No. 850,423. PATENTED APR. 16, 1907.

W. S. ELLIOTT.

WATER TUBE BOILER.

APPLICATION FILED JUNE 25, 1906.

4 SHEETS—SHEET 1.

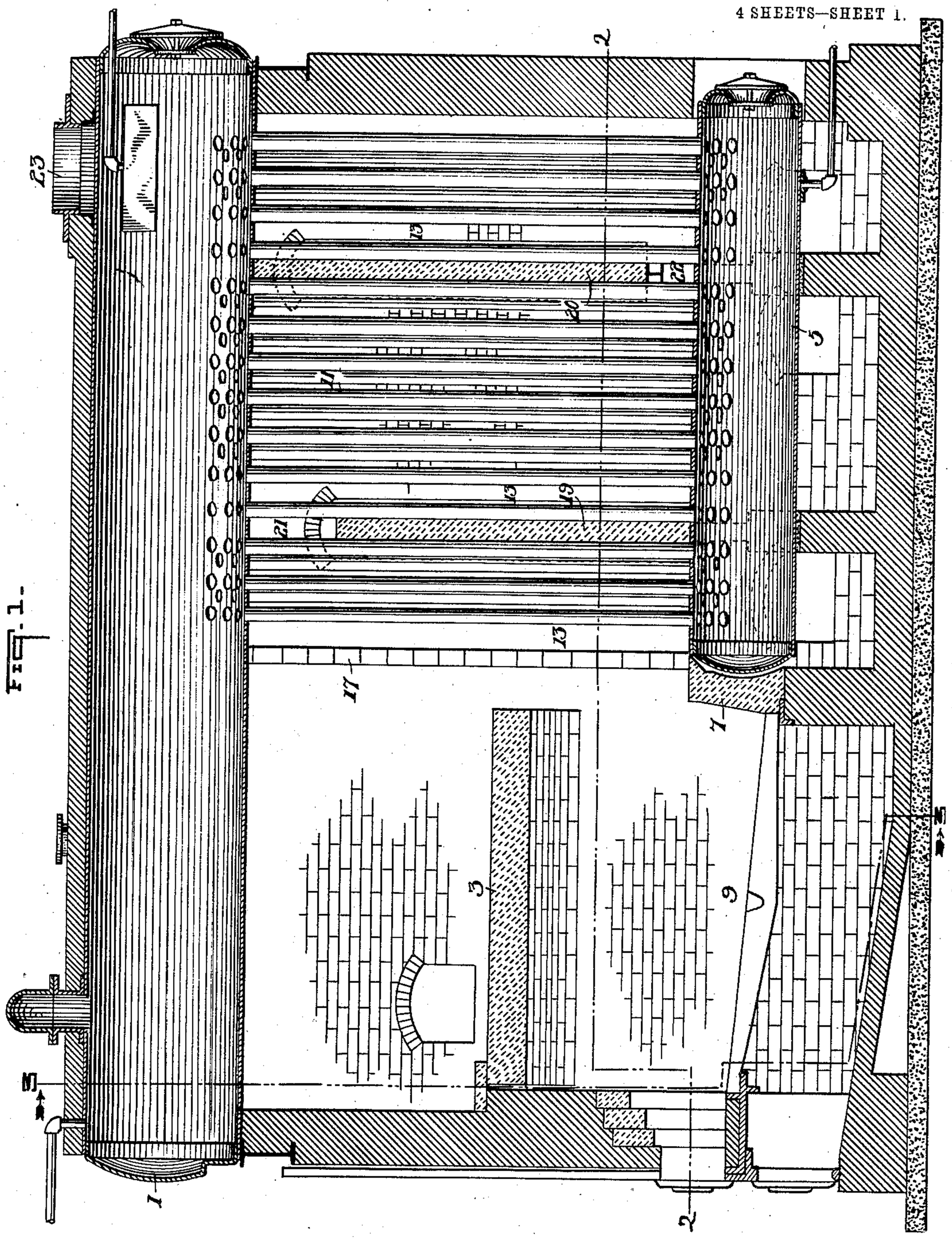

FIG. 1.

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4 SHEETS—SHEET 2.

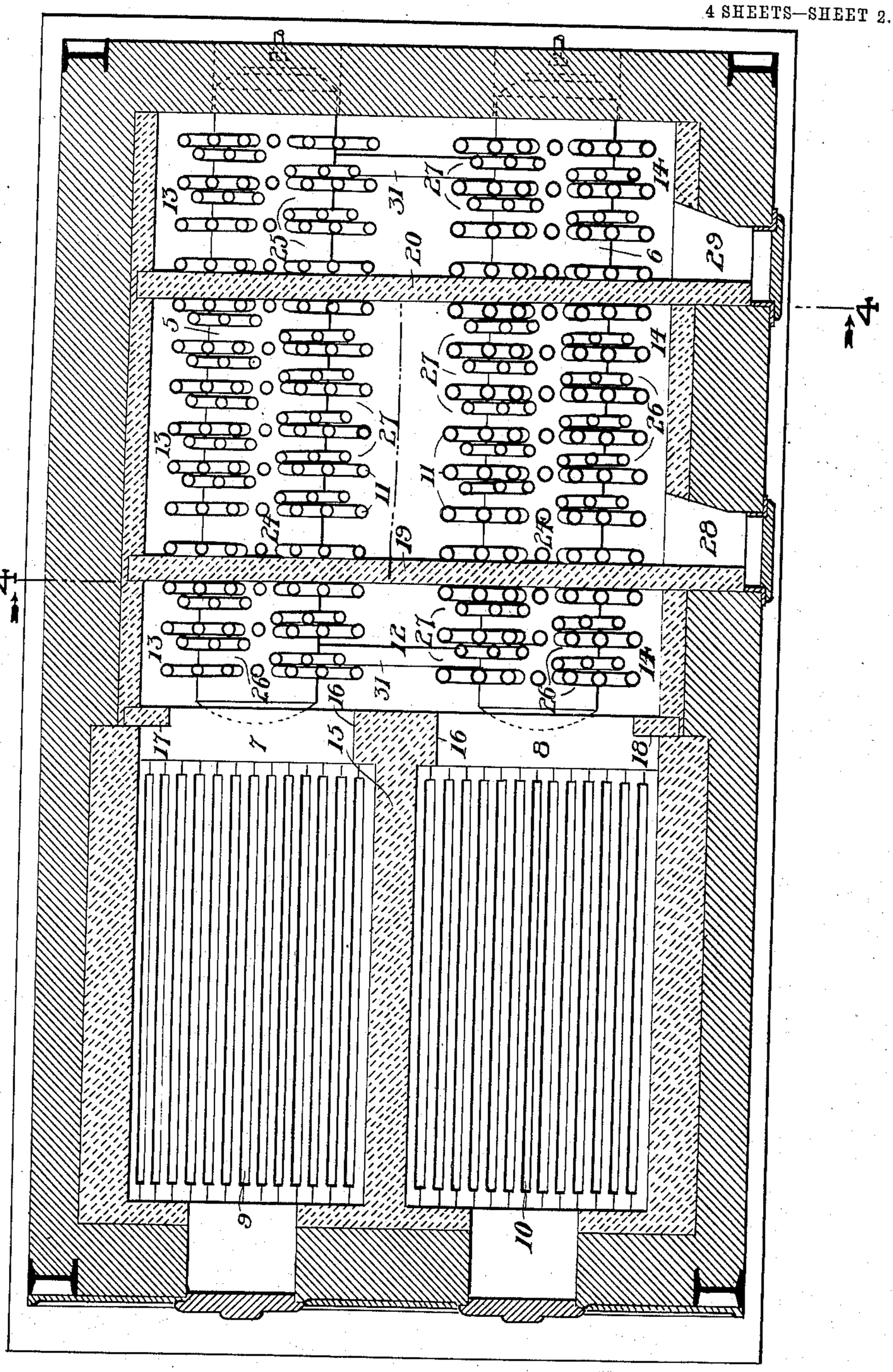

FIG. 2.

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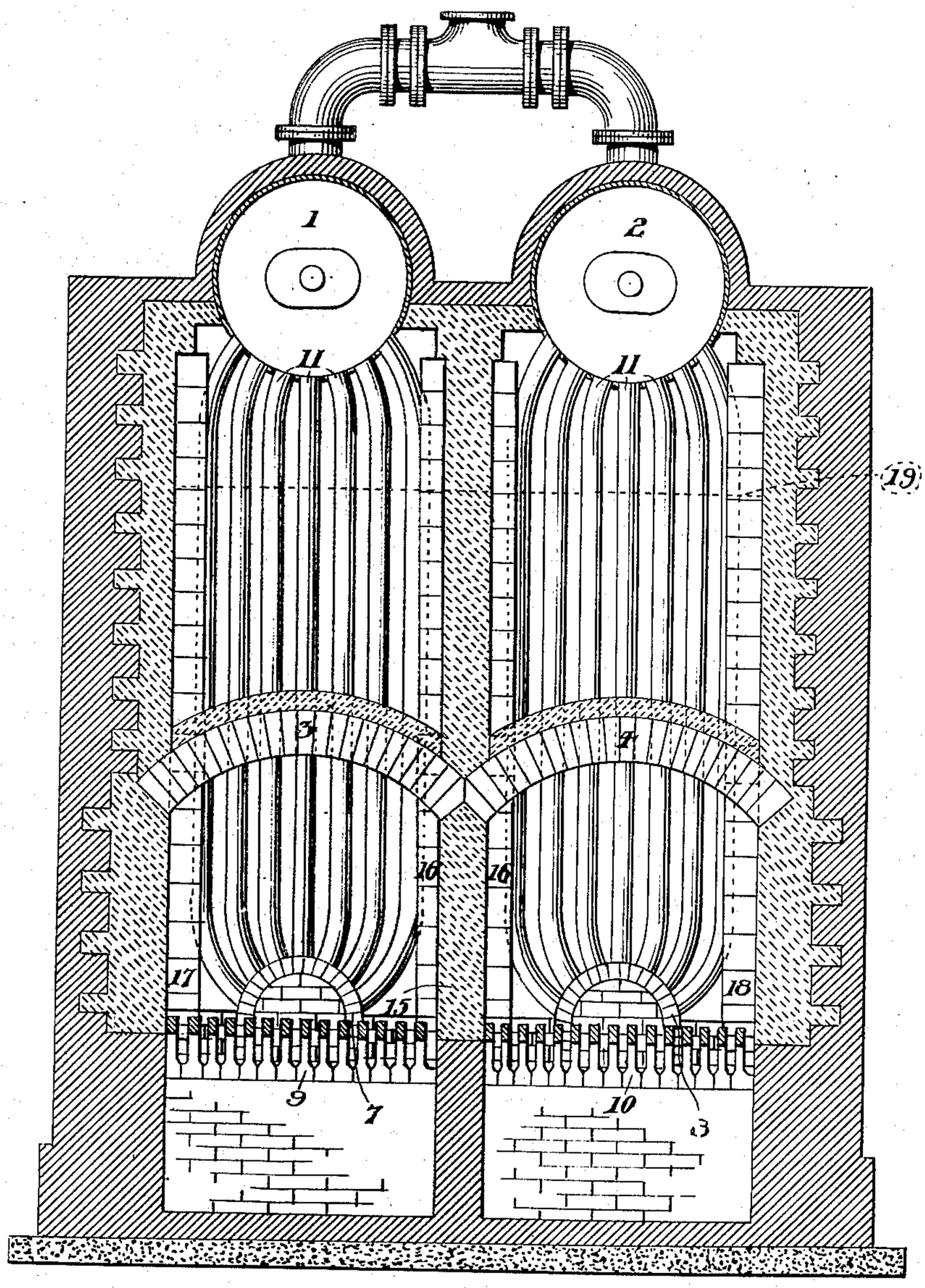
4 SHEETS—SHEET 3.

Fig. 3.



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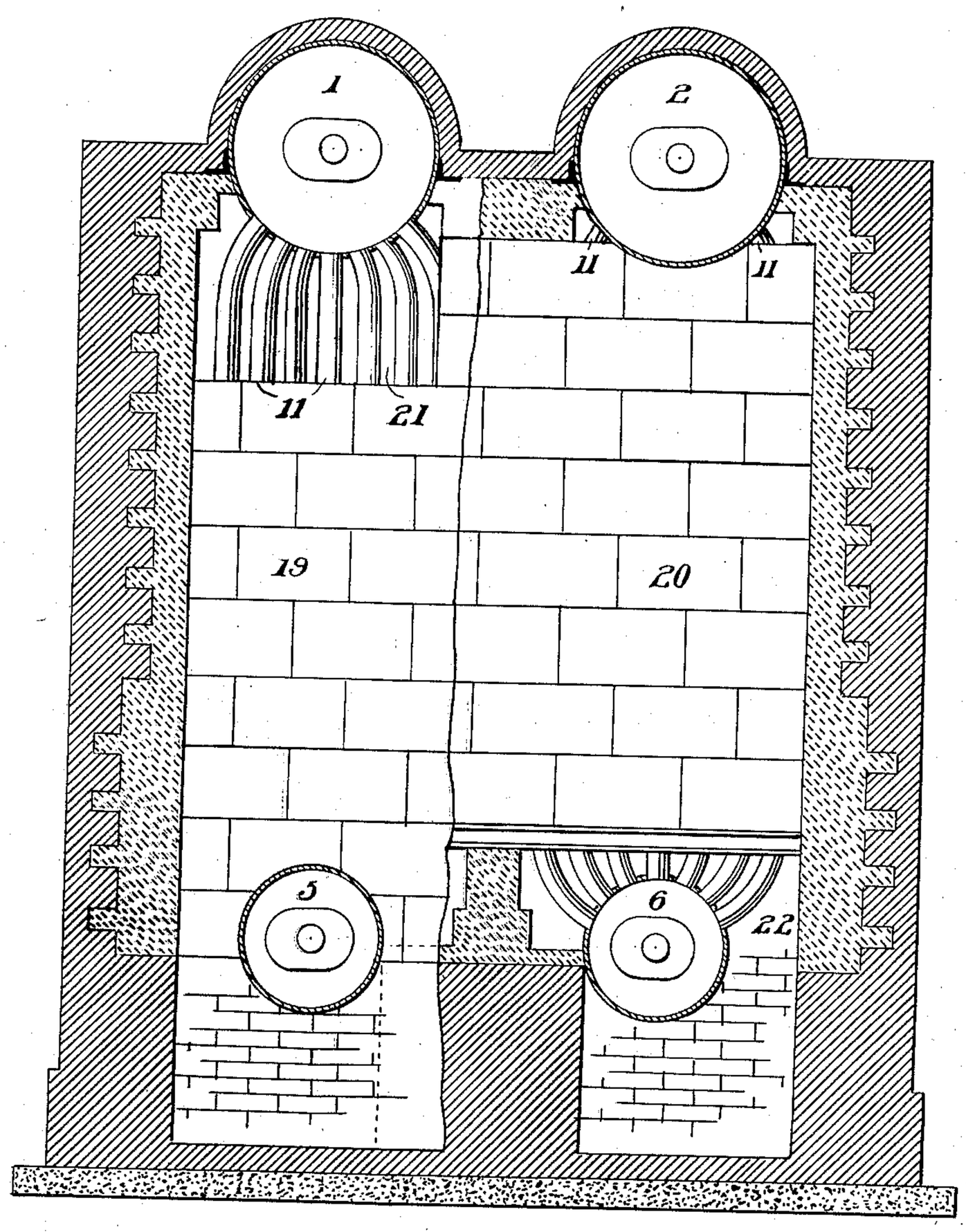
4 SHEETS—SHEET 4.

Fig. 4.



WITNESSES:

J. B. Appleman,

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UNITED STATES PATENT OFFICE.

WILLIAM S. ELLIOTT, OF PITTSBURG, PENNSYLVANIA.

WATER-TUBE BOILER.

No. 850,423. Specification of Letters Patent. Patented April 16, 1907.

Application filed June 25, 1906. Serial No. 323,198.

To all whom it may concern:

Be it known that I, WILLIAM S. ELLIOTT, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered new and useful Improvements in Water-Tube Boilers, of which the following is a specification.

My invention relates to water-tube boilers having upper and lower drums and vertical water-tubes. In boilers of this type the number of tubes that can be placed in one row around a drum is limited, as also is the number of drums that can be placed in a furnace. The length of the tubes, and therefore the amount of heating-surface, may be increased indefinitely; but if the length of the tubes be increased it is necessary to increase the width of the grates to correspond to the increase in the heating-surface. This means that the total width of the furnace must be made greater than the total width of the space occupied by the tubes measured in a line transverse to the drums between the extreme tubes of each bank.

It is one of the objects of my invention to provide means for causing the furnace-gases to pass among the tubes of each bank of a connected pair of boilers rather than between the adjacent banks or between each bank and the adjacent furnace-walls. This object I accomplish while employing a fire-arch before each set of boilers, as hereinafter described.

It is also an object of my invention to stagger the tubes, so as to get the maximum heating effect of the longitudinal travel of the gases when they pass from one compartment to another directly behind it.

It is a further object of my invention to arrange the tubes so that the damaged ones can be readily removed without cutting out good ones.

Another object is to place above the fire-arch a portion of the steam and water drum so that the steam may be taken therefrom where the water is in a quiescent state. These and other objects will be made clear in the detailed description following.

Referring to the drawings, Figure 1 is a longitudinal vertical section through a pair of drums and their setting; and Figs. 2 and 3 are sections on the lines 2 2 and 3 3, respectively, of Fig. 1; and Fig. 4 is a section on the line 4 4 of Fig. 2.

On the drawings, 1 and 2 represent a pair of upper steam and water drums having their front portions over the fire-arches 3 and 4. These drums preferably extend entirely from the front to the rear of the setting, as shown on Fig. 1.

5 and 6 are a pair of mud-drums located, respectively, under the drums 1 and 2, the drums 5 and 6 having their front ends just to the rear of the bridge-walls 7 and 8 of the fire-boxes 9 and 10.

Each upper drum is connected to its corresponding lower drum by several transverse rows of water-tubes 11. I have shown seven as the maximum number of tubes in a row, the tube ends being curved so as to enter the tube-sheet radially; but I do not, however, limit myself to any definite number of tubes in a row or to any definite manner of their entering the drums.

Inasmuch as the width of the furnace must, to attain the results hereinafter set forth, be greater than the total width of the space occupied by the tubes I place the upper drums and also the lower drums a considerable distance apart, leaving the center space 12 between the banks of tubes and the side spaces 13 and 14 between the respective banks and the adjacent walls of the setting, the spaces 12, 13, and 14 being without tubes.

As the furnace shown is wide, and therefore liable to fall in and necessitate repairs, I split the furnace into the two fire-boxes 9 and 10, as aforesaid, and support the adjacent edges of the arches 3 and 4 on the partition 15, which stands opposite the space 12; but the furnace may be otherwise made and have a single fire-box.

In order to cause the furnace-gases to travel among the tubes of the banks instead of through the spaces 12, 13, and 14, which are paths of less resistance to the gases, I place the central baffle 16 opposite the front end of the space 12 and the lateral baffles 17 and 18 in front of the respective spaces 13 and 14. These baffles turn the burning gases into the spaces among the tubes, among which they will remain during their travel.

I divide the tubes into three sections by means of the two transverse baffle-walls 19 and 20, the former being built from the floor up so as to leave the passage 21 between its upper edge and the drums 1 and 2, and the latter being built from the top of the setting

down, so as to leave the passage 22 between its lower edge and the drums 5 and 6. In order to prevent the gases from passing along the space 12 between the banks of tubes after they pass the baffle-walls 19 and 20, I extend the former up between the drums 1 and 2 to the roof of the setting, as shown on Fig. 4, and the latter down between the drums 5 and 6 to the floor of the setting, as shown in Fig. 4. These baffle extensions act like the baffle 16 to direct the gases away from the space 12 and into the spaces occupied by the tubes. The gases thus have an up pass in front of the baffle 19, a down pass between the baffles 19 and 20, and an up pass at the rear of the baffle 20. From the latter pass the gases pass out through the stack connection 23.

Without limiting myself to the precise arrangement of the tubes as shown on the drawings I will explain the principles of their arrangement by minutely describing the same. As the arrangement of the tubes is the same in both banks, I will confine this part of the description to one bank.

The baffle 19 is located between and supported laterally by the seventh and eighth rows of tubes, each row of each bank of tubes containing seven tubes. By so locating the baffle I am able to make the latter of very thin material, thereby economizing the space within the boiler-setting. The baffle 20 is located between and supported laterally by the twenty-fourth and twenty-fifth rows of tubes.

In the first pass I have shown the first, fourth, and seventh rows of tubes composed of seven tubes each, and between these adjacent rows of seven tubes I have shown two rows of three tubes each, the members of the second row standing opposite the spaces between the four inner tubes of the first row and the third row opposite the spaces between the four outer tubes of the fourth row. The fifth and sixth rows are composed of three tubes each, the rows being arranged, respectively, with respect to the fourth row the same as the second and third rows are arranged with respect to the first row.

The ninth to the twenty-fourth rows are precisely the same in arrangement and numbers of tubes in the corresponding rows in the first seven rows, and the twenty-sixth to the thirty-second rows are precisely the same in arrangement and number of tubes in the corresponding rows in the first seven rows. The eighth and ninth rows and also the twenty-fifth and twenty-sixth rows are separated by the respective spaces 24 and 25, which extend entirely across the bank of tubes. The short spaces 26, which open into the spaces 13 and 14, give access to tubes on one side of the bank, and the short spaces 27, which open into the space 12 from each bank, permit access to the tubes on the other side of the banks or on both sides of the space 12. It will be seen that the spaces 24 27 are accessible so that tubes may be cut out. The cut-out tubes in the first pass can be moved from the spaces 26 and 27 into the spaces 12, 13, and 14, and thence through the fire-boxes 9 and 10. The tubes cut out from the second pass will be moved into the nearest spaces 12, 13, and 14 and those in the spaces 12 and 13 will be moved along the spaces 24 in the two banks of tubes to the cleaning-door 28, preferably in line with the spaces 24. Those in the space 14 can be readily passed therealong to the said cleaning-door.

The tubes in the third pass may be moved to and through the cleaning-door 29 as those in the second pass were moved to and through the cleaning-door 28, the spaces 25 being analogous to the spaces 24. I have shown but one side of the setting provided with cleaning-doors, but both sides may have them, if preferred.

It is not to be understood that the tubes are necessarily arranged precisely as described. So far as some of my claims are concerned the arrangement of the tubes does not enter into the same and may be made as desired.

The lower drums are preferably supported by the tubes and the upper drums, a layer of yielding material 30 being placed below the lower drums. The lower drums are connected together by the cross-tubes 31, which equalize the water-levels in the upper drums in a manner readily understood.

I claim—

1. In a water-tube boiler, upper and lower horizontal drums connected by a bank of tubes, a fire-chamber of greater width than the space occupied by the bank of tubes, and means for confining the gases within the bank of tubes from the front to the rear of said bank.

2. In a water-tube boiler, a plurality of upper horizontal drums and a plurality of lower horizontal drums, banks of tubes connecting the upper drums with the lower drums, a fire-chamber of greater width than the space occupied by banks of tubes, and means for confining the furnace-gases within the banks of tubes from the front to the rear of said banks.

3. In a boiler having vertical water-tubes, a fire-chamber of greater width than the space included between the extreme lateral tubes, front baffles to deflect the gases among the tubes and to prevent them from traveling in the dead spaces where there are no tubes, and rear baffles having extensions to direct the gases into the spaces occupied by the tubes.

4. In a boiler, a plurality of upper drums and a plurality of lower drums extending longitudinally of the setting, a bank of tubes connecting each upper drum to one lower

drum, a fire-chamber of greater width than the spaces occupied by the respective banks of tubes, and a baffle to prevent the gases from traveling in the space between the banks of tubes.

5. In a boiler, a plurality of upper drums and a plurality of lower drums extending longitudinally of the setting, a bank of tubes connecting each upper drum to one lower drum, a fire-chamber of greater width than the spaces occupied by the respective banks of tubes, and baffles to prevent the gases from traveling in the space between the bank of tubes and between the chamber-walls and the banks of tubes.

6. In a water-tube boiler, upper and lower horizontal drums, transverse rows of vertical tubes connecting same, and baffles arranged transversely of the drums and forming passes for the gases, there being in each pass spaces between the rows of tubes sufficient for the removal and insertion of tubes, some spaces extending entirely across the bank, other spaces being alternately at opposite sides of the bank.

7. In a water-tube boiler, upper and lower horizontal drums, transverse rows of vertical tubes connecting same, and baffles arranged transversely of the drums and forming passes for the gases, there being in each pass spaces between the rows of tubes sufficient for the removal and insertion of tubes, some spaces extending entirely across the bank, other spaces being alternately at opposite sides of the bank, the tubes in the rows being in staggered relation to the adjacent rows.

8. In a water-tube boiler, upper and lower drums, a bank of vertical water-tubes connecting the same and arranged in rows transverse of the drums, and baffles arranged transversely of the drums and forming passes for the furnace-gases, there being in each pass spaces between the rows of tubes sufficient for the removal and insertion of tubes, one space extending entirely across the bank and the others partly across the same.

9. In a water-tube boiler, upper and lower drums, a bank of vertical water-tubes connecting the same and arranged in rows transverse of the drums, and baffles arranged transversely of the drums and forming passes for the furnace-gases, there being in each pass spaces between the rows of tubes sufficient for the removal and insertion of tubes, one space extending entirely across the bank, and other spaces being open alternately at opposite sides of the bank.

10. In a boiler, upper and lower drums, a bank of vertical water-tubes connecting the drums and arranged in transverse rows containing different numbers of tubes, some of the longer rows being spaced apart their entire length for the removal and insertion of tubes, and other rows being spaced apart to contain two shorter rows, one adjacent to each longer row, leaving a space between each longer row and the second shorter row for the removal and insertion of tubes.

Signed at Pittsburg, Pennsylvania, this 7th day of June, A. D. 1906.

WILLIAM S. ELLIOTT.

Witnesses:

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C. E. EGGERS.