

No. 771,657.

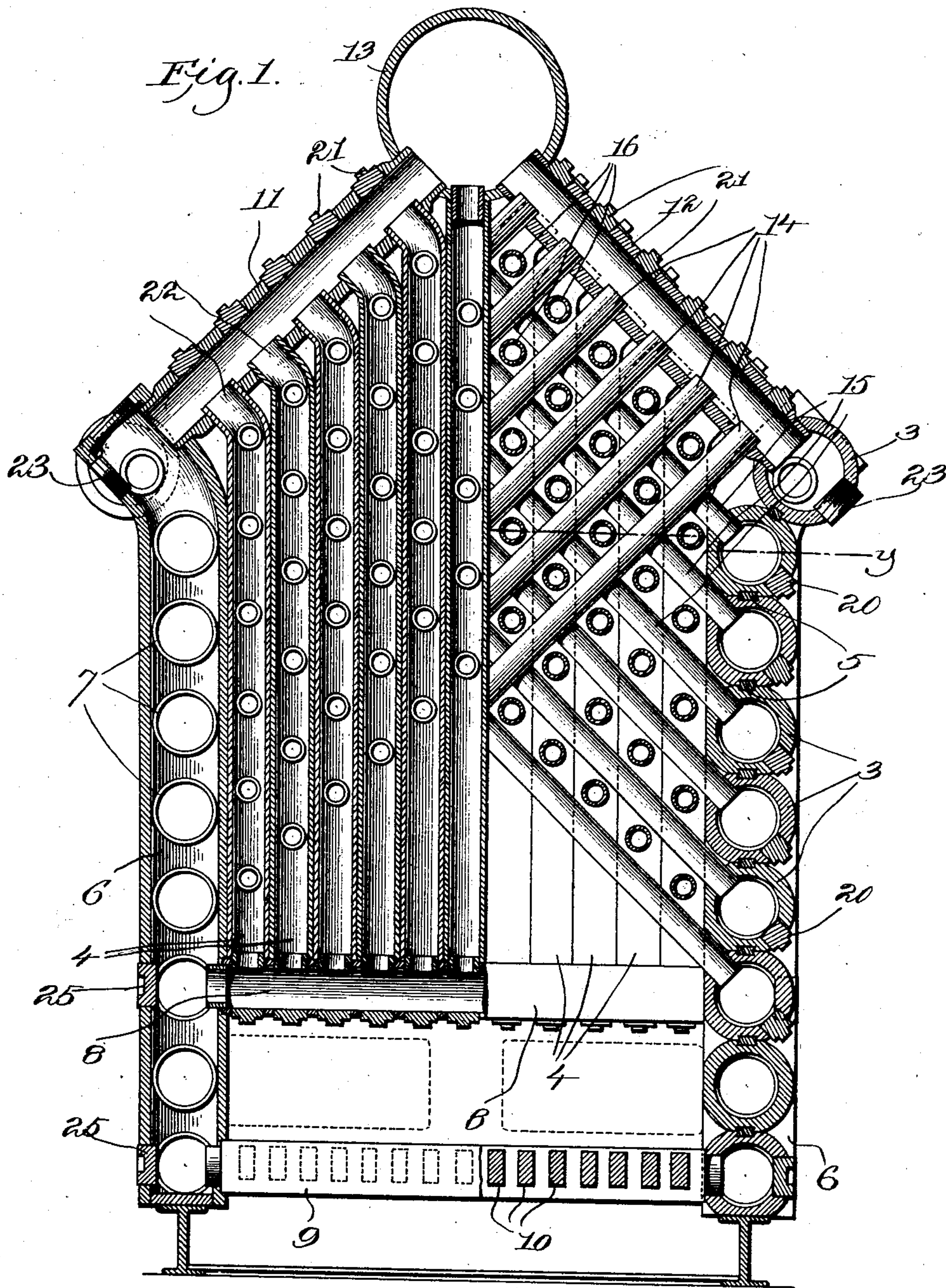
PATENTED OCT. 4, 1904.

J. M. McCLELLON.
BOILER.

APPLICATION FILED DEC. 19, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



Witnesses
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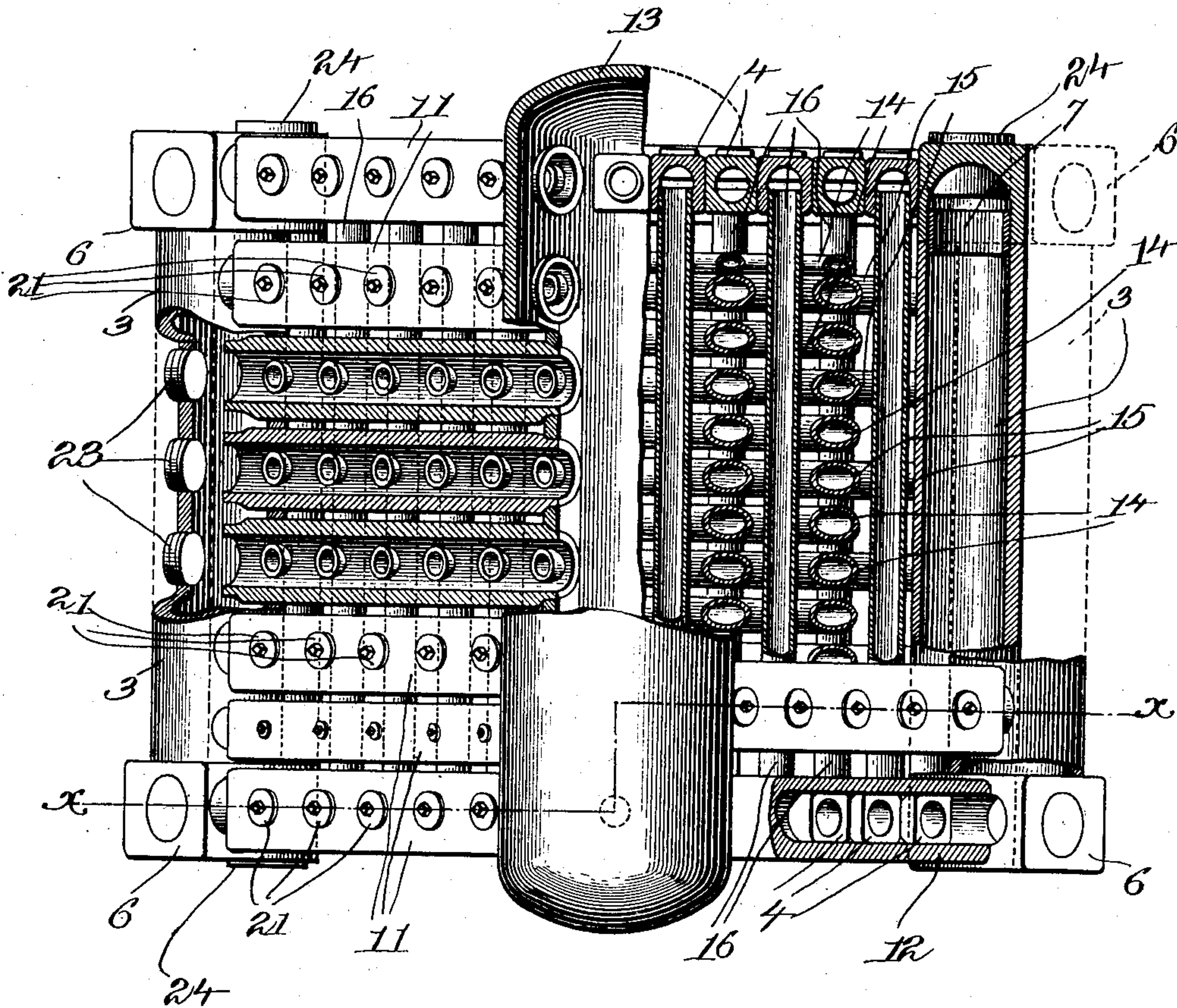
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3 SHEETS—SHEET 2.

Fig. 2.



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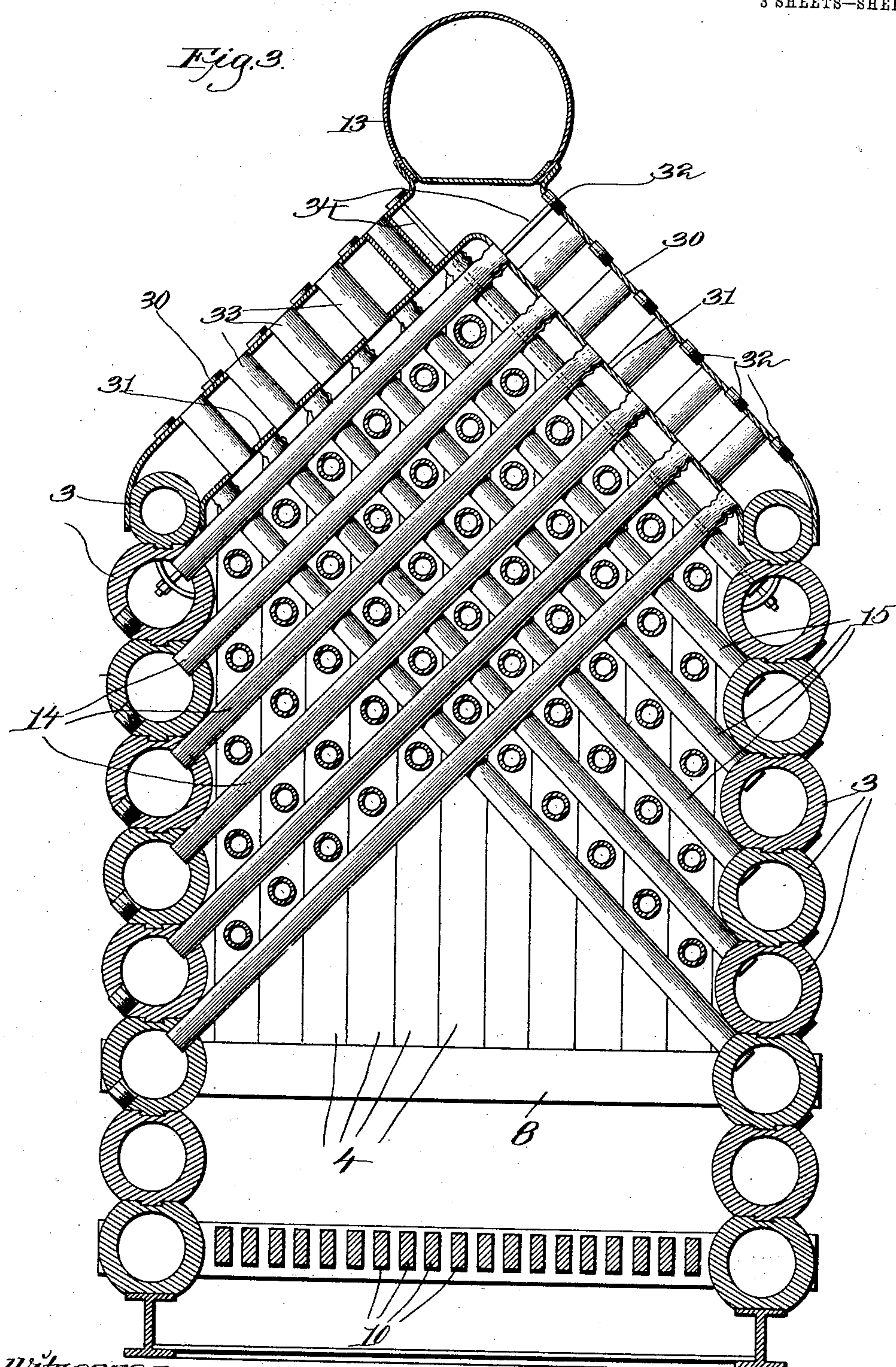
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NO MODEL.

3 SHEETS—SHEET 3.



Witnessed.

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UNITED STATES PATENT OFFICE.

JAMES M. McCLELLON, OF EVERETT, MASSACHUSETTS.

BOILER.

SPECIFICATION forming part of Letters Patent No. 771,657, dated October 4, 1904.

Application filed December 19, 1903. Serial No. 185,781. (No model.)

To all whom it may concern:

Be it known that I, JAMES M. McCLELLON, a citizen of the United States, residing at Everett, county of Suffolk, and State of Massachusetts, have invented an Improvement in Boilers, of which the following description, in connection with the accompanying drawings, is a specification, like figures on the drawings representing like parts.

This invention has for its object the production of a novel boiler in which all stayed surfaces are absolutely eliminated, this object being accomplished by making the boiler entirely of water-tubes, certain of which are so arranged as to form the side walls of the combustion-chamber and others of which are arranged to form the top of the boiler.

The invention can be embodied in boilers of different types and that which I have herein chosen to illustrate is a stationary or marine boiler.

In the best form of my invention now known to me two of the opposed sides of the boiler are formed by closely-arranged horizontally-extending water-tubes, the other two opposed sides by closely-arranged vertically-extending water-tubes, and the top by still other water-tubes, these latter tubes being spaced slightly from each other, so as to afford between them outlets for the escape of the products of combustion. Extending across the interior of the combustion-chamber are crossed inclined and also horizontal water-tubes. With such a construction all of the spaces in the boiler in which water or steam is confined are in the form of tubes, which it is well known can be made to withstand a very high pressure without being stayed.

Another feature of the invention relates to the construction whereby any individual tube can be readily removed and a new one inserted in case such action is necessary.

Referring to the drawings, Figure 1 is a sectional view of a stationary or marine boiler embodying my invention, taken on substantially the line *x x*, Fig. 2. Fig. 2 is a part top plan view and part section of the boiler shown in Fig. 1, this section being taken substantially on the line *y*; and Fig. 3 is a verti-

cal sectional view of a slightly-different form of boiler embodying my invention.

In constructing the boiler illustrated in the drawings I form two opposed sides of the boiler by superimposed closely-arranged horizontal water-tubes 3 and the other two opposed sides by closely-arranged vertical water-tubes 4. For convenience in describing the invention I will hereinafter refer to the sides of the boiler which are formed by the horizontal tubes 3 as the "sides" and the sides formed by the vertical tubes 4 as the "ends" of the boiler. The tubes 3 at the sides of the boiler rest on each other and will be connected in any suitable way. Herein I have illustrated them as united by the dovetailed key-pieces 5, which are preferably used at the ends of tubes only, though any other convenient way of connecting them could be employed without departing from my invention. The ends of the tubes 3 are connected to vertically-extending headers or large tubes 6, one of which stands at each corner of the boiler. The connection between the tubes 3 and the vertical headers 6 may be made in any suitable way, but preferably by means of suitable nipples 7, which are expanded into the ends of the tubes and into apertures in the side of the headers 6. These headers are preferably square exteriorly, but may be either square or round interiorly and are, in effect, large water-tubes. The vertically-arranged tubes 4 are also preferably flat-sided tubes, as shown best in Fig. 2, and the end tubes at each end of the boiler abut against the adjacent vertical headers 6. The lower ends of the tubes 4 are nipped or otherwise secured to cross-tubes or headers 8, which extend across from one riser 6 to the other and which are nipped or otherwise secured to such risers. In the form of boiler shown in Fig. 1 said tubes 8 are situated somewhat above the bottom of the boiler and form the top of the firing-doors. Below the firing-door there may be another cross-tube 9, which is nipped into the vertical risers.

10 designates the usual grates.

In the form of the invention shown in Fig. 1 the top of the boiler is formed by two sets of tubes 11 and 12, which preferably stand

at an angle of substantially forty-five degrees, the tubes 11 being oppositely inclined from the tubes 12, as best seen in Fig. 1. The lower ends of the tubes 11 are expanded into, nipped, or otherwise appropriately secured to the upper horizontal tube 3 at one side of the boiler and the lower ends of the tubes 12 are similarly secured to the upper horizontal tube 3 at the opposite side of the boiler. The upper horizontal tube 3 at each side of the boiler thereby acts as a header for the tubes 11 and 12. The upper ends of all the tubes 11 and 12 are either expanded into, nipped, or otherwise secured to a steam-dome 13, which is in the nature of a drum extending the full length of the boiler. The upper ends of all the tubes 4, except the central tubes at each end of the boiler, are secured to the corresponding end tubes 11 or 12, this preferably being done by bending the tubes 4 slightly at their ends, so as to make them stand perpendicular to the tubes 11 or 12, and then expanding or nipping said tubes 4 to the tubes 11 or 12. The upper ends of the center tubes 4 of each series are suitably secured directly to the drum either by nipping or expanding them, as shown in Fig. 1. The end tubes 11 and 12 are, in effect, tubular headers for the vertical tubes 4. The tubes 11 and 12 are spaced slightly from each other, as best seen in Fig. 2, the space between them affording outlet for the products of combustion. In the interior of the boiler or combustion-chamber are crossed inclined water-tubes 14 and 15, standing at an angle of substantially forty-five degrees, said tubes being preferably arranged in rows. The tubes 14, constituting one row, extend from one of the tubes 12 at the top of the boiler to the various tubular headers 3 at the left-hand side of the boiler, and the tubes 15, forming the next adjacent row, extend from one of the tubular headers 11 to the tubes 3 at the right-hand side of the boiler. It will thus be seen that the tubes 11 and 12 at the top of the boiler are headers for the tubes 14 and 15 and are therefore headers as well as water-tubes. These tubes 14 and 15 are secured to the tubes or headers 3, 12, or 11 in any suitable way, either by expanding or nipping them thereto. Between the tubes 14 and 15 are horizontally-extending tubes 16, which extend from the tubes 4 at one end of the boiler to those at the other end of the boiler and are either nipped or expanded to said tubes 4. Said tubes 4 are therefore headers for the horizontal tube 16. In this particular construction of boiler the tubes 3, 4, 11, and 12 have the function of headers, since they serve to connect other tubes or headers which are expanded into them. It will be understood, however, that if the horizontal tubes 16 were admitted from the boiler the tubes 4 would not be header-tubes or tubular headers, but would simply be water-tubes.

In the specification and claims, therefore, I have used the term "headers" or "tubular headers" when referring to a water-tube into which other water-tubes or headers are expanded. From the above construction it will be seen that all of the sides of the combustion-chamber are formed by closely-arranged water-tubes or headers, and the top is formed by other water-tubes or headers, which are spaced slightly from each other to permit of the escape of the products of combustion, and the interior of the boiler is filled by water-tubes so arranged as to permit of the freest possible circulation of water. The water which rises in the inclined tubes 14 and 15 will pass into the tubes or headers 12 and 11, and part of the water will pass down said tubes or headers into the upper tube or header 3 and from the latter down the risers to other of the horizontal tubes or headers 3 and also through the tube 8 to the vertical tubes or headers. The boiler is so arranged, therefore, as to permit very free circulation of water and at the same time is so constructed as to withstand a very high pressure without any danger of leaks or explosions. Furthermore, the water is all confined in comparatively small bodies, and therefore it is possible to get up steam in a minimum length of time. In order to facilitate the building or repair of the boiler, I have provided each tube or header with a plugged aperture directly opposite the point where any other tube or header is nipped or expanded to such first-named tube. For instance, the tubes or headers 3 are provided with apertures closed by removable plugs 20 opposite the ends of each of the tubes 14 or 15. The tubes or headers 11 and 12 are provided with similar apertures closed by removable plugs 21 opposite the ends of each of the tubes 14 or 15. The end tubes or headers 11 and 12 are also provided with removable plugs 22 opposite the ends of each of the tubes or headers 4. The upper tubes or headers 3 are provided with removable plugs 23 opposite the lower ends of each of the tubes or headers 11 or 12. The risers 6 are provided with removable plugs 24 opposite the ends of each of the tubes or headers 3 and also with other removable plugs 25 opposite the tubes 8 and 9. With this construction it is a simple matter to remove any one of the various tubes forming the boiler and to insert a new tube in its place, if necessary. Moreover, this can be accomplished without disturbing particularly any of the other tubes. The result of this construction is a simple and easily-constructed boiler, one which has a large heating-surface and in which steam can be quickly made, one which will withstand an extremely high pressure without any danger of any parts giving away, and one in which any of the tubes can be very easily and readily removed and a new tube replaced without disturbing the other tubes.

In Fig. 3 I have illustrated a slightly-different form of my invention, wherein the top of the boiler is formed by sheets instead of tubes. These sheets are designated by 30 and 31 and are riveted or otherwise secured at their lower edges to the sides of the upper tube 3. The two sheets 31 may be formed from a single piece bent centrally to form the two parts 31, which stand at right angles to each other and are riveted at their lower edges to the tube 3. The outer sheets 30 are connected at their upper ends to the steam dome or drum 13. In this form of boiler the crossed inclined tubes 14 and 15 are expanded at their upper ends into the inner sheets 31, and the outer sheets 30 will be provided with suitable plugs 32 opposite each of said tubes, so that upon removing any plug the corresponding tube may be reached for removal, if necessary. 33 designates flues extending through the water-space between the sheets 30 and 31 and through which the products of combustion from the combustion-chamber escape. In other respects the boiler shown in Fig. 3 is identical with that shown in Figs. 1 and 2. These flues also act as a means for staying the outer sheets 30. 34 designates tie-rods which extend through the upper tube of each set of tubes 14 and 15 and serve to stay that portion of each outer sheet which is adjacent the steam-dome.

There is another advantage which this boiler has over other types and which I will mention and that is the ease with which boilers of different sizes can be constructed. It will be seen that by simply varying the length of the side tubes or headers 3 the size of the boiler can be varied, or the same thing can be accomplished by employing a different number of tubes or headers 4 at the boiler ends.

While I have herein shown this invention as embodied in a stationary or marine boiler, I do not wish to be limited to its use with this type of boiler, as it may be embodied in other forms of boiler. It will be obvious, therefore, that many changes in the details of construction may be made without departing from the spirit of the invention.

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

1. In a steam-boiler, water-tubes forming the sides and top of said boiler, the water-tubes at two opposed sides extending horizontally, and water-tubes in the interior of the boiler connecting said horizontally-extending tubes at the sides of the boiler to the tubes at the top of the boiler, said horizontal tubes and tubes at the top of the boiler constituting headers for the tubes in the interior of the boiler.

2. A steam-boiler having two of its opposed sides formed by closely-arranged horizontal tubular headers and its top formed by other tubular headers, and water-tubes in the in-

terior of the boiler connecting the headers at the top of the boiler with the horizontally-arranged headers.

3. A steam-boiler having its sides formed by closely-arranged water-tubes and its top by other water-tubes which are spaced from each other, the closely-arranged water-tubes forming the walls of the combustion-chamber and the spaces between the latter water-tubes at the top of the boiler forming the outlets for the products of combustion.

4. A steam-boiler having its sides formed by closely-arranged horizontal water-tubes which form the walls of a combustion-chamber and its top by inclined water-tubes which are separated from each other, the space between said inclined tubes affording an outlet for the products of combustion.

5. A steam-boiler having its sides and ends formed by closely-arranged water-tubes, the water-tubes at the sides extending horizontally.

6. A steam-boiler having its sides and ends formed by closely-arranged water-tubes, the water-tubes at the sides extending horizontally, and vertical risers or headers at the corners to which said horizontal tubes are connected.

7. In a steam-boiler, two rows of superimposed horizontally-extending water-tubes forming the sides of the boiler, vertical risers at the corners of the boiler to which said horizontal tubes are connected, and closely-arranged vertical water-tubes between the risers and forming the ends of the boiler.

8. In a steam-boiler, two rows of superimposed horizontal extending water-tubes forming the sides of the boiler, vertical risers at the corners of the boiler to which said horizontal tubes are connected, closely-arranged vertical water-tubes between the risers and forming the ends of the boiler, and still other water-tubes forming the top of the boiler.

9. In a steam-boiler, two sets of superimposed horizontal water-tubes forming the sides of the boiler, vertical water-tubes forming the ends of the boiler, and inclined water-tubes forming the top of the boiler, said latter water-tubes being spaced from each other to afford outlets for the products of combustion.

10. A steam-boiler having its sides and ends formed by closely-arranged water-tubes, and its top by inclined water-tubes which are spaced from each other, the water-tubes at the sides of the boiler being horizontally arranged.

11. In a steam-boiler, two sets of closely-arranged horizontal water-tubes forming the sides of the boiler, other closely-arranged water-tubes forming the ends of the boiler, and inclined water-tubes forming the top of the boiler, said latter water-tubes being connected to the upper tube of each set of horizontal tubes.

12. In a steam-boiler, closely-arranged hori-

zontal water-tubes forming the sides of the boiler, other closely-arranged horizontal tubes forming the ends of the boiler, inclined water-tubes forming the top of the boiler, and a
5 steam-dome to which all of said latter tubes are connected.

13. In a steam-boiler, closely-arranged horizontal water-tubes forming the sides of the boiler, other closely-arranged water-tubes
10 forming the ends of the boiler, inclined water-tubes connected to the upper horizontal tube at each side of the boiler, and a steam-dome to which all of said inclined tubes are connected.

14. In a steam-boiler, closely-arranged horizontal tubular headers forming two opposed
15 sides of the boiler, closely-arranged water-tubes forming the ends of the boiler, inclined tubular headers forming the top of the boiler, and inclined water-tubes in the interior of the
20 boiler and connecting the headers at the top of the boiler with the horizontally-disposed headers.

15. In a steam-boiler, closely-arranged horizontal water-tubes forming the sides thereof,
25 other closely-arranged water-tubes forming the ends thereof, and two rows of oppositely-inclined water-tubes forming the top thereof, the lower ends of the tubes of each row being connected to the upper horizontal tube at the
30 corresponding side of the boiler.

16. In a steam-boiler, closely-arranged horizontal tubular headers forming the sides thereof, closely-arranged water-tubes forming the
ends thereof, two rows of oppositely-inclined
35 tubular headers forming the top thereof, the lower ends of the tubular headers of each row being connected to the upper horizontal tubular headers at the corresponding side of the boiler, and inclined tubes in the interior of the
40 boiler connecting each inclined tubular header at the top of the boiler with the horizontal tubular headers at the opposite side of the boiler.

17. In a water-tube boiler, closely-arranged
45 horizontal tubular headers forming the sides of the boiler, closely-arranged vertical water-tubes forming the ends of said boiler, means forming a steam or water space at the top of the boiler, and rows of inclined water-tubes
50 in the interior of the boiler connecting said steam and water space with the horizontal tubular headers at each side of the boiler.

18. In a water-tube boiler, closely-arranged horizontal tubular headers forming the sides
55 of the boiler, closely-arranged vertical tubular headers forming the ends of said boiler, means forming a steam or water space at the top of the boiler, rows of inclined water-tubes

in the interior of the boiler connecting said steam and water space with the horizontal tubular headers at each side of the boiler, and
60 horizontal water-tubes also situated within the boiler and connecting the vertical tubular headers at opposite ends.

19. In a steam-boiler, closely-arranged horizontal water-tubes forming the sides of the boiler, closely-arranged vertical water-tubes forming the ends of the boiler and inclined
65 water-tubes forming the top of the boiler, the vertical water-tubes at the ends of the boiler
70 being connected at their upper ends to the adjacent inclined water-tubes.

20. A steam-boiler having its sides formed by horizontal individually-removable water-tubes and its top by inclined individually-removable water-tubes which are spaced from
75 each other, the spaces between said latter water-tubes forming an outlet for the products of combustion.

21. A steam-boiler having its sides formed
80 by horizontal water-tubes, its ends by vertical water-tubes, and its top by inclined water-tubes, said water-tubes being individually removable.

22. In a steam-boiler, horizontal tubular
85 headers forming two opposite sides of the boiler, water-tubes forming the ends of the boiler, inclined tubular headers forming the top of the boiler and inclined water-tubes in the interior of the boiler connecting the headers at the top of the boiler with the horizontal
90 headers.

23. In a steam-boiler, horizontal tubular headers forming the sides of the boiler, inclined tubular headers forming the top of the
95 boiler, and inclined water-tubes connecting the headers at the top with those at the sides.

24. A steam-boiler having its sides formed by tubular headers and its top by other tubular headers and water-tubes in the interior of
100 the boiler connecting the headers at the top to those at the sides, said water-tubes extending substantially perpendicular to both of said headers.

25. In a steam-boiler, horizontal tubular
105 headers at the sides of the boiler, inclined tubular headers at the top of the boiler, and water-tubes connecting the headers at the top with those at the sides.

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

JAMES M. McCLELLON.

Witnesses:

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EDWARD F. ALLEN.