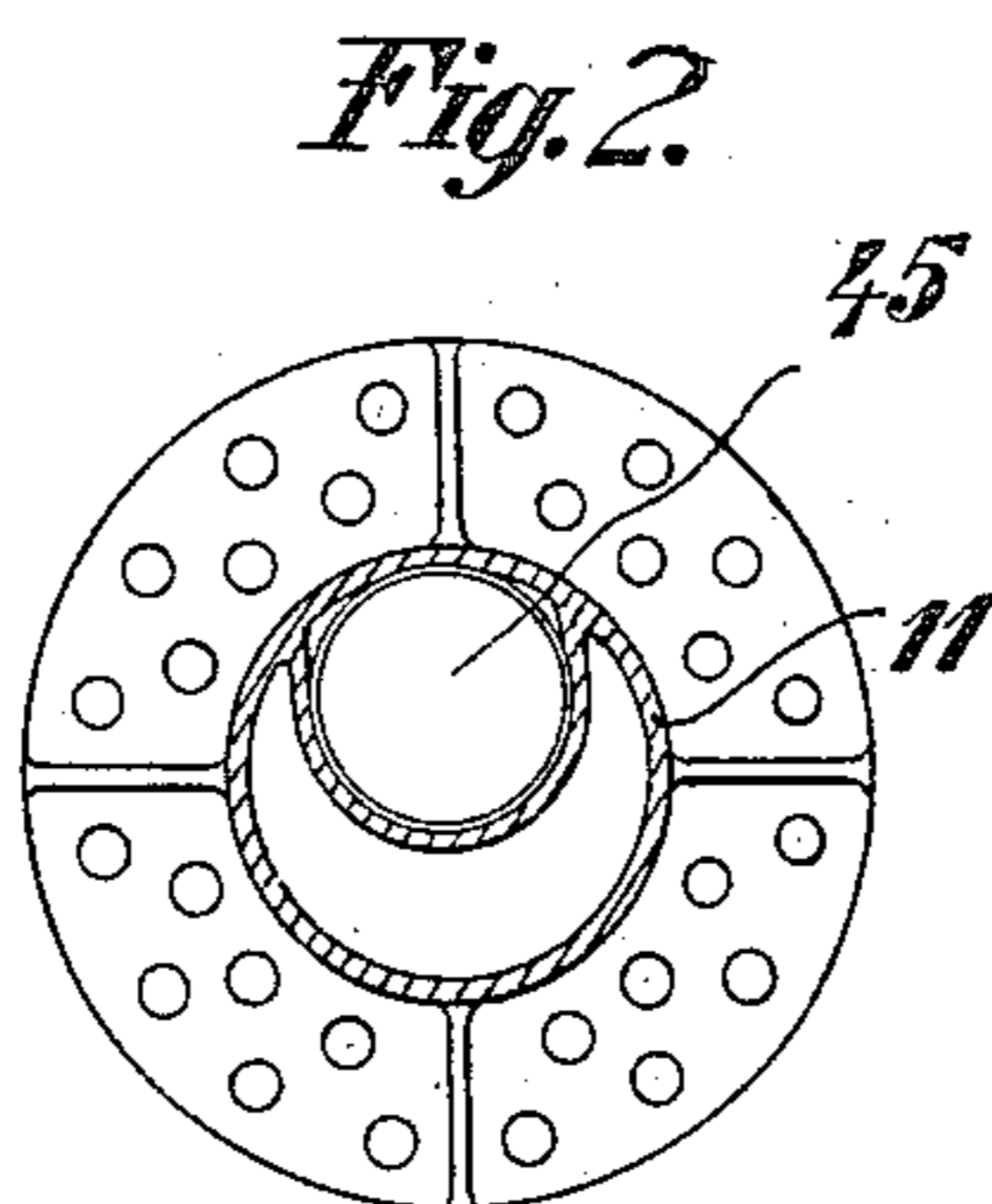
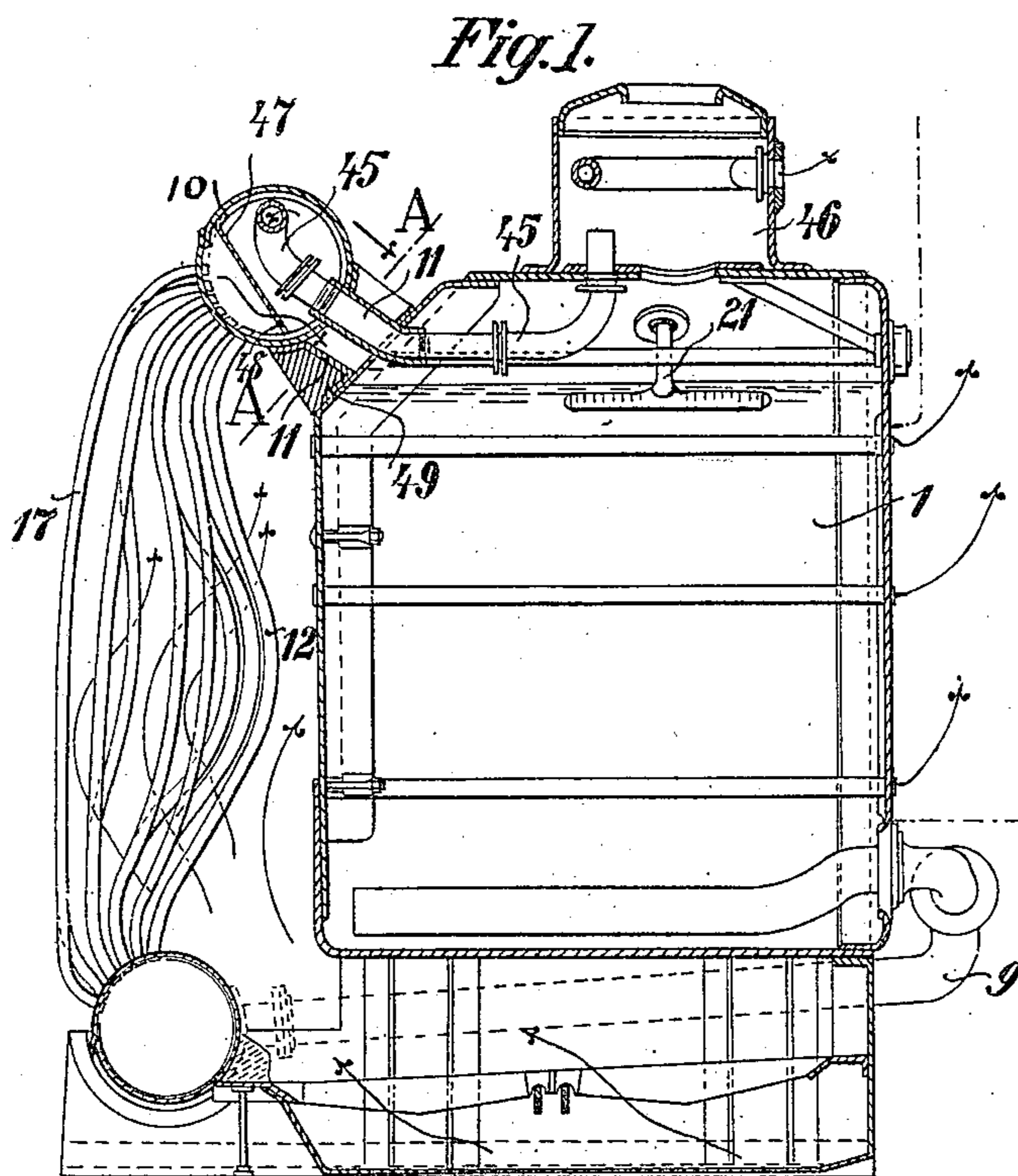


No. 843,497.

PATENTED FEB. 5, 1907.

J. SCHÜTTE.
STEAM GENERATOR.
APPLICATION FILED MAR. 26, 1904.

3 SHEETS—SHEET 1.



Witnesses:
James P. Mansfield
Mae Stephen

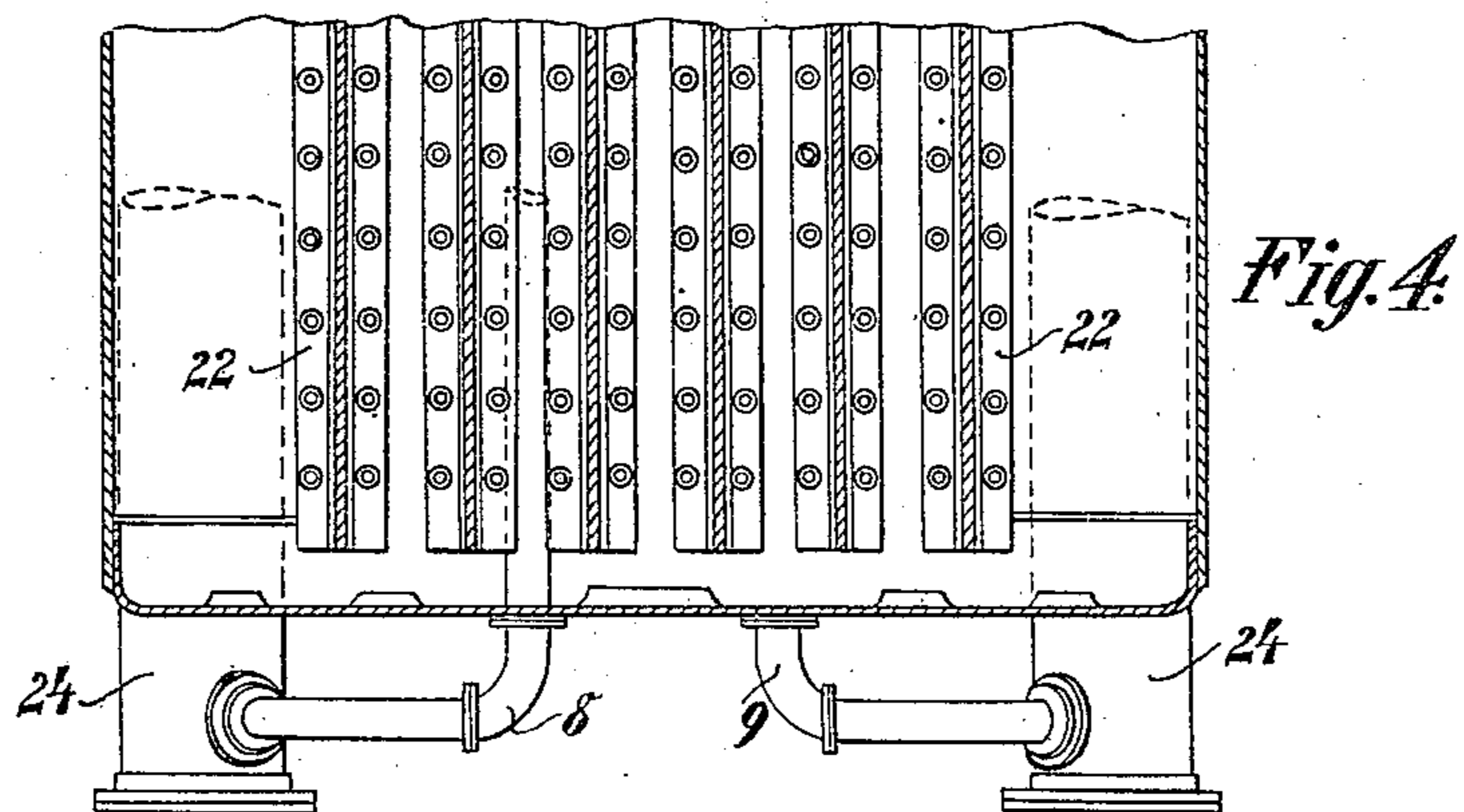
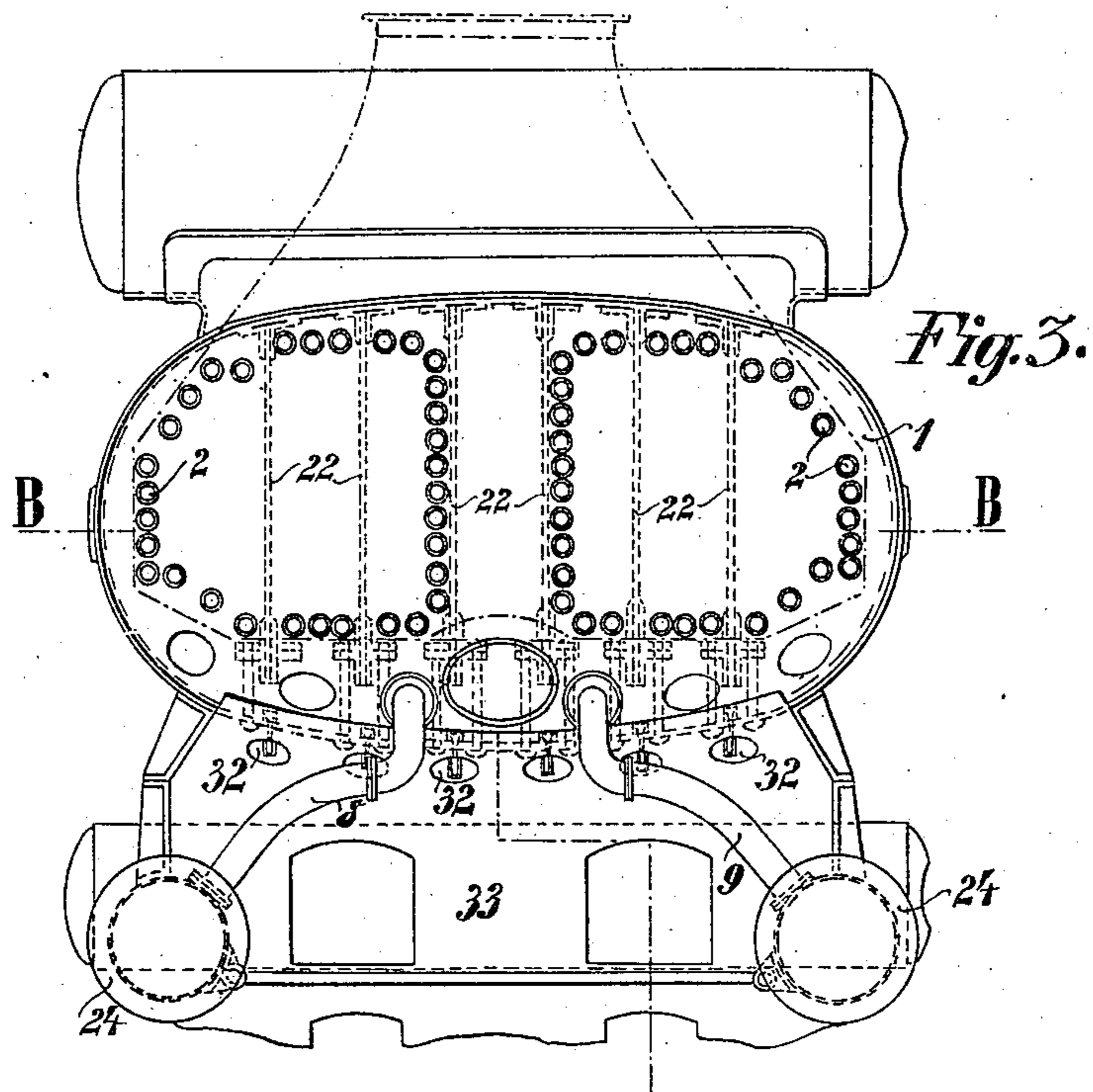
Inventor:
Johann Schütte
By:
Alexander F. Fowell
Attorneys.

No. 843,497.

PATENTED FEB. 5, 1907.

J. SCHÜTTE.
STEAM GENERATOR.
APPLICATION FILED MAR. 26, 1904.

3 SHEETS—SHEET 2.



Witnesses:
James J. Mansfield
Mar. Stephen

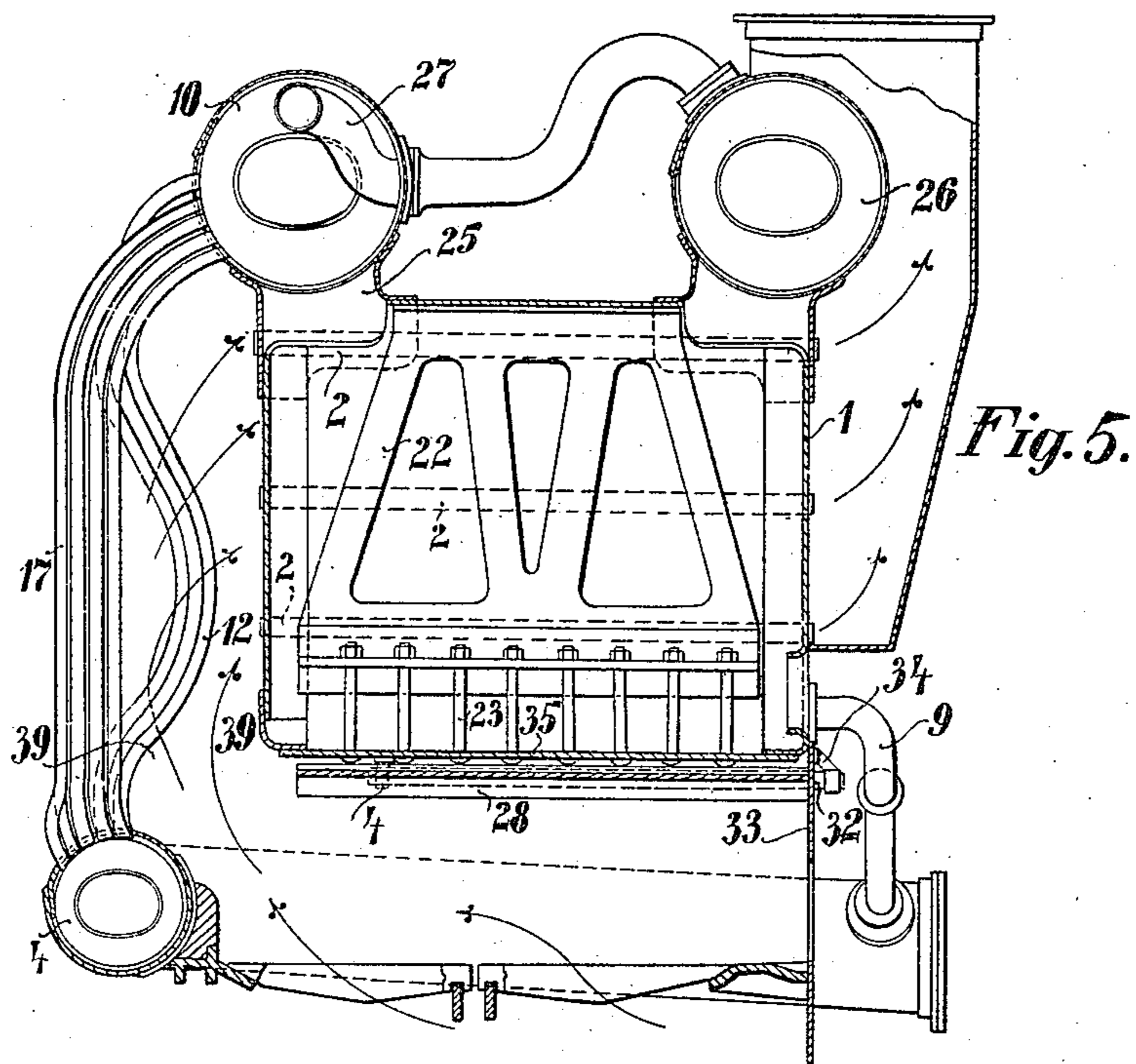
Inventor:
Johann Schütte
By:
Alexander & Lowell
Attorneys

No. 843,497.

PATENTED FEB. 5, 1907.

J. SCHÜTTE.
STEAM GENERATOR.
APPLICATION FILED MAR. 26, 1904.

3 SHEETS—SHEET 3.



Witnesses:
James J. Mansfield
Mac Stephen

Inventor:
Johann Schütte
By:
Alexander T. Soull.
Attorneys

UNITED STATES PATENT OFFICE.

JOHANN SCHÜTTE, OF BREMERHAVEN, GERMANY.

STEAM-GENERATOR.

No. 843,497.

Specification of Letters Patent.

Patented Feb. 5, 1907.

Application filed March 26, 1904. Serial No. 200,099.

To all whom it may concern:

Be it known that I, JOHANN SCHÜTTE, a subject of the German Emperor, a resident of Bremerhaven, free and Hansa town Bremen, Empire of Germany, naval architect, have invented new and useful Improvements in and Connected with Steam-Generators, of which the following is a specification.

This invention relates to a steam-boiler, more particularly intended for marine purposes, but also adaptable for use on land.

The characteristic features of the boiler consist of a fire-tube boiler being combined with a water-tube boiler and by its also having a further property that the fire-tube boiler is heated by a fire beneath it in similar manner to what is done in the case of many stationary boiler installations. The fire-tube boiler may be made cylindrical or oval. A boiler constructed according to these points of view combines the advantages of the ordinary cylindrical marine boiler with return-flame, with these of the water-tube boiler—that is to say, such a boiler raises full steam-pressure in a considerably shorter time than a similarly-sized cylindrical boiler and has a very good water circulation both at the commencement of the firing and also under normal working, and the coal consumption in consequence of this water circulation and of the fire beneath it is less than is the case of a good fire-tube boiler with internal firing. The boiler also yields a very high percentage of evaporation per kilogram of coal consumed without its being necessary to employ any artificial draft or blast, and it is about forty-five per cent. lighter than an ordinary cylindrical marine boiler with returning flame.

Three forms of construction of this improved boiler are shown as an example in the accompanying drawings.

Figure 1 is a vertical longitudinal section of a form of construction of this combined boiler provided with a circular fire-tube boiler. Fig. 2 is a cross-section on the line A A of Fig. 1. Fig. 3 is a front view of a third form of construction of the combined boiler, in which the fire-tube boiler is of oval section. The smoke-chamber which faces the person looking at it, and is therefore really visible, is in this figure shown in dotted lines. Fig. 4 is a horizontal section of this boiler on the line B B of Fig. 3. Fig. 5 is a central vertical section of the boiler.

1 indicates a fire-tube boiler which is assumed to be cylindrical and is heated by a fire beneath it. The fire is attended to in the ordinary manner through a fire-door and ash-pit. A water-tube boiler is arranged behind the fire-tube boiler 1 and consists of a lower water chamber or drum 4, lying transversely, and an upper chamber or drum 10, serving for receiving steam and water, and tubes 12 16 17 connecting the two drums.

The flames and furnace-gases before reaching the fire-tubes 2 of the boiler 1 pass through the group of water-tubes 12 16 17—that is to say, must more or less play around the tubes 12–17. In order to prevent too much heat being imparted to the space behind the water-tube boiler, the second row 16 of tubes is bent in such a way that the separate tubes 16 for the greater part of their length lie in the spaces between the tubes 17. In this way a kind of water-wall is formed, which forms a very good protection against too much heat being given off to the rear. In order to prevent the escape of furnace-gases through the unavoidable space still left between the tubes 16 and 17, a wall 18, of suitable fireproof material, is provided, which fits tightly against the two chambers or drums 4 and 10. It is necessary for the water-tube boiler to be entirely inclosed at the sides and rear (as shown, for instance, by the wall 18 for the back of the boiler) in order to avoid direct admission of cold air to the series of tubes 12–17. In order to force the flame and furnace-gases to pass first through the group of tubes of the water-tube boiler, a horizontal wall 19 is provided.

The number 20 indicates the outer smoke-chamber, or rather the lower smoke-stack attachment.

In order to produce in a boiler of the kind described a vigorous and constant circulation of the water through the fire and water tube boilers, the upper drum 10, into which the feed-water is also introduced by a pipe 21, is connected by a short pipe 11 with the upper part of the fire-tube boiler, the level of the water being preferably only maintained at such a height that a free connection of the remaining steam-spaces is possible through the pipe 11. In order to allow of the connection between the lower parts of both boilers necessary for obtaining a constant circulation of water between the fire-tube boiler and the water-tube boiler being obtained, two

fully large pipes 8 and 9 are provided in the form of construction shown in Fig. 4.

In order to be able to take off the water as far as possible from the absolute bottom of the fire-tube boiler, it is preferable to allow one of the two tubes—for instance, 8, as shown in Fig. 4—to penetrate to a considerable extent into the boiler, so that it mainly draws water from the proximity of the rear tubular wall and the other tube 9 to penetrate only a little way, or even not at all, into the fire-tube boiler, so that this tube 9 mainly draws water from the proximity of the front tubular wall. In this manner sludge is prevented accumulating on the bottom of the boiler and baking fast thereon in a manner dangerous to the boiler under the action of the fire, which action is particularly strong here. Owing to the relatively small pipes 8 and 9 connecting with the wide transverse drum 4, a rapid diminution in the speed of the circulating water is produced in the latter, whereby any dirt and sludge contained in the transverse drum 4 falls to the bottom and may be expelled as required through a sludge-cock located at the lowest point of said boiler. In this form of construction the drum 10, which is connected with the fire-tube boiler 1 by the pipe 11, is raised, so that its lower edge stands above the highest water-level, and it is thus only traversed by the water thrown up by the pipes 12–17—that is to say, the water cannot be stationary in the pipe 11. The steam carried along with this water is able, however, to become separated in the boiler-drum 10, and is conveyed by a pipe 45 in the dome 46 of the fire-tube boiler 1. In order to prevent too much of the water thrown up by the tubes 12–17 from being carried up into the chamber-drum 10 and getting with the steam through 45 into 46, a baffle-plate 47 is arranged, which is only provided in its lower part with suitably-diminished apertures 48 for the passage of the water and steam. It is evident from Fig. 1 that the water retained by this baffle-plate can flow off without further difficulty through the inclined pipe 11, which is mounted in a part 49 of the rear wall of the fire-tube boiler, which part of this object is also made sloping.

In the form of construction shown in Figs. 3 and 4 fire-tube boiler 1 is oval in section and suitably stiffened by perforated sheet-metal stay-bars 22 and stays 23, while the water-tube boiler, in addition to being connected with the transverse drum 4, is also connected with longitudinal drums 24. Two circulation-pipes 8 and 9 also connect with these drums, one, 8, of which pipes takes the water from the proximity of the rear boiler-wall and the other, 9, from the proximity of the front boiler-wall of the fire-tube boiler. The upper drum 10 of the water-tube boiler in this form of construction does not lie be-

hind the fire-tube boiler, but above it. The connection of the drum 10 with the boiler 1 is established by means of a collar-like pipe 25, which in horizontal section is elongated. A second similar drum 26 serves as steam-accumulator and for the actual connection with the main steam-pipe. In order to be able to introduce into the fire-tube boiler as large a number of fire-tubes 2 as possible, which in Fig. 3 are only shown above and below in dotted lines for the sake of more clearly showing the other parts of the boiler, it is preferable in this form of construction to dispense with an actual steam-chamber in the fire-tube boiler and to establish the necessary communication between chambers 10 and 26 by a separate large pipe 27. In this form of construction the circulation of the water takes place in exactly the same manner as in the form of construction shown in Figs. 1 and 2, as here also the water is introduced through the pipes 8 and 9 into the lower drums 24 of the water-tube boiler, in which also any sludge can accumulate without doing harm, and said water passes out of these drums through the strongly-heated water-tubes 12–17 to the upper drum 10, which allows it to flow back again to the fire-tube boiler 1 through the pipe 25. As a vigorous heating of the water-tubes 12–17 in both forms of construction, Figs. 1, 2, and 3, takes place already at the commencement of the firing of the boiler, steam is formed in the small tubes very soon after the fire is lighted, and the water circulation commences very soon and very powerfully of itself, as mentioned at the beginning of this specification, without the help of any special means. This circumstance that a vigorous circulation of the water through the fire-tube and water-tube boilers comes into action very soon after the starting of the fire allows the boiler to be heated in about a fifth of the time which is necessary in an ordinary fire-tube boiler with internal heating for obtaining a full working pressure.

Where oval fire-tube boilers are used, it is difficult to avoid exposing the rivet-seams and stay-bolt heads to the direct action of the fires. These rivet-seams and stay-bolts are, however, so deleteriously affected by the admission of cold air to the fire, which is unavoidable when stoking, that they easily become leaky. This difficulty may be obviated by arranging under the oval bottom of the fire-tube boiler, as shown in the form of construction in Figs. 3–5, a number of air-tubes 28, formed of fireproof material, which tubes are preferably provided with side flanges and are arranged so close together that the flame cannot directly encounter the bottom of the boiler. By allowing air to constantly flow through these tubes their premature destruction can be avoided. The

form of their section and the method in which they are mounted beneath the bottom of the boiler is of subordinate importance.

When the quantity of air admitted through the pipes 28 to the rear combustion-chamber 39 of the boiler is correctly calculated, it very much assists in producing a complete combustion of the smoke evolved, more particularly when fuel is freshly thrown on. What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a steam-boiler the combination of a fire-tube boiler having the top part of its rear wall inclined, a steam-chamber above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, the lower open end of said roomy tube being connected to the inclined top part of the rear wall of the fire-tube boiler, a water-chamber, water-tubes connecting said water-chamber with the steam-chamber, and a fire-grate below the fire-tube boiler, as set forth.

2. In a steam-boiler the combination of a fire-tube boiler, a steam-chamber arranged above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, a steam-tube passing through said roomy connecting-tube and adapted to lead steam from the steam-chamber into the steam-receiver of the fire-tube boiler, a water-chamber, water-tubes connecting said water-chamber with the steam-chamber, and a fire-grate below the fire-tube boiler, as set forth.

3. In a steam-boiler the combination of a fire-tube boiler having the top part of its rear wall inclined, a steam-chamber above the water-level of the fire-tube boiler, a roomy short tube having its lower open end connected to the inclined top part of the rear wall of the fire-tube boiler forming an open connection between the fire-tube boiler and said steam-chamber, a steam-tube passing through said connecting-tube and conveying steam from the steam-chamber into the steam-receiver of the fire-tube boiler, a water-chamber, and water-tubes connecting said water-chamber with the steam-chamber, and a fire-grate below the fire-tube boiler, as set forth.

4. In a steam-boiler the combination of a cylindrical fire-tube boiler having the top part of its rear wall inclined, a steam-chamber above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, the lower open end of said roomy tube being connected to the inclined top part of the rear wall of the fire-tube boiler, a water-chamber, water-tubes connecting said water-chamber with the steam-chamber, and a fire-grate below the fire-tube boiler, as set forth.

5. In a steam-boiler the combination of a cylindrical fire-tube boiler, a steam-chamber arranged above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, a steam-tube passing through the roomy connecting-tube to conduct steam from the steam-chamber into a steam-receiver of the fire-tube boiler, a water-chamber, water-tubes connecting said water-chamber with the steam-chamber, and a fire-grate below the fire-tube boiler, as set forth.

6. In a steam-boiler the combination of a cylindrical fire-tube boiler having the top part of its rear wall inclined, a steam-chamber above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, the lower open end of said roomy tube being connected to the inclined top part of the rear wall of the fire-tube boiler, a steam-tube passing through the roomy connecting-tube and conducting steam from the steam-chamber into a steam-receiver of the fire-tube boiler, a water-chamber, water-tubes connecting said water-chamber with the steam-chamber, and a fire-grate below the fire-tube boiler, as set forth.

7. In a steam-boiler the combination of a fire-tube boiler, a steam-chamber above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, a water-chamber, water-tubes connecting said water-chamber with the steam-chamber, a fire-grate below the fire-tube boiler, two roomy water-tubes, connecting the fire-tube boiler with the water-chamber of the water-tube boiler, one of said roomy tubes opening into the front wall of the fire-tube boiler, while the other passes through the front wall of the fire-tube boiler and extends therein to near the back wall of fire-tube boiler, as set forth.

8. In a steam-boiler the combination of a fire-tube boiler having the top part of its rear wall inclined, a steam-chamber above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, and having its lower end connected to the inclined top part of the rear wall of the fire-tube boiler, a water-chamber, water-tubes connecting said water-chamber with the steam-chamber, a fire-grate provided below the fire-tube boiler, two roomy water-tubes, connecting the fire-tube boiler with the water-chamber of the water-tube boiler, one of said roomy tubes being connected to the front wall of the fire-tube boiler, and the other passing through the front wall of the fire-tube boiler and extending therein to a point near the back wall thereof as set forth.

9. In a steam-boiler the combination of a

fire-tube boiler, a steam-chamber above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, a steam-tube passing through the roomy connecting-tube and adapted to lead steam from the steam-chamber into the steam-dome of the fire-tube boiler, a water-chamber, water-tubes connecting said chamber with the steam-chamber, a fire-grate below the fire-tube boiler, two roomy water-tubes connecting the fire-tube boiler with the water-chamber of the water-tube boiler, one of said water-tubes opening into the front of the fire-tube boiler, while the other passes through the front wall of the fire-tube boiler, and opens therein near the back wall thereof.

10. In a steam-boiler the combination of a fire-tube boiler having the top part of its rear wall inclined, a steam-chamber above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, the lower open end of said roomy tube being connected to the inclined top part of the rear wall of the fire-tube boiler, a steam-pipe passing through the said connecting-tube and adapted to lead steam from the steam-chamber into the fire-tube boiler, a water-chamber, water-tubes connecting said chamber with the steam-chamber, a fire-grate provided below the fire-tube boiler, two roomy water-tubes, connecting the fire-tube boiler with the water-chamber of the water-tube boiler, one of said water-tubes being connected to the front wall of the fire-tube boiler, while the other passes through the front wall of the fire-tube boiler, and has its inlet near the back wall thereof.

11. In a steam-boiler the combination of a cylindrical fire-tube boiler, a steam-chamber arranged above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, a water-chamber, water-tubes provided to connect said water-chamber with the steam-chamber, a fire-grate below the fire-tube boiler, two water-tubes, connecting the fire-tube boiler with the water-chamber of the water-tube boiler, one of said tubes opening into the front of the fire-tube boiler, while the other passes through the front wall of the fire-tube boiler and opens therein near the back wall thereof.

12. In a steam-boiler the combination of a cylindrical fire-tube boiler having the top part of its rear wall inclined, a steam-chamber above the water-level of the fire-tube boiler, a short tube forming an open connection between the fire-tube boiler and said

steam-chamber, the lower end of said tube being connected to the inclined part of the rear wall of the fire-tube boiler, a water-chamber, water-tubes connecting said water-chamber with the steam-chamber, a fire-grate below the fire-tube boiler, two water-tubes connected to the water-chamber of the water-tube boiler, one of said tubes being also connected to the front wall of the fire-tube boiler, while the other tube passes through the front wall of the fire-tube boiler, and has its inlet near the back wall thereof as set forth.

13. In a steam-boiler the combination of a cylindrical fire-tube boiler, a steam-chamber above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, a steam-tube passing through the roomy connecting-tube and conducting steam from the steam-chamber into a steam-receiver of the fire-tube boiler, a water-chamber, water-tubes connecting said water-chamber with the steam-chamber, a fire-grate below the fire-tube boiler, two roomy water-tubes, connecting the fire-tube boiler with the water-chamber of the water-tube boiler, one of said roomy tubes being connected to the front wall of the fire-tube boiler, while the other passes through the front wall of the fire-tube boiler and opens therein near the back wall thereof as set forth.

14. In a steam-boiler the combination of a cylindrical fire-tube boiler having the top part of its rear wall inclined, a steam-chamber above the water-level of the fire-tube boiler, a roomy short tube forming an open connection between the fire-tube boiler and said steam-chamber, the lower end of said tube being connected to the inclined top part of the rear wall of the fire-tube boiler, a steam-tube passing through the roomy connecting-tube and conducting steam from the steam-chamber into the fire-tube boiler, a water-chamber, water-tubes connecting said water-chamber with the steam-chamber, a fire-grate below the fire-tube boiler, two water-tubes, connecting the fire-tube boiler with the water-chamber of the water-tube boiler, one of said water-tubes being connected to the front wall of the fire-tube boiler, while the other passes through said front wall and has its inlet end near the back wall of the fire-tube boiler, as set forth.

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

JOHANN SCHÜTTE.

Witnesses:

W. BERKER,
BRIDERMANN.