No. 864,853. PATENTED SEPT. 3, 1907.

C. D. MOSHER.

STEAM GENERATOR.

APPLICATION FILED APR. 19, 1905.

4 SHEETS—SHEET 1.

Fig. 1.

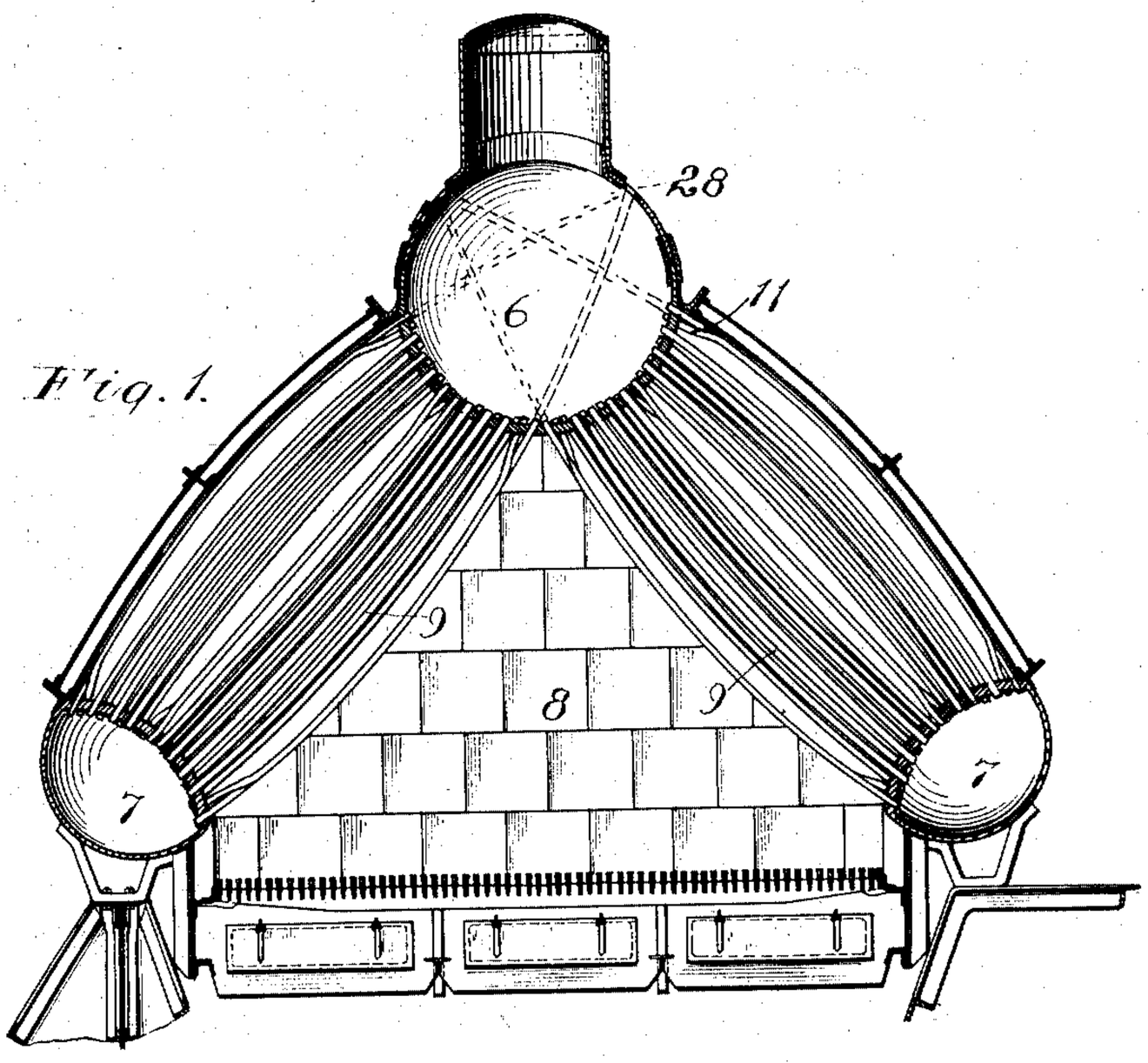
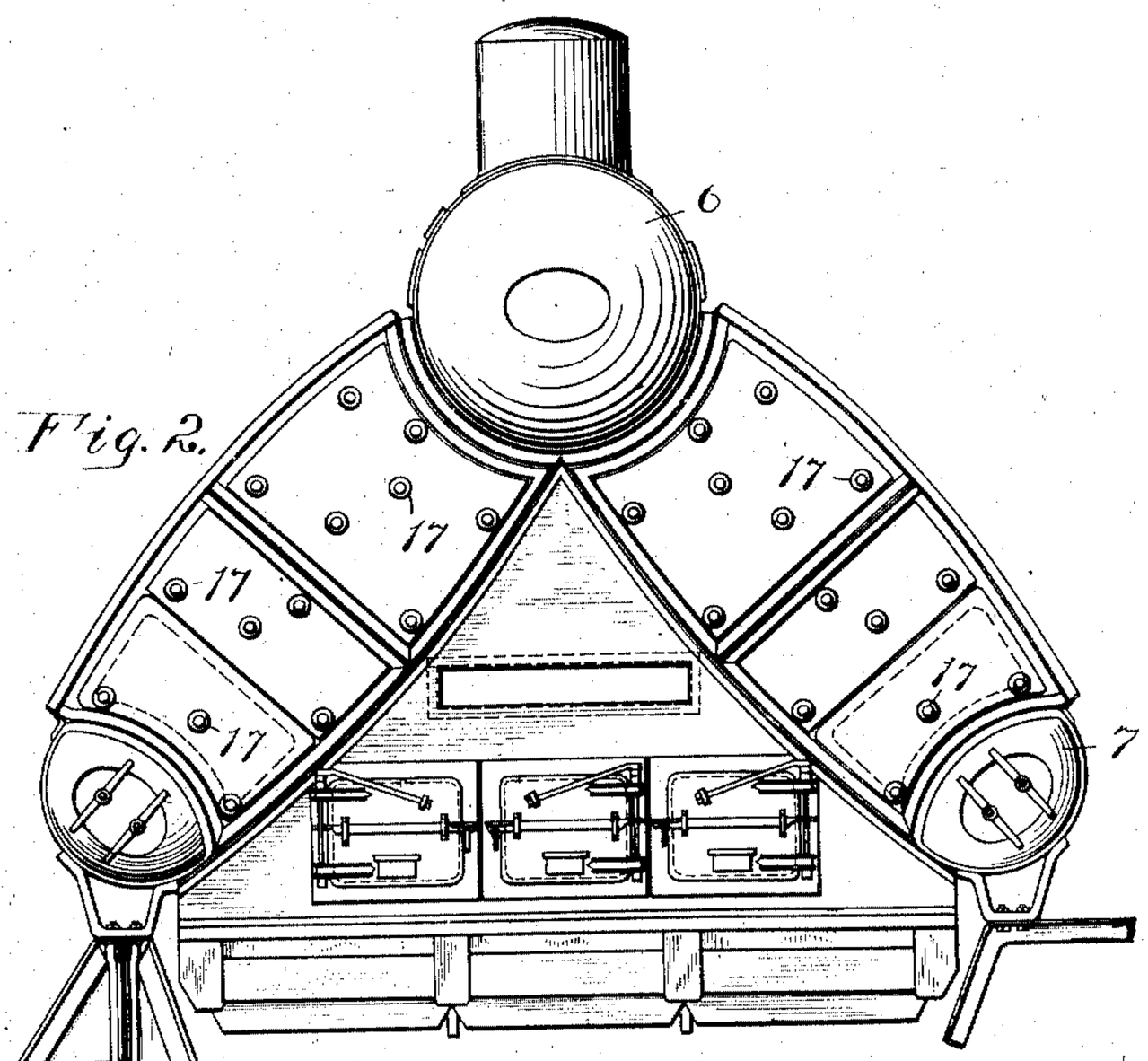


Fig. 2.



Witnesses,
John D. Keeler
Thomas W. Morrison.

C. D. Mosher, Inventor

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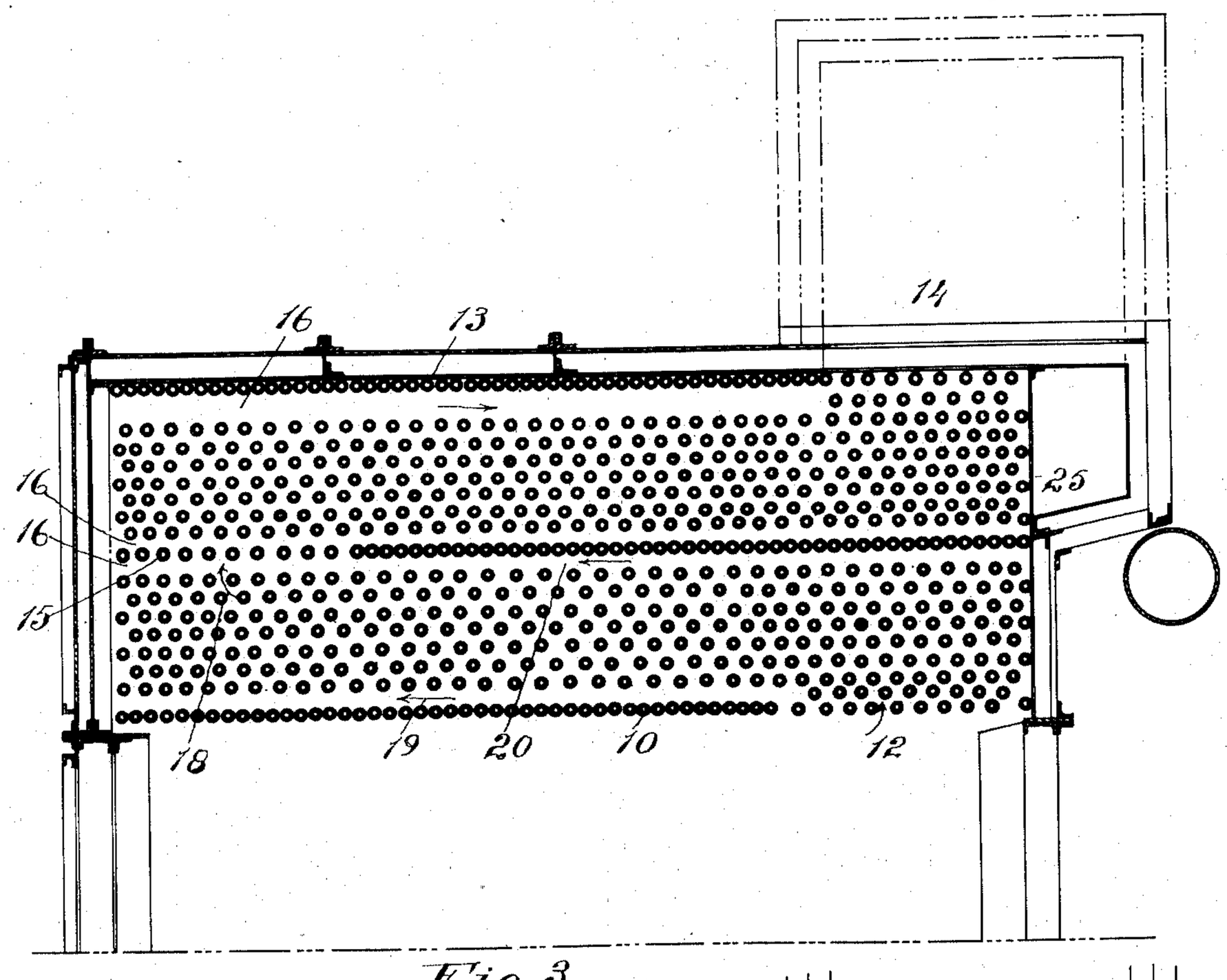

Fig. 3.

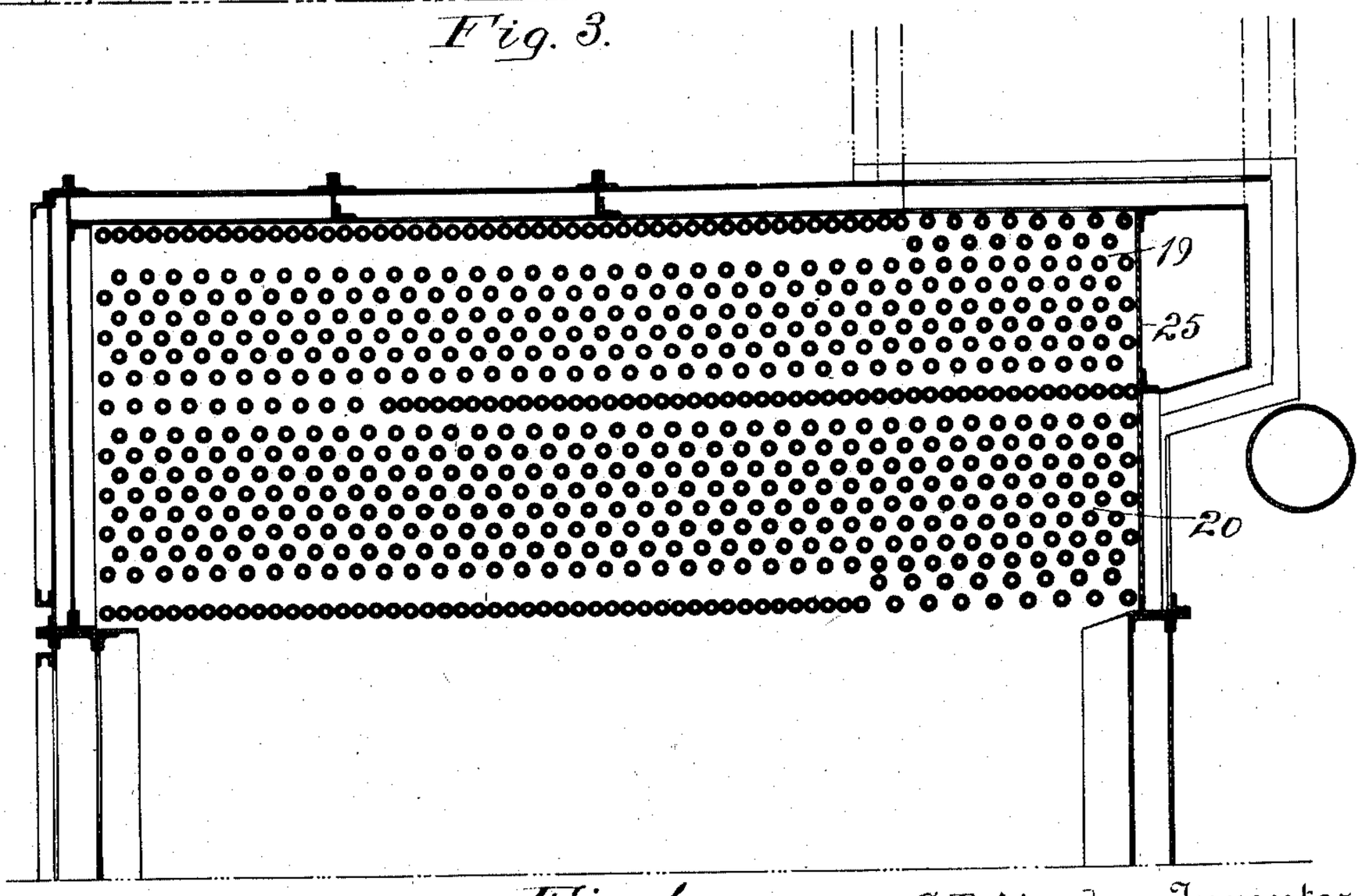

Fig. 4.

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4 SHEETS—SHEET 3.

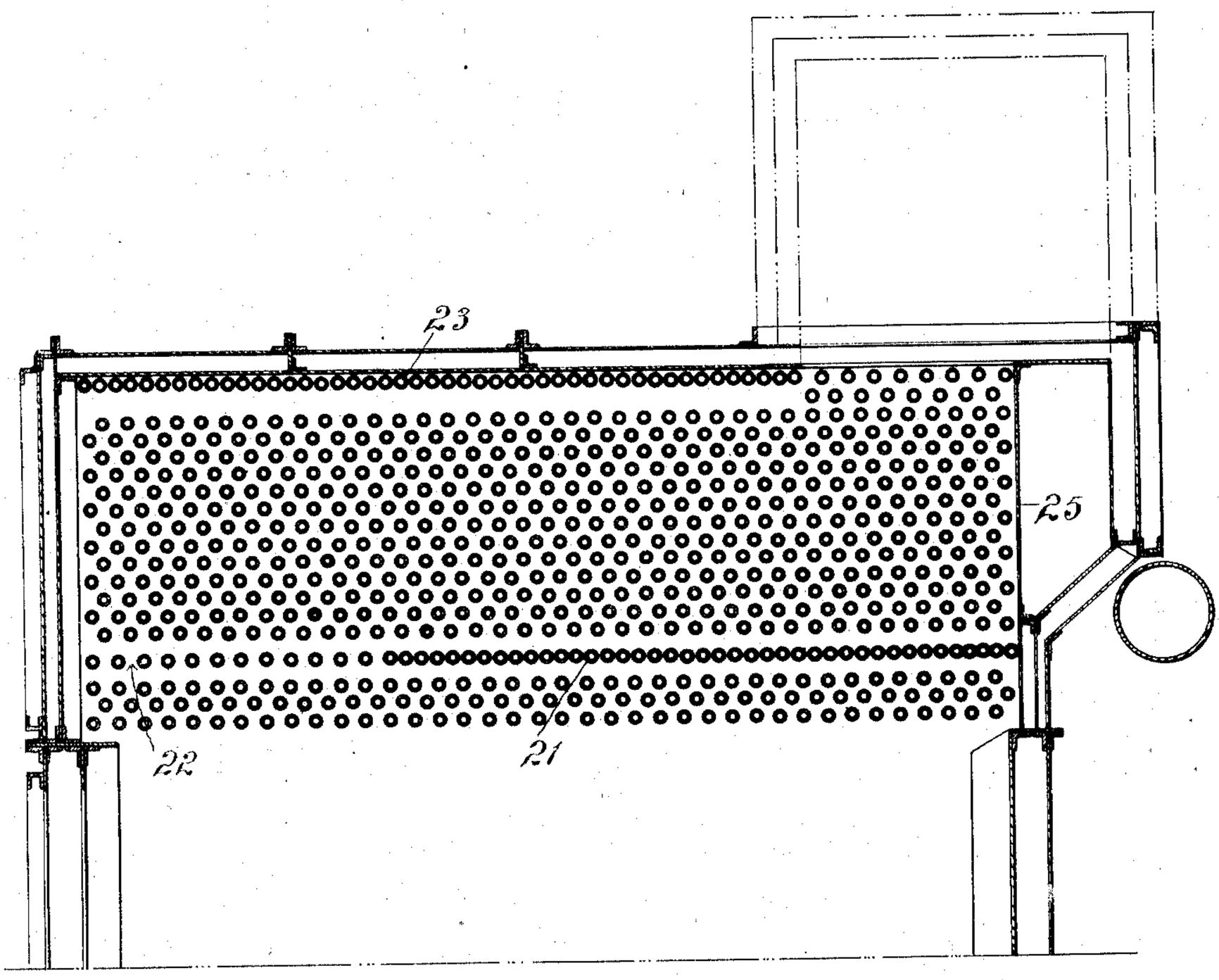

Fig. 5.

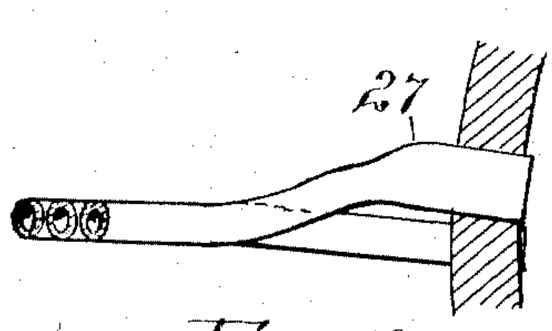

Fig. 6.

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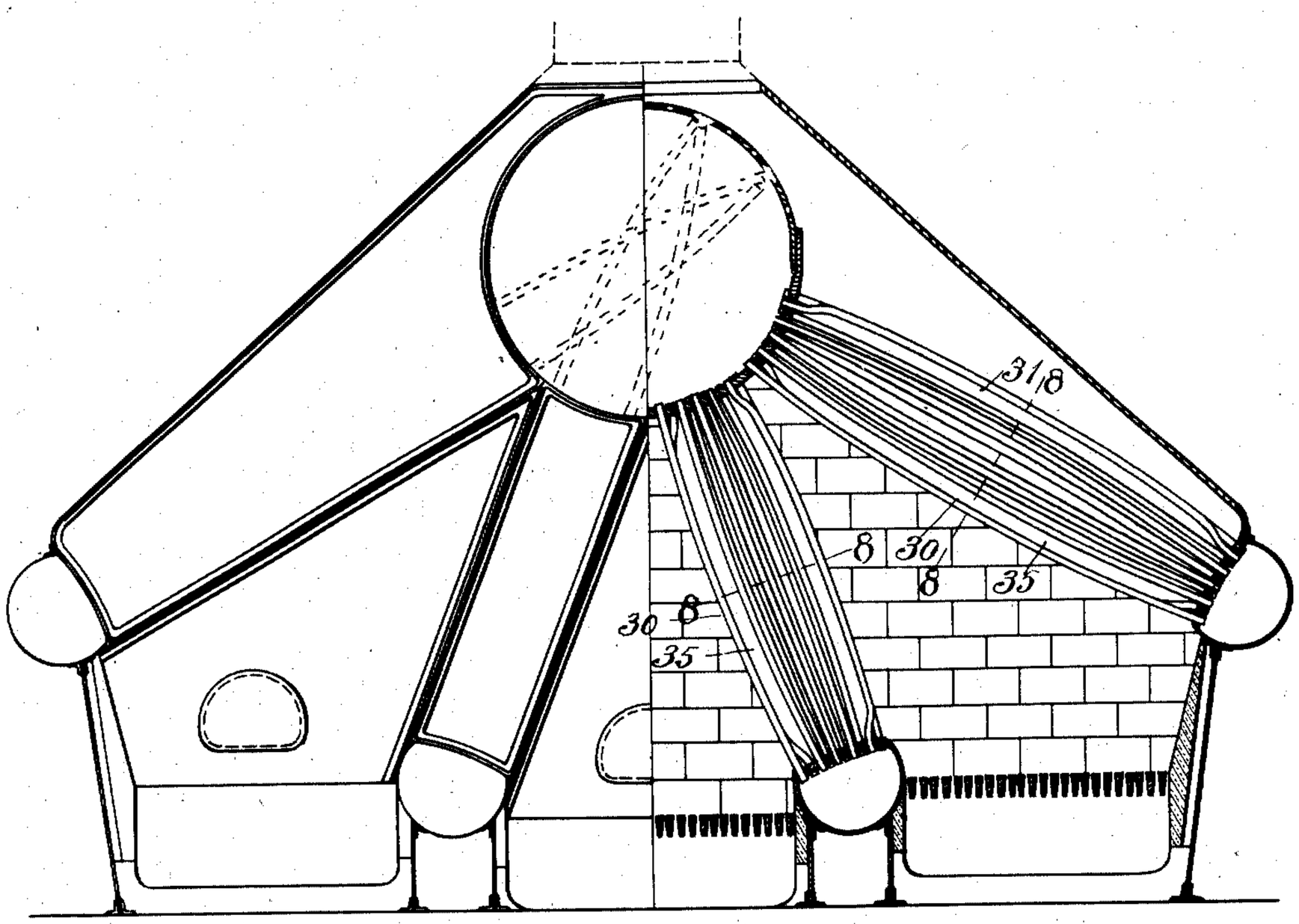

Fig. 7.

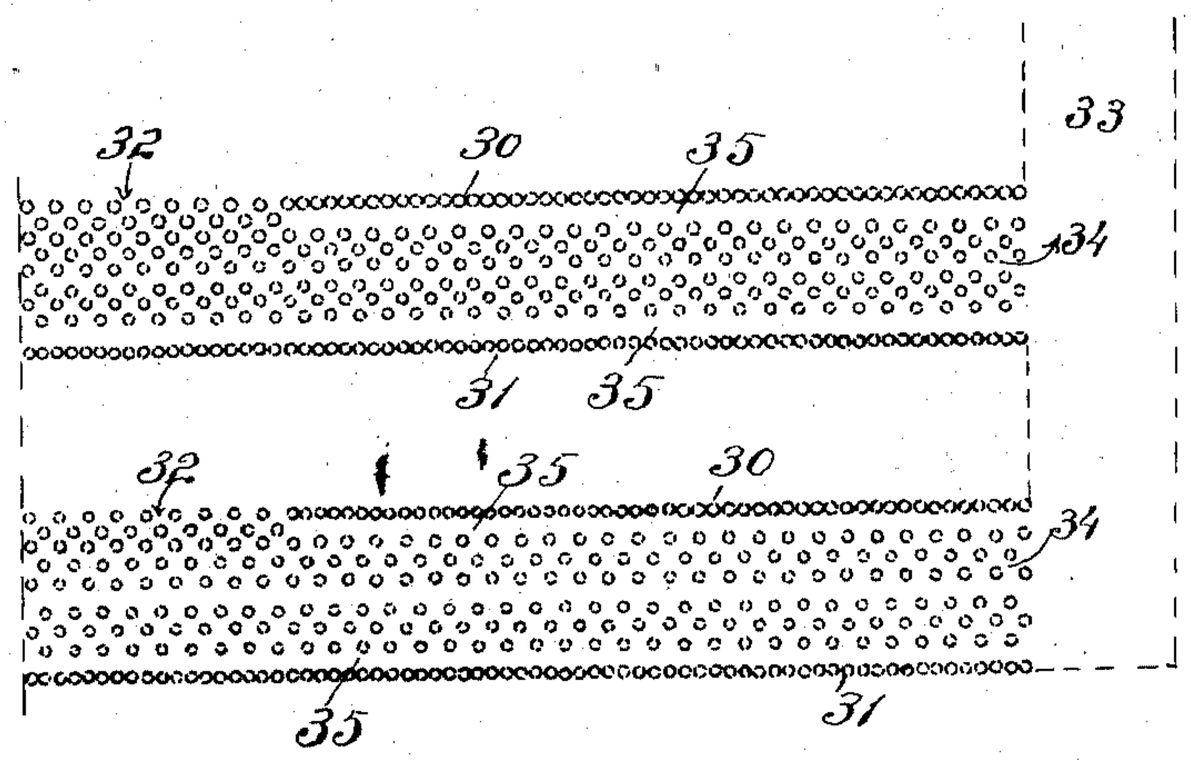

Fig. 8.

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UNITED STATES PATENT OFFICE.

CHARLES D. MOSHER, OF NEW YORK, N. Y.

STEAM-GENERATOR.

No. 864,853. Specification of Letters Patent. Patented Sept. 3, 1907.

Application filed April 19, 1905. Serial No. 256,451.

To all whom it may concern:

Be it known that I, CHARLES D. MOSHER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

My invention pertains to steam generators and has special reference to what is known as water tube boilers, wherein the steam and water drums are connected together by bent or curved tubes.

The objects of the invention are as follows: First, to provide a more convenient manner of removing and renewing the generator tubes. Second, to provide a ready means for cleaning the exterior of all the tubes in the boiler. Third, to provide for a more uniform and efficient distribution of the heated gases from the combustion chamber. Fourth, to provide tubular walls along the tube groupings with channels or spaces alongside of such walls. Fifth, to provide the tubes which constitute these walls with enlarged ends, and also providing plug holes of sufficient diameter to receive the enlarged ends of said tubes, all of which will now be set forth in detail.

In the drawings Figure 1 is a central vertical cross section of the generator. Fig. 2 is a front view thereof. Fig. 3 is a cross section of one set of generating tubes. Fig. 4 is a cross section of a modified form of tube grouping. Fig. 5 is another form of tube grouping, adapted for certain types of boilers, Fig. 6 detail of the large end of the tube. Fig. 7 a front view, partly in section of a three furnace generator, and Fig. 8 a cross section of tubing on line 8 of Fig. 7.

My invention provides for the usual form of steam drum 6, and two water drums 7, which drums are connected together by two groups of generating tubes 9, said water drums being separated a sufficient distance to provide space for the combustion chamber 8. This type of boiler has, therefore, the two groups of tubes inclined at an angle of about 45° and it is, therefore an important problem to so construct the tube spacing and the conduits for the heated gases, that the greatest amount of heat will be absorbed. To accomplish the best results I have made numerous experiments, which convince me that it is important under severe forced draft to convey the gases through the generating tubes as great a distance as possible, and in doing so the utmost facility should be provided for readily cleaning the tubes. Furthermore, it is essential that the distribution of the gases through and among the tubes should be assisted so that the heat will be uniformly applied.

To this end my invention herein has special reference to the manner in which I arrange and group my tubes, whereby the gases will enter the tube groupings at the rear end of the boiler, and be then directed to the forward end of the boiler, and again returned to the rear end of the boiler and to the stack, then exposing the inner half of the tubes of each group to the most intense heat. In order to fully understand this it will be seen in Fig. 3, that I form a tubular wall 10, on the inner side of each group, the wall being made up of the first and second rows of tubes, next the combustion chamber, the bodies of the second row of tubes being directly in line and in juxtaposition with the first row, and the ends of the second row being bent, as shown at 11, Fig. 1, so that they will enter the staggering holes in the drums. This tubular wall extends back only about three-fourths of the length of the fire box, leaving openings as at 12, through the staggered tubes for the gases to pass in. The outer rows of tubes as at 13, are treated in a similar manner, so as to form a tubular wall, the bodies of the next to the last row being in line with the outer row of tubes and this wall extends back to the flue opening 14.

Midway between the inner and the outer tubular walls 10—13, I form a tubular wall 15, this wall extending forward to a point which permits a sufficient opening for the gases to pass through and return, a practice which with various modifications is known in this art, and is not claimed herein. It will be observed however, that by the special construction herein shown I provide a new and important feature in connection with boiler of this class. In Figs. 2 and 3 I show alongside of each tubular wall, a channel or passageway 16. These channels or passage ways have two useful functions; First, they serve as passage ways for cleaners which may be entered through the doors 17, Fig. 2, in the front wall of the furnace, and, second, aid in the distribution of gases of combustion.

It is well known that gases tend to flow directly toward the outlets through the nearest opening and would not sweep over the tubes in the corner portions of the gas conduits formed by the tubular wall. Where, however, there are channel ways or gaps between the tubes, and where as in this case the inlet and outlet of each conduit is on opposite sides of the particular grouping of tubes within each conduit, it is obvious that these channels or passage ways will serve to cause a much more thorough distribution of the gases among all the tubes from end to end of the boiler. It is also obvious that when the gases are diverted from the grouping of tubes in one conduit, to the grouping of tubes in the return conduit, there is less resistance where the gases pass from one conduit to the next, owing to the decreased number of tubes at this point. Thus in Fig. 3 at 18, the gases are shown passing from the inner to the outer conduit through a space which at the division line between the conduits has but a single

row of tubes, and a channel way on each side. As the channel way next to the combustion chamber offers less resistance it follows that the gases would be more thoroughly distributed in order to reach this channel, as shown at 19, and this is equally true as regards the distribution of the gases by the passage ways formed along the walls 13, 15. It is also obvious that, as the tubes are inclined at an angle the tendency of the gases is to rise to the top and move along the upper gap or channel, thereby causing a better distribution of the gases in their tendency to reach this channel, while the lower channel tends to cause the gases to flow more thoroughly over the lower rows of tubes next to the channel. I may modify the placing of these walls as in Fig. 4, where it will be observed, the inner conduit of tubes 20 has several rows of tubes more than the outer conduit 19, or in other words the inner conduit is wider than the outer conduit so as to provide for the difference of volume in the hot gases in the inner conduit and the comparatively cooler gases in the outer conduit. I may also modify the arrangement of the tubular walls by providing only two tubular walls as shown in Fig. 5. In this case the tubular wall 21 may be placed some distance within the grouping, and the opening or passage way 22 is placed at the front end of the boiler, so that the tubes directly over the fire box, and below the tubular wall 21, will receive the benefit of radiated heat for a depth of several tube-rows. By reversing the position of the openings through the walls when the stack is placed at the front end of the boiler the gases will in like manner be caused to pass over all the tubes. The outer row of tubes, in this case also constitute a tubular wall 23, and channel ways 24 are formed on each side of the wall 21 and on the inner side of wall 23, as in the other figures.

In either form of construction, where the gases enter the stack from both the side and the end of the tube-group, it is preferable to stop off the end of the discharge conduit, at the rear end of the boiler by means of a perforated baffle plate 25, to prevent a too free liberation of the gases into the stack from the upper portions of the tubes.

I call particular attention to the structural details of the ends of the generating tubes, of the tubular wall as shown in Fig. 6. The tubes have their ends enlarged, as at 26, for some distance back and the holes in the drums are correspondingly enlarged, and when they are placed in position are expanded in the ordinary way. The object of this is to provide a means of removing them, as the inner row of tubes in the tubular wall, have their ends bent, as at 27, and as it is necessary on removing them to take them out through the plug holes 28, in the opposite wall in the steam drum, it is necessary to so enlarge them in order to have a hole sufficiently large to pass the bend of the tube through.

In Figs. 7 and 8 I show a boiler construction having four groups of generating tubes, in which I employ my system of arranging the tubes. In this arrangement, it will be observed that I have solid tubular outer walls 30, 31 in each group, the lower wall 30 extending only partly along the fire box, leaving the tubes separated, as at 32, so that the products of combustion may pass into the group, and the opposite end of each group is connected with a transverse flue or channel 33 which connects with the stack. The products of combustion therefore enter each group of tubes, at 32, and after passing through the group, escape through between the open tubes at 34 into the flue 33. It will also be observed that each group has alongside of each of its solid walls, a channel or passage way 35 similar in construction and in its uses to the channels in the other figures.

What I claim as new, is:—

1. In a steam generator a tube-wall composed of closely-spaced tubes in substantially the same plane, the alternate tubes having their end-portions enlarged and off-set to fix the tube-ends in two rows in the drum, and a drum formed with two rows of holes in which the tube-ends are fixed, those holes receiving the off-set tubes being enlarged to fit the enlarged tube-ends and permit the passage of the off-set tubes into the drum.

2. In a steam generator the combination of a drum, and a tube having an abrupt bend and an enlarged end fastened in a hole in the drum of sufficient size to permit the passage of the bend.

3. In a steam generator, a steam-drum, and a series of water-tubes having abrupt bends near their upper ends and enlarged ends fixed in holes in the drum of sufficient size to permit the passage of the bends, said drum having one or more openings in its wall opposite the ends of the tubes to permit the withdrawal of said tubes.

4. In a steam generator, a steam and a water drum, and a group of water-tubes connecting said drums, adjacent rows of tubes within the group having their bodies located in the same plane to form a tube wall at a depth of one or more tube-rows from the combustion-chamber, the rows between said wall and the combustion-chamber being open-spaced to admit the radiant heat and gases among the tubes.

5. In a steam generator, a steam and a water drum, a group of tubes connecting said drums, and a solid tube-wall within the group adapted to deflect gases and formed by adjacent rows of tubes having their bodies located in the same plane, the steam drum having provisions for the removal from the boiler of the tubes in said tube-wall by passing them into said drum.

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

CHARLES D. MOSHER.

Witnesses:
ADA C. NEILSON,
J. T. ZIRBY.