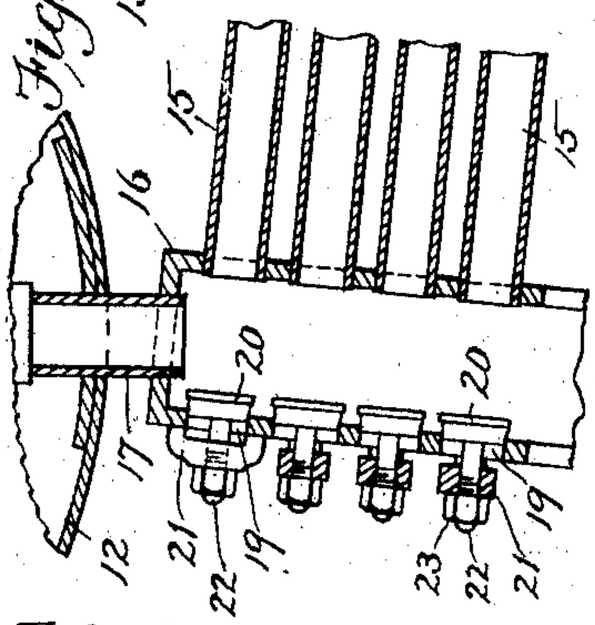

Fig. 4.

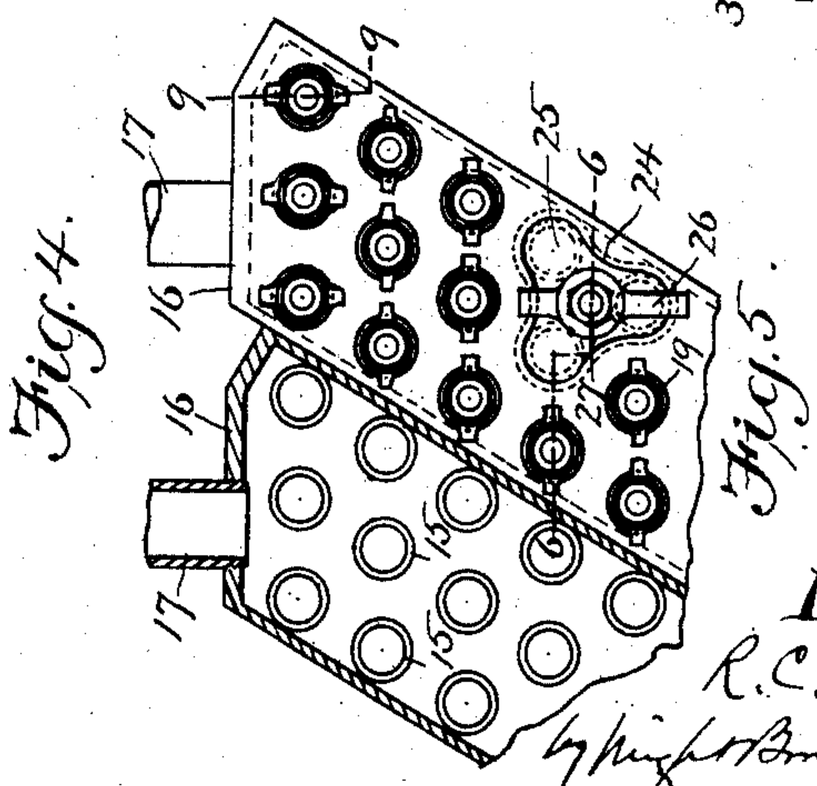

Fig. 5.

Witnesses.

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UNITED STATES PATENT OFFICE.

ROBERT CHARLES MONTEAGLE, OF WINCHESTER, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO JAMES SPIERS, JR., OF SAN FRANCISCO, CALIFORNIA.

WATER-TUBE BOILER.

No. 864,323. Specification of Letters Patent. Patented Aug. 27, 1907.

Application filed March 16, 1906. Serial No. 306,383.

To all whom it may concern:

Be it known that I, ROBERT CHARLES MONTEAGLE, of Winchester, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Water-Tube Boilers, of which the following is a specification.

This invention relates to that class of water tube boilers in which the tubes, located over the firebox in the path of the ascending products of combustion, are expanded at their ends into headers, there being a series of headers at each end of the series of tubes, abutting together edge to edge, the headers communicating with the steam and water drums of the boiler. In this class of boilers, it is desirable that the water tubes be staggered so that each tube will alternate vertically or in a vertical plane with a space between two tubes in an adjacent row of tubes, to the end that the products of combustion rising between the tubes shall, after passing between the members of one transverse row or series of tubes, impinge against and be deflected by the members of the next transverse row above, thus insuring a maximum duration of contact between the heated gases and the surfaces of the tubes. Heretofore the abutting edges of the headers have been vertically arranged. In order to secure the desired staggering of the tubes when vertical headers are employed, it is necessary to corrugate the abutting edges of the headers in order that the tubes of one transverse row may alternate vertically with spaces between the tubes of an adjacent transverse row. This construction involves an undesirable frictional resistance to the flow of water through the headers, the flow of water having to conform to the sinuosities of the edges of the headers so that its direction is abruptly changed several times in passing from end to end of a header. Corrugated headers are also open to the objection that they are relatively expensive in construction, owing to the increased quantity of metal involved.

My invention has for its chief object to enable the water tubes to be staggered in such manner as to cause the members of each transverse row of tubes to alternate vertically with spaces between the members of the adjacent row of tubes, without the employment of corrugated headers, the headers having substantially straight internal surfaces along which the water is adapted to flow with the minimum frictional resistance.

The invention also has for its object to augment or accelerate the flow or circulation of the water in a water tube boiler by the aid of the feed-water.

The invention also has for its object to provide certain improvements in the details of construction of the headers.

To these ends the invention consists in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification,—Figure 1 represents a transverse vertical section taken through the steam drum of a water tube boiler and through a portion of the casing in front of the forward series of headers. Fig. 2 represents a section on line 2—2, Fig. 1. Fig. 3 represents a top plan view of the boiler shown in Figs. 1 and 2. Fig. 4 represents an enlargement of a portion of Fig. 2. Fig. 5 represents a fragmentary view of portions of two headers, one being shown in section and the other in front elevation. Fig. 6 represents a section on line 6—6, Fig. 5. Fig. 7 represents a section on line 7—7, Fig. 6. Fig. 8 represents a side view of the hand hole plate shown in section in Fig. 7. Fig. 9 represents a section on line 9—9, Fig. 5.

The same letters of reference indicate the same parts in all the figures.

In the drawings, 12 represents the steam drum and 13 the water or mud drum of a water-tube boiler, the steam drum being located above the forward portion of the firebox 14, while the mud drum is located at a considerably lower point and at the rear end of the firebox. Inclined water tubes 15 are located over the firebox in the path of the ascending products of combustion. The ends of the water tubes 15 are expanded into headers 16, of which there are two series, one series at the front and the other at the rear of the space above the firebox. The headers are abutted together edge to edge, and their abutting edges are inclined, preferably at an angle of 60 degrees to the horizontal, the edges of each header being substantially straight and substantially parallel with each other, excepting the outer edges of the headers at the end portions of the series, which are necessarily truncated to conform to the vertical side walls of the boiler casing as shown in Fig. 1. The horizontal distance between the abutting edges of each header is preferably such that two or more (preferably three) tubes are adapted to be inserted in a horizontal or transverse row in each header, between the abutting edges, the tubes in each header coinciding with the tubes in the other headers, so that the entire series of tubes is arranged in transverse or horizontal rows exetnding from side to side of the boiler. The tubes are also arranged in oblique rows extending parallel with the inclined abutting edges of the headers. The inclination of the abutting edges of the headers being as above stated, preferably at an angle of 60 degrees to the horizontal, it will be seen that the tubes are laid out or arranged in a continuous sequence of equilateral triangles, so that the members of each horizontal row of tubes alternate vertically with spaces between the members of an adjacent row of tubes; hence the products of combustion passing upwardly between the members of one horizontal row will impinge upon and be deflected by

the members of the next higher horizontal row. This arrangement results in a relatively long and intimate contact of the heated gases with the tubes, and the maximum utilization of the thermal efficiency of the fire.

It will be seen that the described inclination of the abutting edges of the headers enables the tubes to be relatively arranged as above described without corrugation of the abutting edges, the said edges being substantially straight and presenting straight internal surfaces, along which the water flows with the minimum frictional resistance. The straight-edged inclined headers give the advantage of a more rapid circulation, and are, moreover, less expensive and lighter than the ordinary corrugated headers.

The upper ends of the front series of headers are connected with the steam drum 12 by conduits 17 expanded into the upper ends of the headers and into the wall of the steam drum. The lower ends of the headers of the rear series are similarly connected with the mud drum 17 by short conduits 18.

The front walls of the front headers and the rear walls of the rear headers are provided with hand holes 19, each hand hole coinciding with a hole for the reception of a water tube 15, and permitting the insertion into the header of a device for expanding the end of a tube inserted in said hole, and also permitting the inspection and removal of the tubes. The hand holes 19 are provided with tapered plugs 20 which are inserted in the hand holes from within the header, the tapered metal surfaces of the plugs bearing directly on the walls of the hand holes without gaskets or packing. Each plug 20 is secured by means of the usual dog or yoke 21, bolt 22, and nut 23. The header walls are provided at suitable intervals with larger hand holes 24, each being preferably of sufficient size to coincide with a plurality, and preferably three, of the water-tube holes, as indicated in Fig. 5. The larger hand holes 24 permit the application, inspection, and removal of a plurality of tubes, and also permit insertion and removal of the plugs 20, the larger hand holes 24 being provided in such numbers and so arranged that all the plugs 20 can be reached through the series of larger hand holes. The hand holes 24 are provided with covers 25, held by yokes 26, bolts 27, and nuts 28.

30 represents a down-flow pipe which extends from an end portion of the steam drum 12 to an end portion of the mud drum 13. If desired, there may be two of these down-flow pipes, one at each end of the steam and mud drums. The return of water from the steam to the mud drum is wholly through the down-flow pipe 30, the flow through the headers being wholly upward. To accelerate or augment the circulation, I provide means for injecting feed water downwardly into the upper portion of the down-flow pipe 30. The feed water is preferably supplied through an economizer, comprising rear transverse headers 31, forward transverse headers 32, and inclined water tubes 33, connecting the headers 31 and 32. The feed water enters the rear header 31 through a supply pipe 34, and is heated in its passage through the headers and through the pipes 33, the economizer as a whole being preferably located above the water tubes 15 and in the path of the ascending products of combustion, which leave the casing through an outlet 35, above the economizer.

36 represents an outlet pipe which conducts water from the front header 32 of the economizer downwardly into the upper portion of the down-flow pipe 30, the outlet 36 extending into the upper end of the down-flow pipe and a short distance below the same. The stream of feed water thus discharged into the down-flow pipe gives a positive impetus to the downwardly flowing water. The velocity of the water is converted into pressure upon reaching the mud drum, causing a positive upward flow from thence irrespective of the action of the heat. The rapidity of the circulation is thus materially increased or augmented.

The boiler casing may be of any suitable construction, and is preferably composed of sheet iron, firebrick and asbestos. It is provided with the usual or any suitable boiler mountings, grate bars and ash pan.

The hand holes 19 are preferably made of sufficient diameter to permit the temporary insertion therein of a bushing or ferrule, through which a water-tube 15 may pass, when it is being inserted or removed. This ferrule prevents abrasion of the wall of the hand hole by the tube. The ferrule is to be removed after the passage of a tube through the hand hole.

It will be observed that the front and rear sides or faces of the headers are substantially rhomboidal, two of the parallel sides being inclined and the other two substantially horizontal.

I claim:

1. A water tube boiler comprising headers having substantially straight opposed edges and water tubes communicating with said headers, the tubes engaging each header being arranged in transverse rows, and the edges of the headers being inclined at an angle of substantially 60 degrees to the horizontal, whereby the tubes are staggered so that the members of each row alternate vertically with spaces between the members of the contiguous row.

2. A water tube boiler comprising headers having substantially straight opposed edges and water tubes communicating with said headers, the tubes being arranged in a continuous sequence of equilateral triangles, and the edges of the headers being inclined at an angle of substantially 60 degrees to the horizontal.

In testimony whereof I have affixed my signature, in presence of two witnesses.

ROBERT CHARLES MONTEAGLE.

Witnesses:
C. F. BROWN,
E. BATCHELDER.