

No. 697,561.

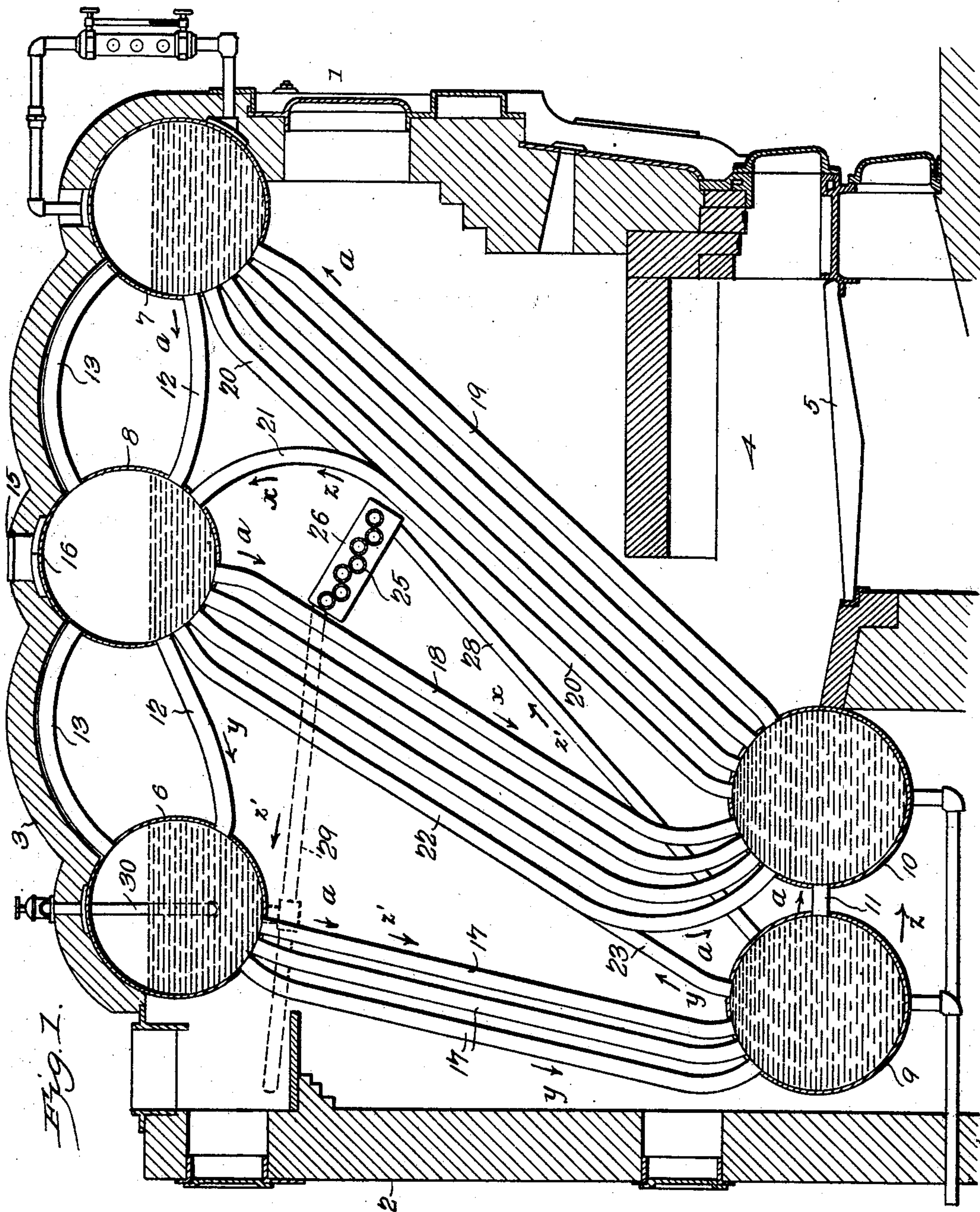
Patented Apr. 15, 1902.

J. S. STEVENS.
STEAM BOILER.

(Application filed Oct. 8, 1901.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses
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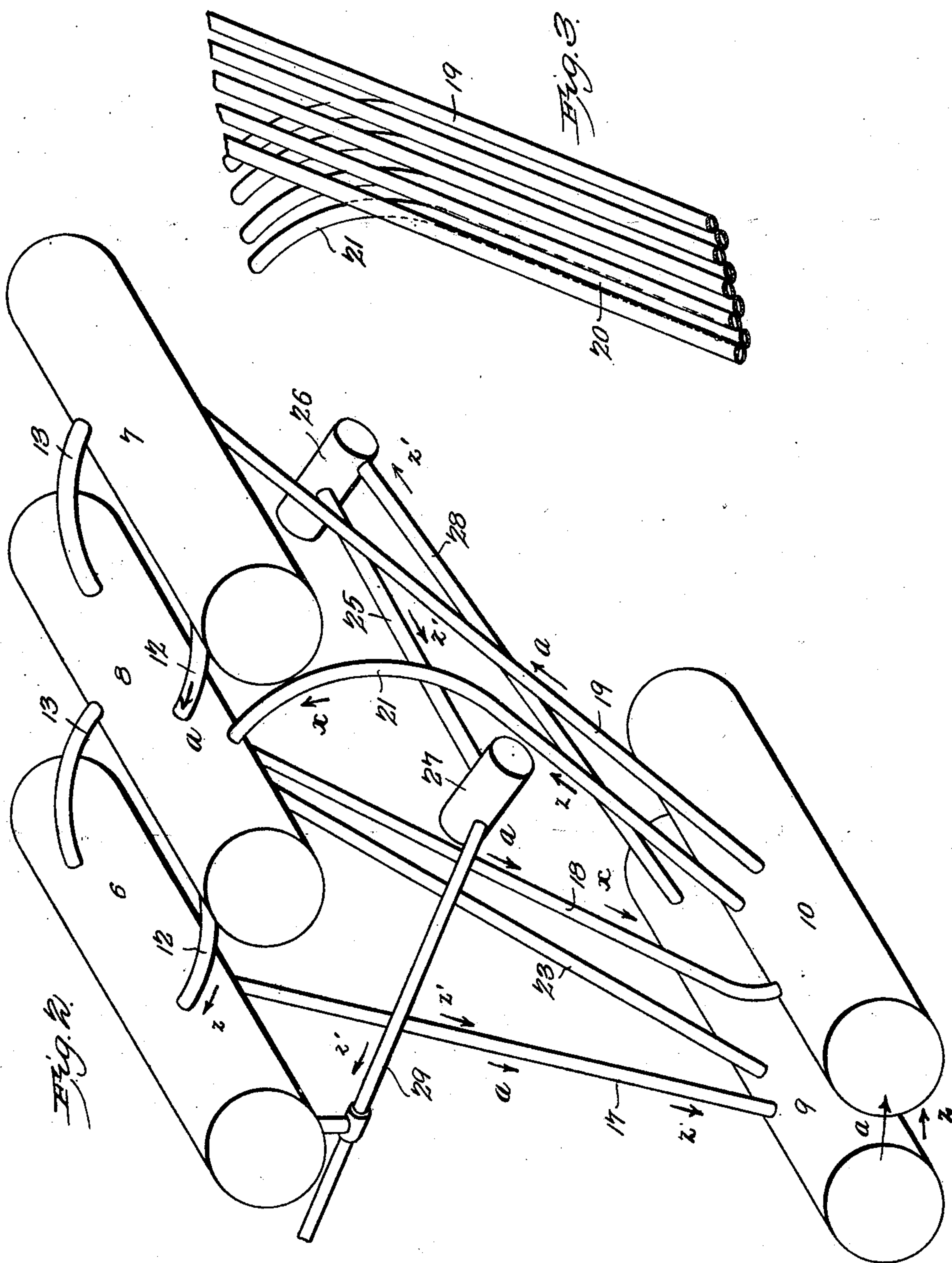
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UNITED STATES PATENT OFFICE.

JAMES S. STEVENS, OF BARBERTON, OHIO.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 697,561, dated April 15, 1902.

Application filed October 8, 1901. Serial No. 78,004. (No model.)

To all whom it may concern:

Be it known that I, JAMES S. STEVENS, a citizen of the United States, residing at Barberton, in the county of Summit and State of Ohio, have invented a new and useful Steam-Boiler, of which the following is a specification.

My invention relates to certain improvements in tubular boilers, and has for its principal object to so construct and arrange the tubes and their connecting-drums as to provide for the better circulation of the water and formation of a much larger volume of steam from a given quantity of fuel than has hitherto been possible in boilers of the class.

A further object is to dispense with the baffle-plates ordinarily employed to direct the course of the products of combustion and to so arrange the tubes as to form such baffle-plates, thus avoiding the trouble and inconvenience resulting from the crumbling and breaking up of the plates and at the same time securing an increased area of water-heating surface.

With these and other objects in view the invention consists in the novel construction and arrangement of parts hereinafter described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims.

In the drawings, Figure 1 is a transverse sectional elevation of a steam-boiler constructed and arranged in accordance with my invention. Fig. 2 is a diagram in perspective, illustrating the water circulation. Fig. 3 is a detail perspective view illustrating the arrangement and disposition of the water-tubes which form one of the baffle-plates.

Referring to the drawings, 1 and 2 designate, respectively, the front and rear walls of a furnace having a top 3, a combustion-chamber 4, a grate 5, and the usual fire and ash-pit doors. In the upper portion of the furnace are arranged three horizontally-disposed circulating-drums 6, 7, and 8, the drum 8 being centrally disposed between the drums 6 and 7 and in a plane somewhat above the latter to form the steam-dome. In the lower portion of the furnace are two mud-drums 9 and 10, which are connected to the upper drums by a series of water-tubes lying in the path of the products of combustion. The

two mud-drums are connected by circulating-pipes 11, and in some cases a single drum may be substituted for the two herein illustrated and described. The upper drums are connected by water-circulating pipes 12 and steam-pipes 13, the central drum 8, which forms the steam-dome, being provided with a suitable safety valve or valves 15 and having connections 16, through which the steam may pass to an engine or heating system.

At the rear of the furnace the drum 9 is connected to the upper rear drum 6 by a series of rows of tubing 17 17, and the drum 10 is connected to the upper central drum 8 by a number of rows of tubing 18 18, a similar series of tubes 19 19 being arranged between the drum 10 and the upper front drum 7, or where a single mud-drum is employed the lower ends of the tubes 17, 18, and 19 are all connected to said single drum.

The construction thus far described is common to boilers of this class, and the course of the products of combustion is directed through the furnace into contact with the three sets of tubes by suitable baffle-plates located between each set. These baffle-plates are usually made of some refractory material and after being in use for any considerable length of time are likely to crumble or break and fall to the bottom of the furnace, pieces being caught between the tubes and necessitating the expenditure of considerable time and labor in making repairs. A further objection to the employment of the usual baffle-plates is that they absorb heat and to some considerable extent reduce the available heat absorbed by the water. In order to overcome these difficulties and at the same time to provide for the better circulation of the water, I form the baffle-plate by arranging a number of the circulating-tubes in such manner as to form a practically solid wall or walls, which will properly direct the course of the products of combustion.

The forward baffle-plate is shown at 20 and comprises the rear row of tubes 19, leading from the drum 10 to the drum 7, and an additional row of tubes 21, leading from the drum 10 to the upper central drum 8. The tubes 19 and 21 are disposed alternately and in as intimate contact as practice will permit, the tubes being slightly staggered, as

shown, in order to make a practically solid wall from the lower drum to a point near the upper drums. The tubes 19 and 21 continue in close relation to a point some distance below the upper drums and then separate, the tubes 19 being extended on the same line and connecting with the forward drum 7, while the tubes 21 are bent rearwardly and upwardly and connected with the water-space of the central drum 8. A similar baffle-plate 22 is arranged at the rear of the tubes 18, this second baffle-plate being formed by alternating the rear row of tubes 18 with an additional row of tubes 23, leading in a substantially direct line from the lower rear mud-drum 9 to the central upper drum 8. The arrangement of these tubes is substantially the same as the tubes 19 and 21, the tubes extending in close relation from the upper drum 8 to a point near the mud-drums, separating at a sufficient distance above the mud-drums to afford a passage for the products of combustion to the escape-tube.

In order to direct the products of combustion into intimate contact with the central bank of tubes, I provide at a point to the rear of the baffle-plate 20 an additional row of tubes 25, arranged closely together in the same manner as the baffle-plates, said tubes being connected at their opposite ends to side drums or manifolds 26 and 27, arranged at the opposite sides of the furnace. The drums 26 and 27 are arranged at an angle to the horizontal, and the lower end of one drum 26 is connected by one or more tubes 28 to the rear mud-drum 9, while the opposite drum 27 has its upper end connected by one or more tubes 29 to the upper rear drum 6. The tubes 25 serve to prevent the direct downward passage of the products of combustion at the rear of the baffle-plate 20, the gases being deflected against the bank of tubes 18 and in their passage acting to heat the water in the tubes 25.

As is usual in boilers of this class the upper rear drum 6 forms the feed-water drum, water being supplied by means of a suitable pipe 30.

In operation the water enters the upper feed-drum and passes down into the rear mud-drum 9, being slightly warmed or heated in its passage and depositing a portion of its sediment in the rear mud-drum. The water then passes through the pipes 11 to the forward mud-drum 10 and, owing to the greater heat to which the forward bank of tubes is subjected, passes up to said forward bank of tubes into the upper front drum 7 and from thence, as water and steam, passing through the connecting-pipes to the central drum 8. The water will then flow downwardly through the central bank of tubes 18 and continue circulating through the mud-drum 10, tubes 19, and drums 7 and 8. This may be considered as the general course of the circulation; but in addition to this minor or secondary circulations are set up, which, owing to their con-

tinuity, will expose the water more constantly to the action of the fire and will permit the water to more readily yield up its steam in the upper drums.

The secondary circulations referred to are as follows: Water in the upper central drum 8 will pass down through the middle bank of tubes 18 into the forward mud-drum 10 and from thence through the tubes 21, which form part of the baffle-plate 20, back into the drum 8. Water contained in the feed-water drum will flow through the rear bank of tubes 17 to the lower drum 9, thence passing upwardly through the tubes 23, forming part of the rear baffle-plate, into the central drum 8, and thence back to the feed-water drum through the tubes 12. A further circulation is maintained from the feed-water drum through the tubes 17, the rear mud-drum 9, pipes 11, forward mud-drum 10, tubes 21, the central upper drum 8, and the tubes 12. An independent circulation is also maintained from the rear mud-drum 9 through tubes 28, the side drum 26, the tubes 25, side drum 27, tubes 29, to feed-water drum, and thence to the rear mud-drum through the tubes 17. This latter arrangement may be modified by connecting the tubes 28 to the forward mud-drum and the tubes 29 to the forward drum 7 or the central drum 8.

In order to more clearly illustrate the general course of the water, together with the secondary or minor circulation, the diagram Fig. 2, which illustrates only a single tube of each bank or set, has indicating-arrows (marked, respectively, x, y, z, z') to indicate the secondary circulations, the arrows a indicating the general course of the water.

It has been found in practice that, other things being equal, a boiler constructed in the manner herein described will produce a much larger volume of steam than boilers constructed in the usual manner and provided with baffle-plates of the ordinary construction.

While the construction herein described is the preferred form of boiler, it is obvious that many changes may be made in the form, proportions, size, and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus described my invention, what I claim is—

1. A water-tube boiler having a plurality of banks of tubes, the tubes forming the rear portions of one or more of the banks being arranged closely together and forming a baffle-plate.

2. A water-tube boiler comprising a plurality of upper drums having communication with each other, a lower mud-drum, a plurality of banks of tubes extending between the mud-drum and the upper drums, the tubes forming the rear wall of the first bank being arranged closely together for a portion of their length and forming a baffle-plate, and thence being separated for the remainder of

their length, alternate tubes being connected to different drums.

3. A steam-boiler having as elements, a pair of connected upper drums 7 and 8, a lower mud-drum 10, a bank of tubes 20 extending from the mud-drum to the drum 7 at a point adjacent to the combustion-chamber, a second bank of tubes 18 extending between the mud-drum and the second upper drum 8, and an auxiliary set of tubes 21 alternating with the tubes 20 forming the rear row of the first bank, the said tubes of the rear row and the tubes 21 being arranged closely together for a portion of their length to form a baffle-plate and thence being separated for the remainder of their length, the tubes 20 continuing with those of the first bank to the drum 7 and the said tubes 21 being connected to the drum 8, substantially as specified.
4. The combination in a water-tube boiler, of a series of upper drums 6, 7 and 8, having communication with each other, two lower drums 9 and 10 also in communication with each other, a bank of water-tubes 17 extending between the drums 6 and 9, a second bank of tubes 18 extending between the drums 8 and 10, a third bank of tubes 19 extending between the drums 7 and 10, an auxiliary row of tubes 21 arranged in alternation with the rear row of tubes in the bank 19 and being

arranged closely together for a portion of their length to form a baffle-plate, said tubes 21 being separated from the tubes 19 near their upper ends and being connected to the drum 8, an auxiliary row of tubes 23 arranged in alternation with the rear row of tubes and the bank 18 and being arranged closely together for a portion of their length, said tubes 23 being separated from the tubes 18 near their lower ends and being connected to the rear mud-drum 9, substantially as specified.

5. In combination in a water-tube boiler, of a plurality of upper drums, a mud-drum, tubes connecting the mud-drum to the upper drums, an auxiliary set of transversely-disposed tubes arranged closely together and forming a baffle-plate or deflector, end drums or manifolds 26 and 27 to which the opposite ends of said auxiliary tubes are connected, and connections between one of said drums and the mud-drum and between the opposite side drums and one of the upper drums, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JAMES S. STEVENS.

Witnesses:

E. E. BOYLE,
C. WARRENER.