

No. 746,533.

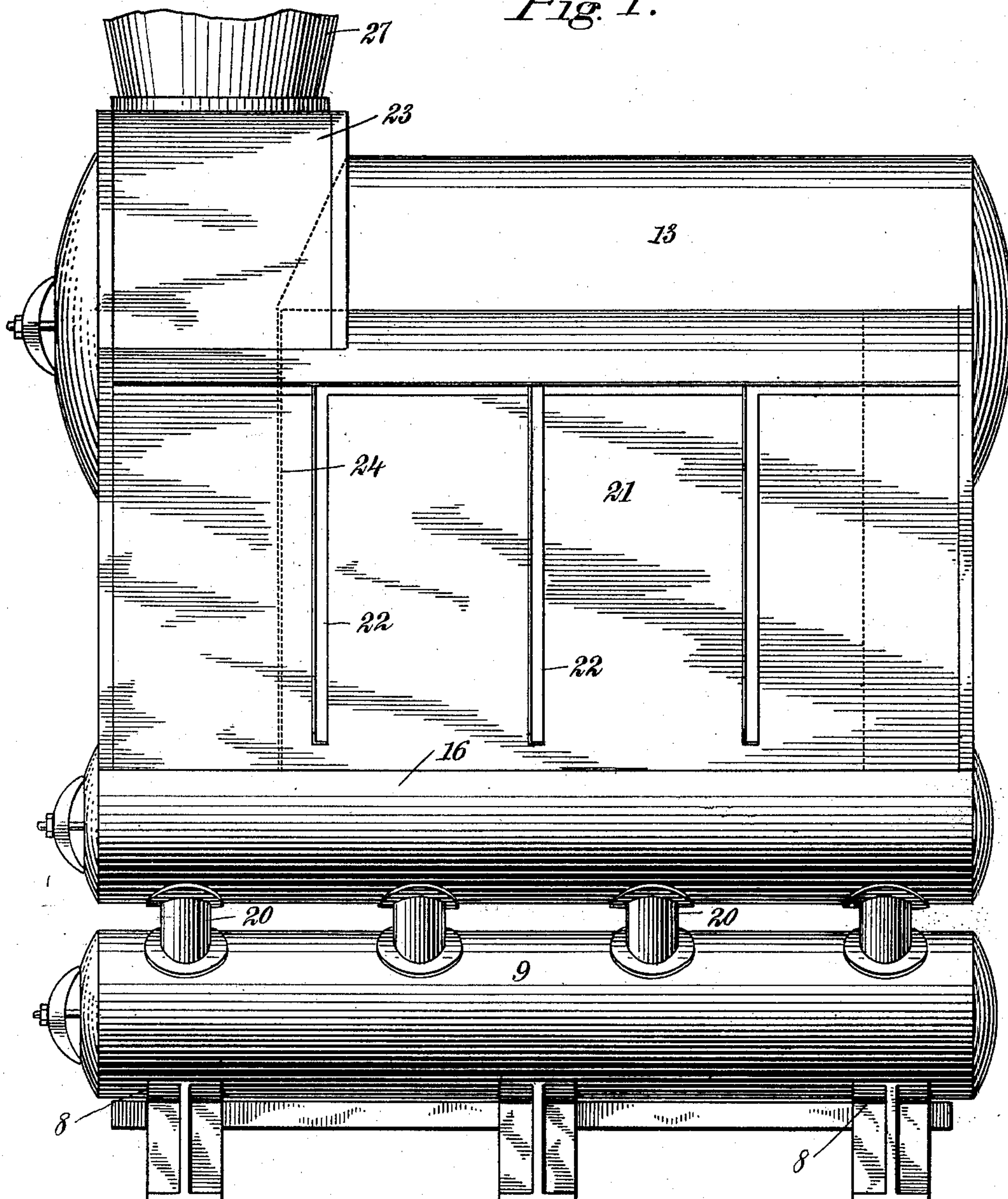
PATENTED DEC. 8, 1903.

H. LAWSON.  
WATER TUBE BOILER.  
APPLICATION FILED NOV. 19, 1902.

NO MODEL.

4 SHEETS—SHEET 1.

*Fig. 1.*



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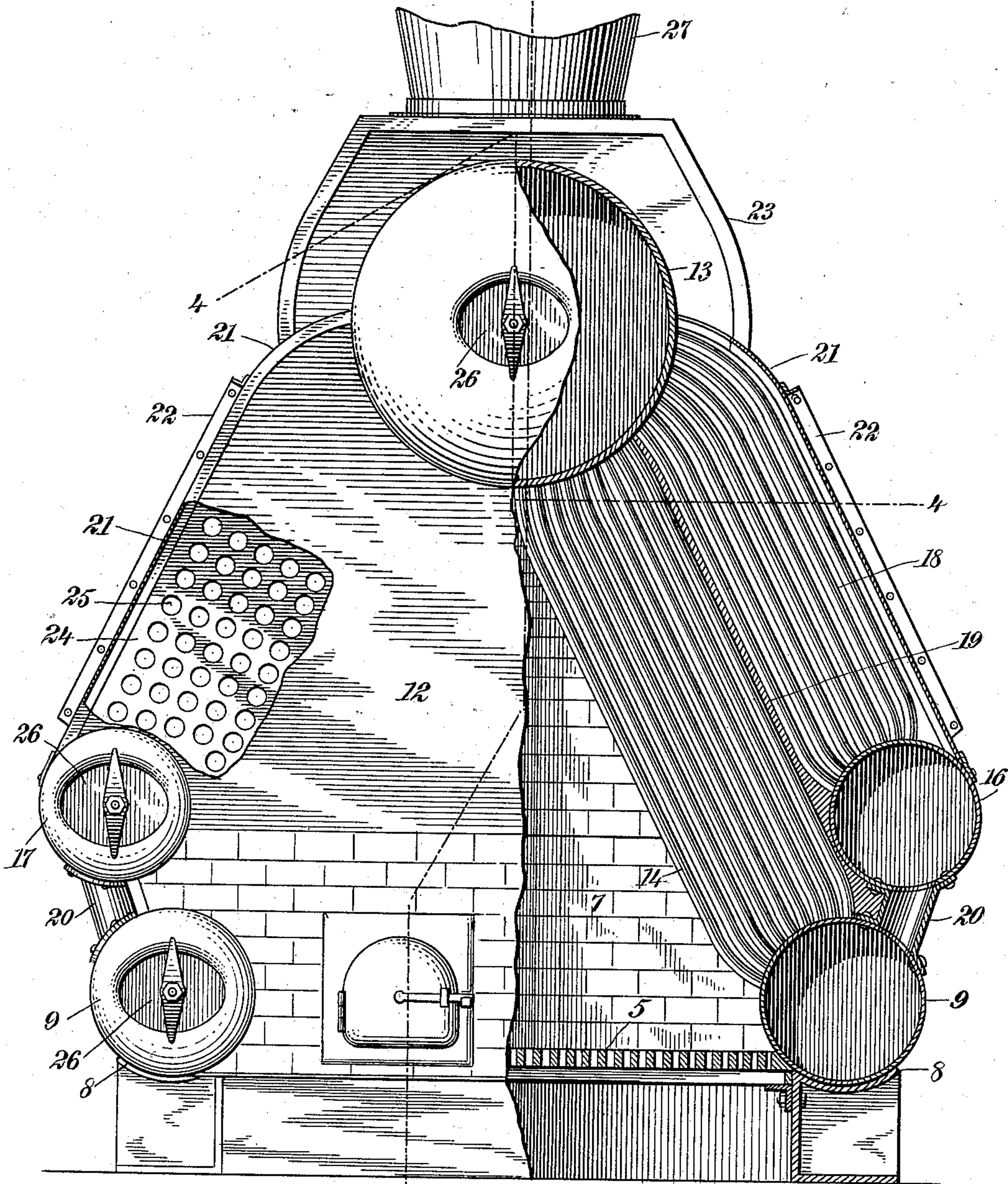
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4 SHEETS—SHEET 2.

Fig. 2.

3



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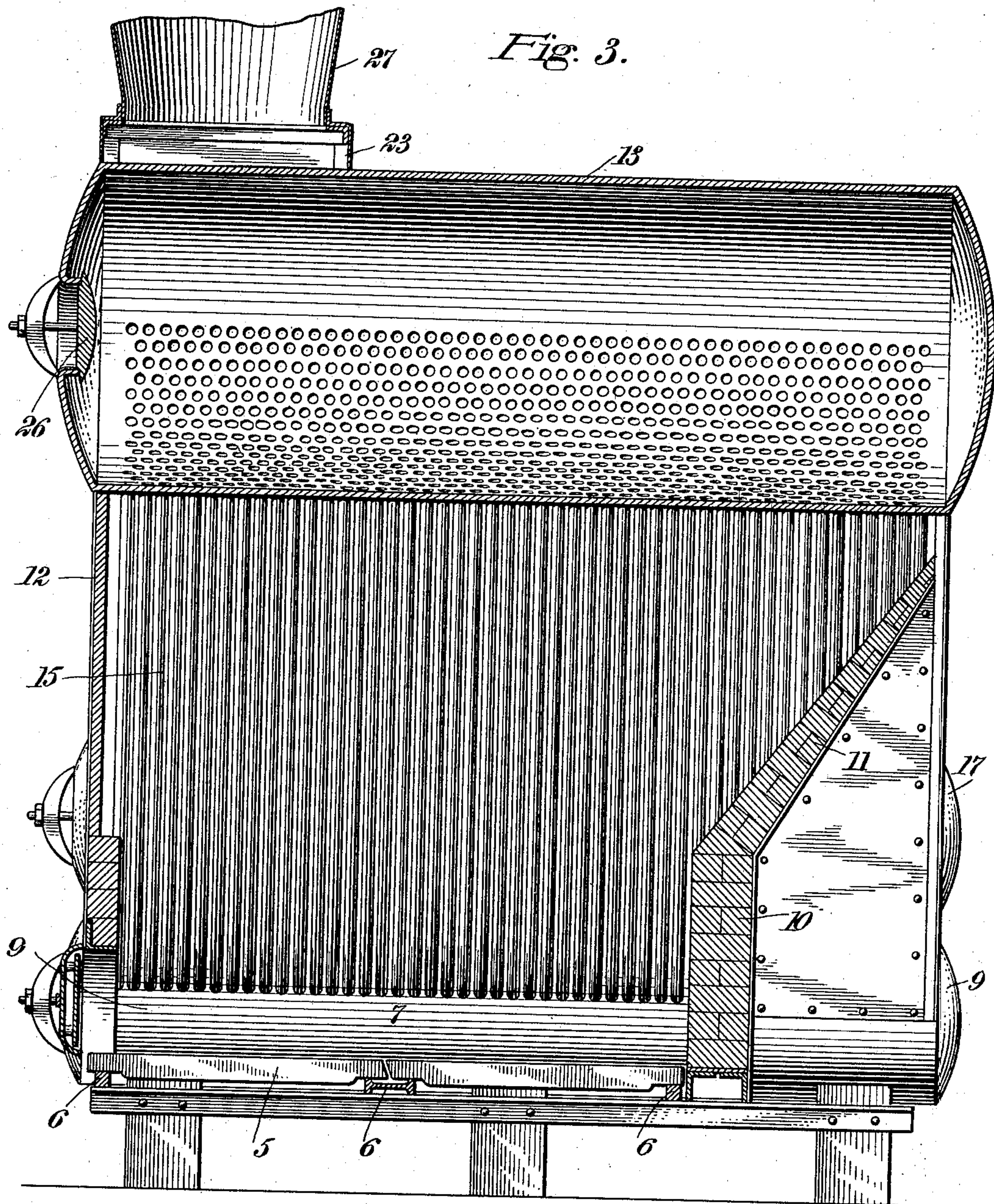
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4 SHEETS—SHEET 3.



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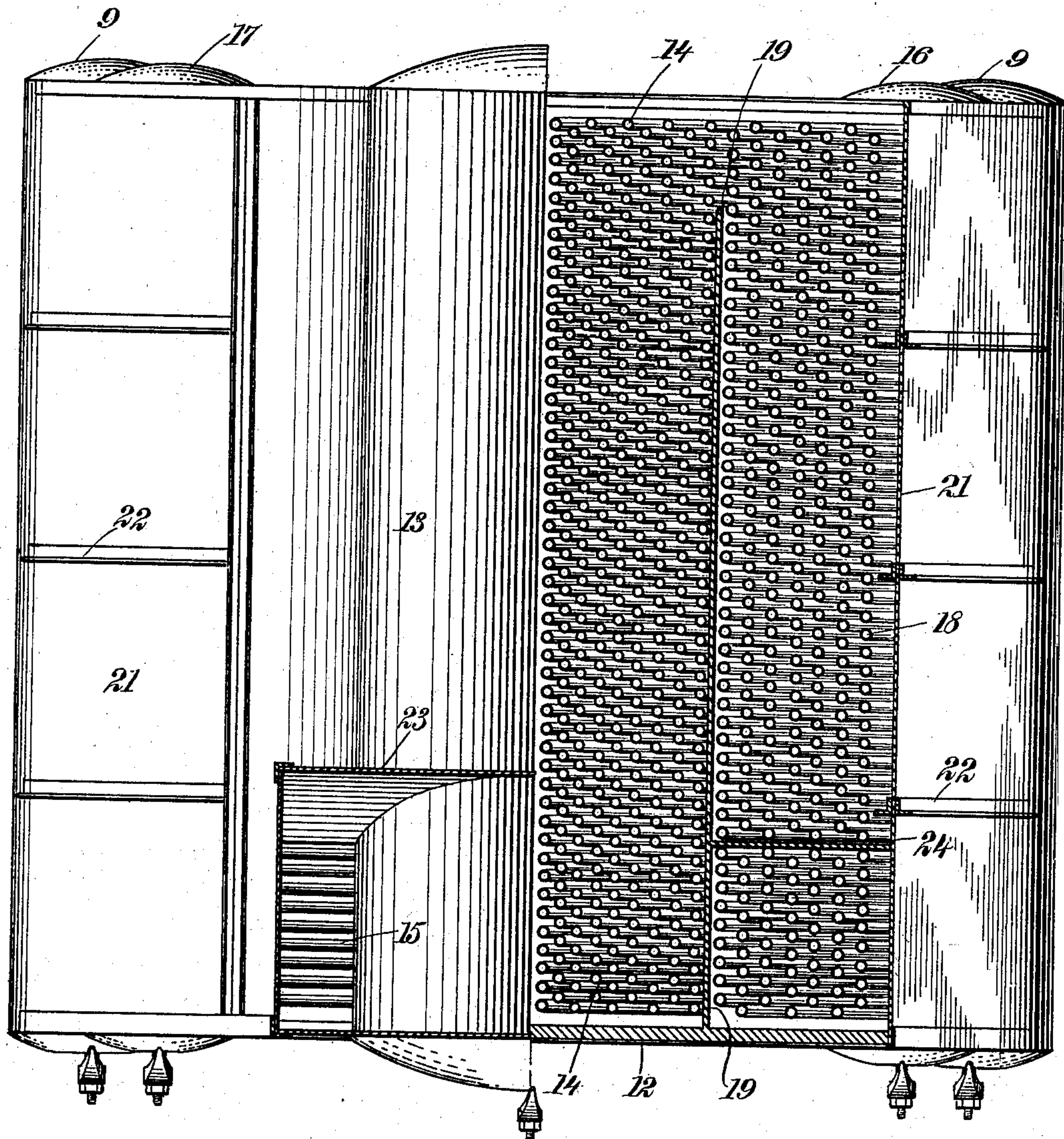
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NO MODEL.

4 SHEETS—SHEET 4.

*Fig. 4.*



WITNESSES:

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# UNITED STATES PATENT OFFICE.

HARRY LAWSON, OF JERSEY CITY, NEW JERSEY.

## WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 746,533, dated December 8, 1903.

Application filed November 19, 1902. Serial No. 131,962. (No model.)

*To all whom it may concern:*

Be it known that I, HARRY LAWSON, a citizen of the United States, and a resident of Jersey City, in the county of Hudson and State of New Jersey, have invented a new and Improved Water-Tube Boiler, of which the following is a full, clear, and exact description.

My invention relates to improvements in steam-boilers of the water-tube type; and one purpose of said invention is to provide means for securing an improved circulation of the water and of the products of combustion. The water circulates through two nests of tubes and a series of drums or shells in a way to be heated in one nest of tubes by the escaping products of combustion; but the other nest of tubes form a heating-surface which arches the grate-chamber, so as to expose said nest of tubes to the intense heat and rapidly generate steam from the previously-heated water supplied by the first-named or heating nest of tubes. The products of combustion circulate first through the chamber formed by the arching nest of steam-generating tubes, thence they are returned so as to impinge the nest of heating-tubes, they are then baffled to escape through the breeching, and finally make their exit through the stack or uptake. The nests of tubes provide heating-surfaces of large area to utilize the heat of the gaseous products of combustion to the best advantage. The shells or drums which are associated with the outer nests of heating-tubes serve as reservoirs to supply hot water to the drums which are combined with the steam-generating tubes, and all these drums are readily accessible for the purpose of cleaning and repairs.

Further objects and advantages of the invention will appear in the course of the subjoined description, and the novelty will be defined by the annexed claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of a steam-boiler constructed in accordance with my invention. Fig. 2 is a front view showing one half of the boiler in vertical section and the remaining half in elevation. Fig. 3 is a vertical longitudinal section taken in the irregu-

lar plane indicated by the dotted line 3 3 of Fig. 2, and Fig. 4 is a sectional plan view taken in the irregular plane indicated by the dotted line 4 4 of Fig. 2.

5 designates the grates which are supported in horizontal positions at the lower part of the boiler on the grate-bars 6, although any suitable means may be adopted for supporting the grates, which necessarily lie at the bottom of the furnace-chamber 7. On opposite sides of the grate are provided the saddles 8, which support the lower cylindrical drums or shells 9, two of said shells being provided. These shells extend the full length of the boiler and beyond a rear bridge-wall 10, the latter having an inclined upper portion 11 arranged to serve as a deflector for the escaping products of combustion. The boiler is closed at one end by a front wall 12, which may be of metal or fire-brick or a combination of both; but the back wall and its inclined portion are preferably made of fire-brick.

13 designates an elevated cylindrical shell arranged in a horizontal position extending longitudinally of the boiler and lying centrally over the grate-chamber 7. The lower shells or drums 9 are connected with the elevated central shell 13 by nests of steam-generating tubes. (Indicated at 14 15 in Figs. 2 and 3.) These nests of tubes are disposed in oppositely-inclined positions, so as to converge upwardly from the lower shells or drums 9 toward the elevated shell 13, and said nests of tubes practically arch the grate-chamber 7, whereby the nests of tubes are exposed to the direct action of the heat and products of combustion generated in the chamber 7. Each tube in the nests of tubes is preferably straight, except at the end portions, where it is gently curved in order to easily enter the shells 9 13.

Above the drums 9 are other drums 16 17, which are disposed on opposite sides of the grate-chamber and extend longitudinally of the boiler, said drums 16 17 being parallel with the drums 9. With the drums 16 17 and the elevated shell 13 are combined other nests of tubes 18, and these nests of tubes are disposed outside of the nests of tubes 14 15. Said nests of tubes 18 lie on opposite sides of the vertical axis of the boiler and



they are connected with the drums 16 17 and the shell 13, each tube being straight throughout its length, except at its end portions, where said tube is gently curved to easily enter the drums 16 17. The tubes comprising the nests 18 communicate with the elevated shell 13 at points above the communication between said shell and the inner nests of tubes 14 15; but said tubes of the nests 18 communicate with the shell 13 below the water-line therein, so as to establish a water circulation between the shells 13, 16, and 17 by means of the outer nests of tubes. The nests of tubes 18 are isolated or separated from the nests of tubes 14 15 by longitudinal partitions or baffle-plates 19. (See Figs. 2 and 4.) These longitudinal partitions or baffle-plates extend from the front 12 of the boiler to a suitable distance near the back or bridge wall 10 11; but said rear ends of the longitudinal partitions terminate short of the rear end of the boiler in order to provide return-spaces for the products of combustion, the latter passing through the grate-chamber 7 to the rear portion of the boiler, around the rear ends of the baffle-plates or partitions 19, and thence returning through the chambers in which are contained the outer nests of tubes 18. These partitions 19 are reversely inclined to conform to the inner and outer nests of tubes, and each partition extends from the elevated shell 13 downwardly to one drum 16 or 17 and to its companion lower drum 9. The partitions thus serve to mechanically separate the nests of tubes and to close the space between the drums 9, 16, and 17 in order to confine the products of combustion within the grate-chamber 7 and prevent the same from passing between the pairs of longitudinal drums.

The drums 16 17 are connected with the lower drums 9 by short water-legs 20, the same being suitably united to the opposing surfaces of the pairs of drums, thus establishing a series of channels whereby the water may pass from the drums 16 17 into the drums 9. The sides of the boiler are inclosed by suitable casings or jackets 21, which are preferably equipped with external stays 22, and these jackets extend from the drums 16 17 up to the shell 13 and the elevated breeching 23, the latter surrounding the upper part of the elevated shell 13.

24 designates baffle-plates which are arranged transversely in the chambers that contain the nests of tubes 18 and are formed by the longitudinal partitions 19 and the external casings 21. These transverse baffle-plates are secured in the chambers parallel to the front 12 of the boiler, (see Figs. 2 and 4 and dotted lines in Fig. 1,) said baffle-plates lying quite close to the front 12. The baffle-plates 24 are provided with perforations 25, as shown by Fig. 2, to permit the products of combustion to pass from the rear part of the boiler into the front part thereof, and these baffle-plates extend into the breeching 23 for the

purpose of conducting the products of combustion upwardly to the stack 27 through the elevated breeching.

The baffle-plates 24 in the return circulating-chambers for the smoke are each perforated for a part of the length and width, as shown at 25 in Fig. 2, while the remaining part of the plate is imperforate. Such imperforate portions of the plates 24 lie next to the longitudinal partitions 19 and adjacent to the breeching 23, an imperforate upper portion of one baffle-plate being shown by Fig. 4, while the perforated portion of each plate lies toward the reservoir-drum 16 or 17 and toward the outer casing 21, whereby the smoke and gases are caused to circulate toward the lower and outer portions of the baffle-plates and then to ascend in abrupt paths toward and into the breeching 23, thus increasing the area of the surfaces exposed to the escaping products of combustion and causing the latter to circulate in tortuous paths.

The front ends of the shells 13, 16, 17, and 9 are extended through the boiler-front 12, and they are provided with suitable closures 26, adapted to be clamped in place by any preferred means, such as the manhole-clamps employed on ordinary boilers, thus making provision for easily obtaining access to the interior of the drums in order to repair or clean the same.

In the use of the improved boiler the flame, gases, and products of combustion generated in the chamber 7 travel longitudinally through the furnace and impinge the nests of tubes 14 15 until they reach the rear of the boiler. At this point the products of combustion are divided and deflected upwardly and rearwardly by the inclined portion 11 of the bridge-wall, after which the gases and smoke pass through the longitudinal chambers formed by the casings and the partitions 19. The nests of tubes 18 are thus exposed to the escaping products of combustion which pass through the perforations of the transverse baffle-plates 24, and finally the gases and smoke pass in upward paths through the breeching 23 and into the stack 27. The water circulates from the shell 13 in a downward direction to the nests of tubes 18 and the drums 16 17. From said drums the water passes through the legs 20 into the lower pair of drums 9, from whence the water passes in an upward direction through the nests of tubes 14 15 back into the elevated shell 13. The water which circulates through the nests of tubes 18 and downwardly to the shells 16 17 is heated by the escaping products of combustion which impinge said tubes; but the water circulating in upward directions from the drums 9 toward the shell 13 through the tubes 14 15 is exposed to the intense heat generated into the furnace. I therefore provide nests of tubes in which the water is heated as it circulates in one direction, and other nests of tubes adapted to generate steam as the water circulates through them in an



opposite direction. The drums 16 17 and their water-legs 20 establish communication between the heating-nests of tubes 18 and the steam-generating nests of tubes 14 15, and these drums 16 17 also act as reservoirs for the hot water to be supplied to the drums 9 and the steam-generating nests of tubes 14 15.

The sides of the boiler herein described are formed by the lower pairs of drums 9, 16, and 17, the same serving to effectually inclose the lower portion of the boiler at the sides thereof, and thereby render it unnecessary to extend the jackets or casings 21 around the lower part of the boiler.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A water-tube boiler having a grate-chamber, smoke-circulating chambers extending longitudinally of the grate-chamber and each communicating with the rear portion of the grate-chamber, an uptake in communication with the front ends of said circulating-chambers, baffles disposed across said circulating-chambers near the front ends thereof, and nests of water-circulating tubes in the grate-chamber and said circulating-chambers.

2. A water-tube boiler having a grate-chamber, lower drums at the sides of the grate-chamber, an elevated steam-drum over the grate-chamber, longitudinal return circulating-chambers for the products of combustion arranged on opposite sides of the grate-chamber, nests of ascending tubes in the grate-chamber and connecting the lower drums with the elevated steam-drum, reservoir-drums above the lower drums, intermediate water-legs connecting the upper and lower water-drums in pairs, and other nests of descending tubes disposed in the return circulating-chambers and connecting the reservoir-drums with the elevated steam-drum.

3. A water-tube boiler having a grate-chamber, drums at the sides of said chamber, an elevated steam-drum over said grate-chamber, nests of ascending tubes connecting said drums with said elevated steam-drum and arching the grate-chamber, longitudinal partitions disposed outside of said nests of tubes and forming return-smoke-circulating chambers which extend longitudinally of the boiler,

reservoir-drums disposed above and connected by intermediate water-legs with the first-named drums, and other nests of descending tubes connecting the reservoir-drums with the elevated steam-drum and disposed in said return-smoke chambers.

4. A water-tube boiler having a grate-chamber, longitudinal partitions forming return circulating-chambers for the products of combustion, baffle-plates in the return-chambers formed by said longitudinal partitions, drums at the sides of the grate-chamber, a central elevated shell, nests of tubes connecting said drums with said shells and arching the grate-chamber, reservoir-shells connected with said first-named drums, and other nests of tubes connecting the reservoir-drums with the elevated shell and disposed in the chambers formed by said partitions and baffle-plates.

5. A water-tube boiler having a grate-chamber, an inclined rear wall at the back portion of said chamber, a steam-drum, division-plates ranging lengthwise of the grate-chamber and forming, within the boiler-setting, return longitudinal chambers which have communication at their rear ends with said grate-chamber, baffles disposed across said circulating-chambers near the front ends thereof, water-drums at the sides of the grate-chamber and the return-smoke-circulation chambers, and ascending and descending tubes connecting the water-drums with the steam-drum and disposed in the grate-chamber and the smoke-circulation chambers respectively.

6. A water-tube boiler having a grate-chamber, a steam-drum, water-drums at the sides of the chamber, a stack, a breeching in communication with the stack, longitudinal smoke-circulation chambers on opposite sides of the grate-chamber, nests of tubes in the grate-chamber and the smoke-circulation chambers, and perforated baffles in said circulation-chambers.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HARRY LAWSON.

Witnesses:

CHARLES A. ROE,  
JOHN P. LEWIS.