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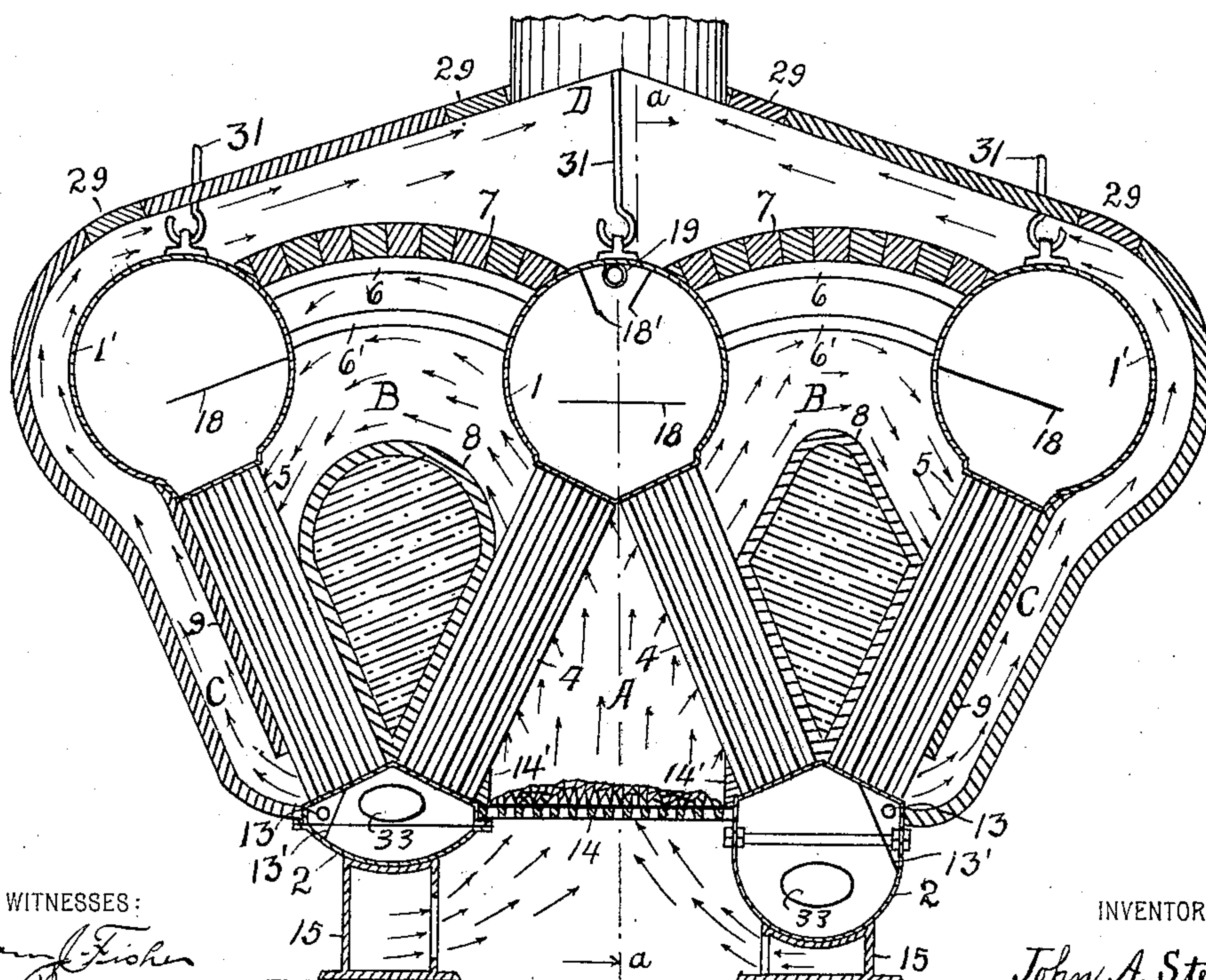
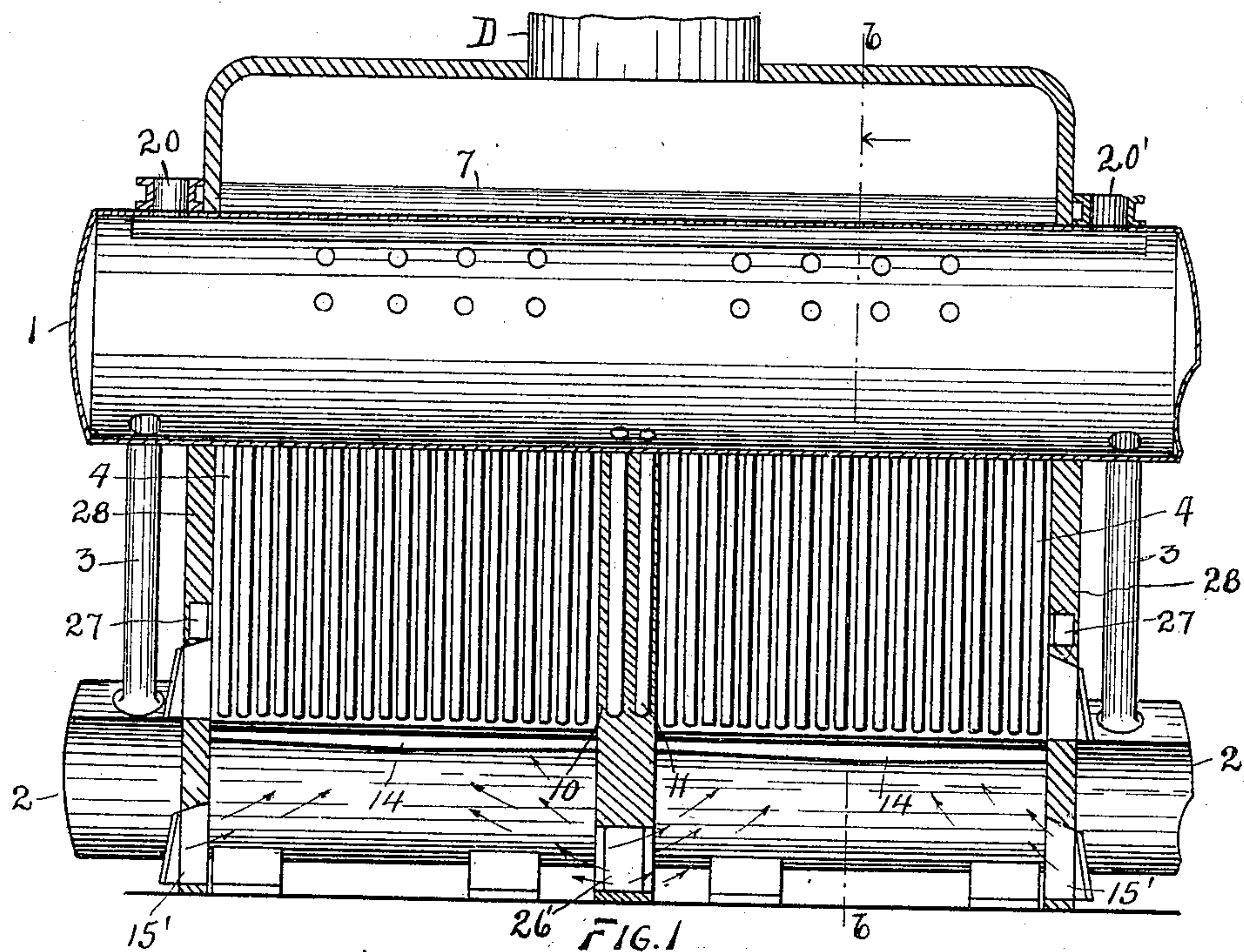
Patented Dec. 20, 1898.

J. A. STEVENS.
BOILER AND FURNACE.

(Application filed July 12, 1898.)

(No Model.)

3 Sheets—Sheet 1.



WITNESSES:

William Fisher
J. C. Butler.

INVENTOR

John A. Stevens

BY

Charles A. Butler

ATTORNEY.

No. 616,157.

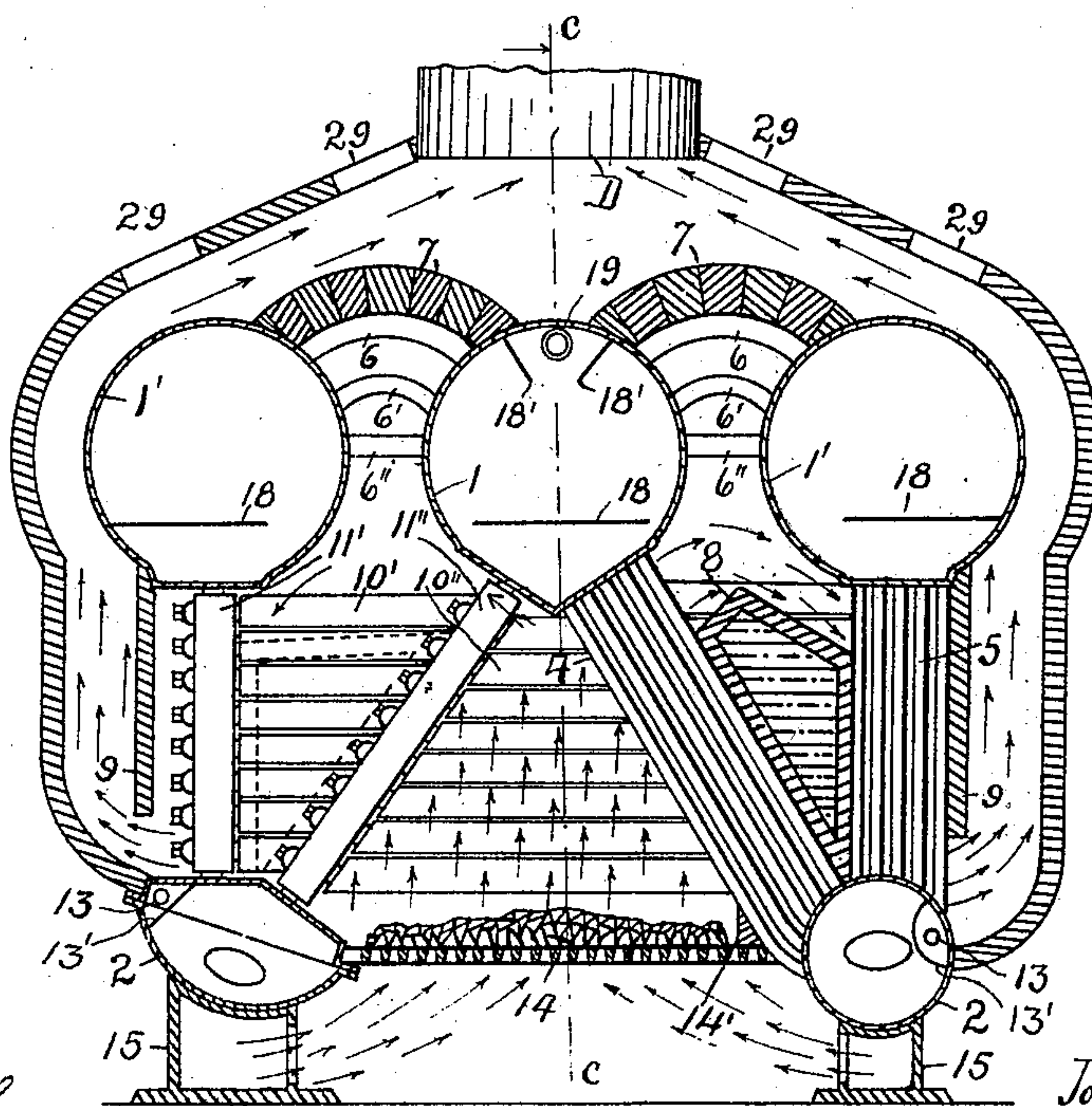
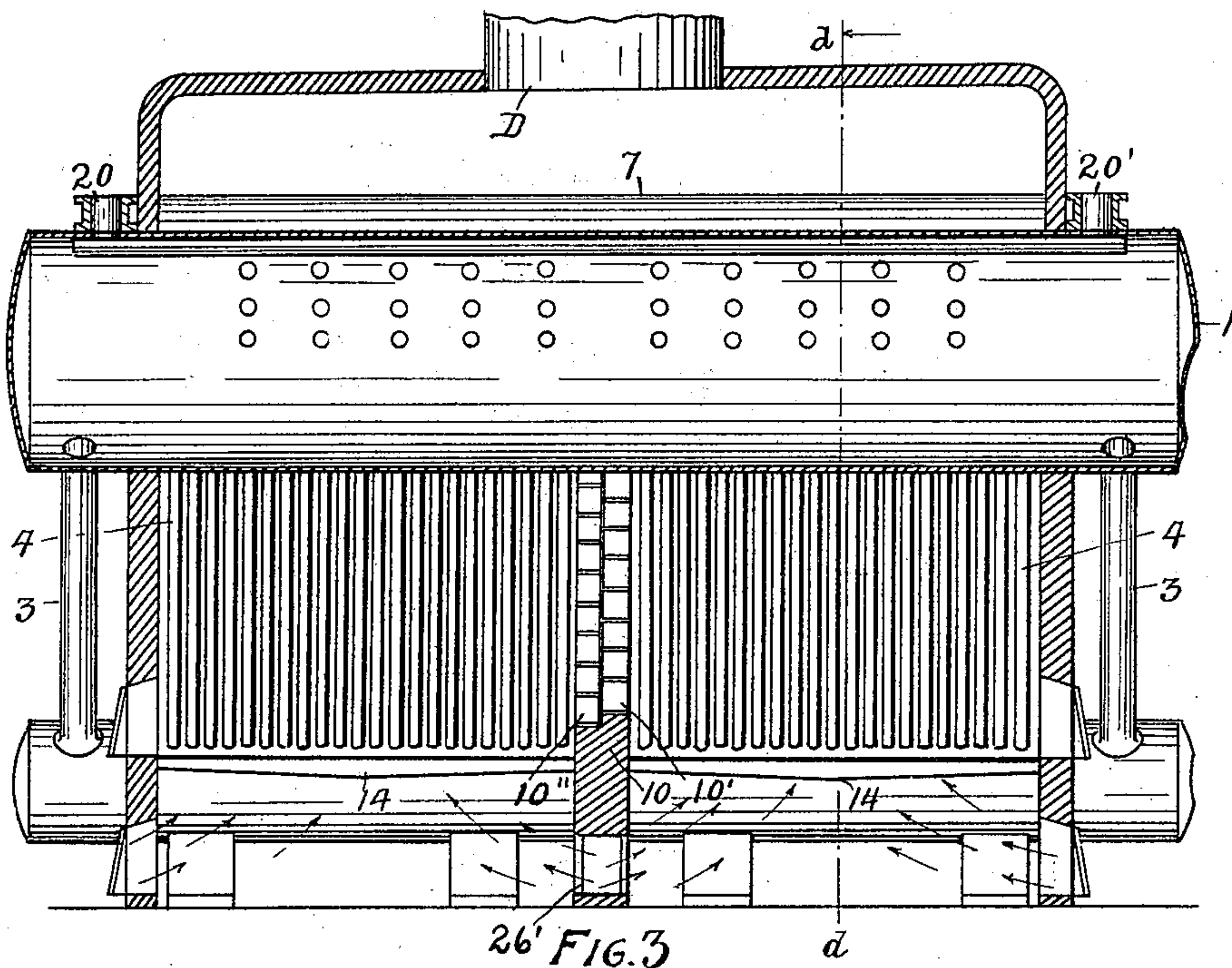
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(No Model.)

3 Sheets—Sheet 2.



WITNESSES:

William J. Fisher
J. E. Butler

FIG. 4

INVENTOR

John A. Stevens

Charles A. Butler
ATTORNEY.

No. 616,157.

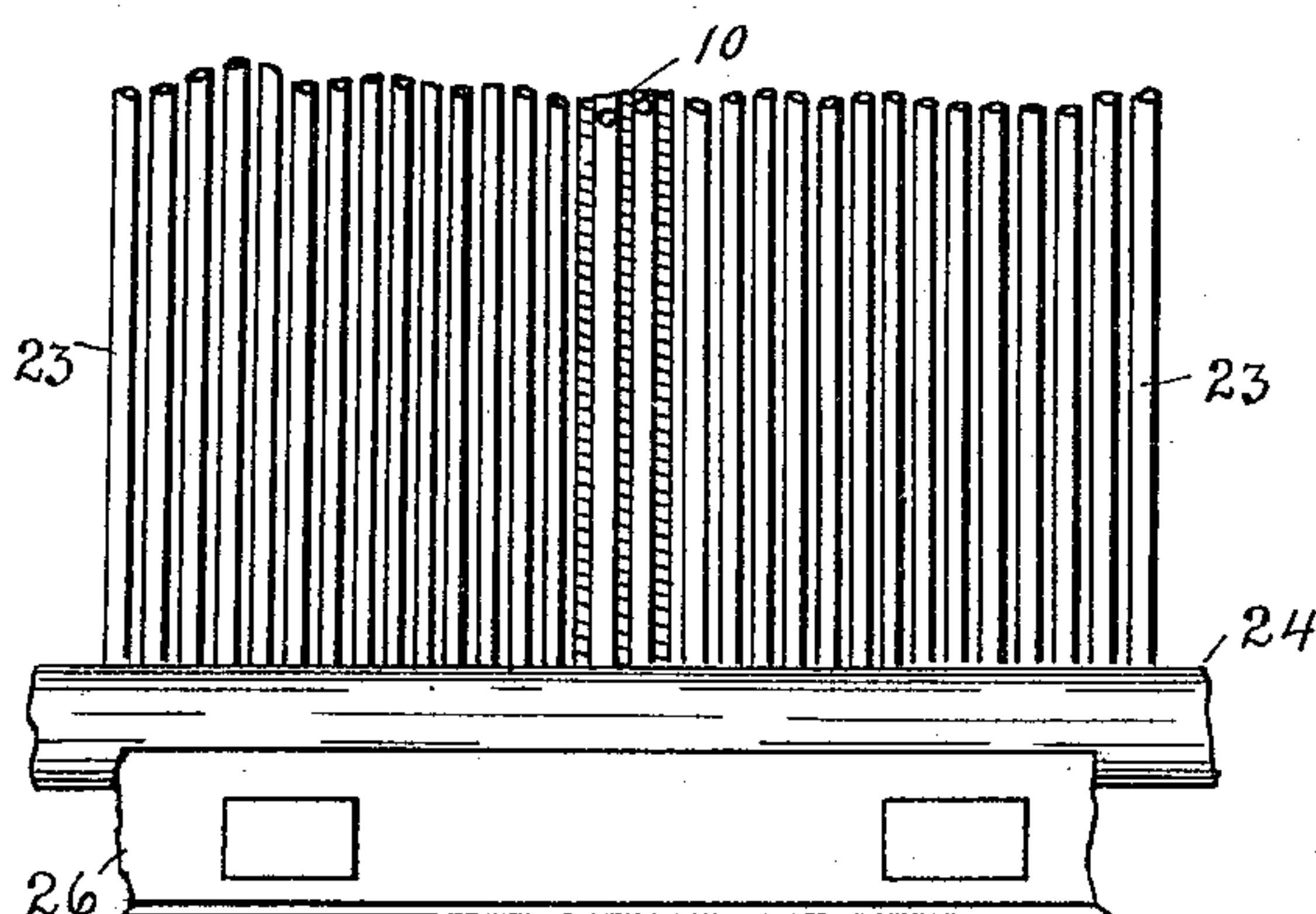
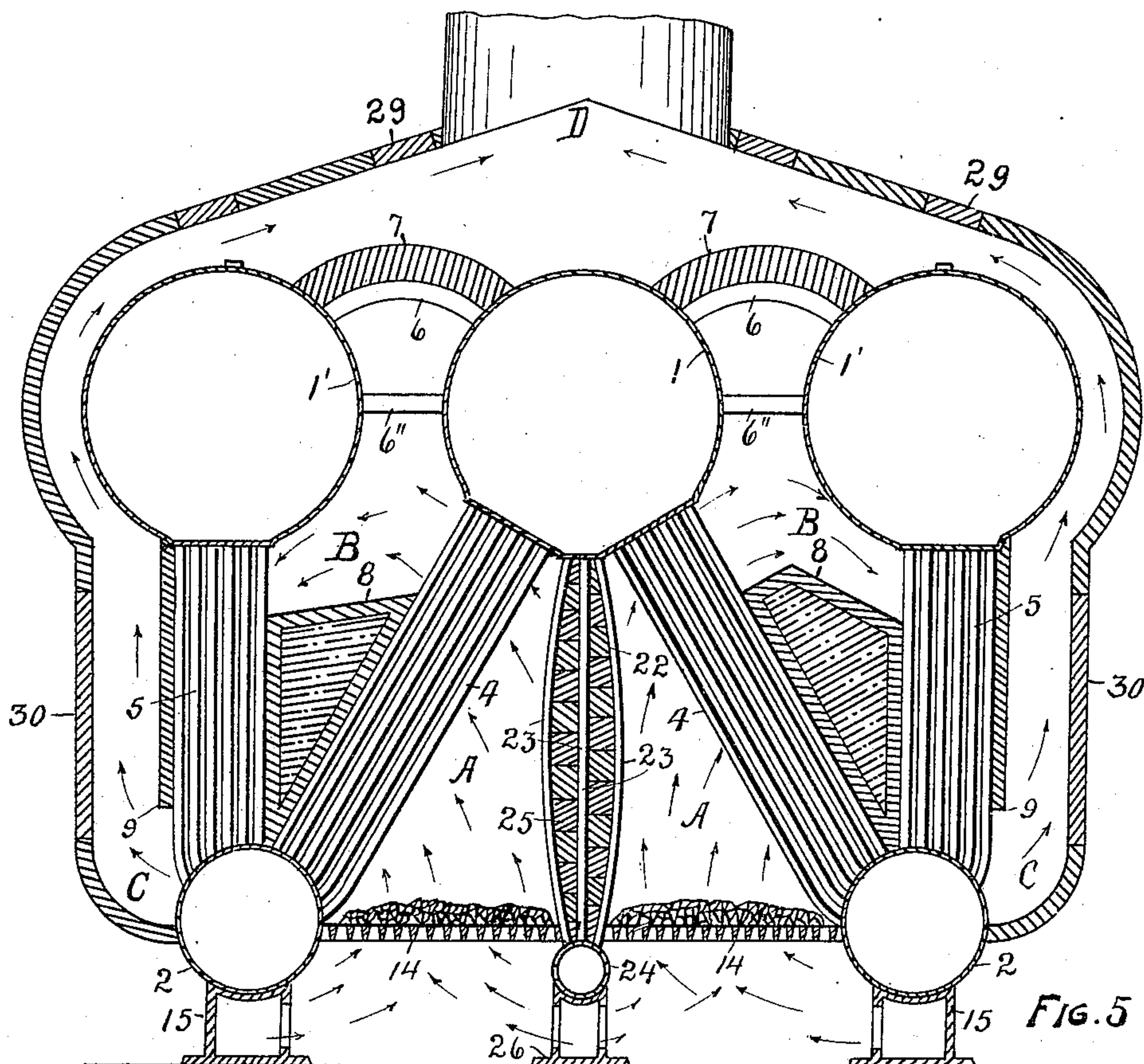
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(Application filed July 12, 1898.)

(No Model.)

3 Sheets—Sheet 3.



WITNESSES:
William J. Fisher
J. C. Butler

FIG. 6

INVENTOR
John A. Stevens
BY
Charles A. Butler
ATTORNEY.

UNITED STATES PATENT OFFICE.

JOHN A. STEVENS, OF LOWELL, MASSACHUSETTS.

BOILER AND FURNACE.

SPECIFICATION forming part of Letters Patent No. 616,157, dated December 20, 1898.

Application filed July 12, 1898. Serial No. 685,802. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. STEVENS, residing at Lowell, in the county of Middlesex, State of Massachusetts, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

My invention is more particularly a water-tube boiler and furnace therefor adapted for land and marine service. It is designed to obtain a compact system of drums and tubes of large heating-surface for the circulation of water and the generation of steam in combination with a high degree of economy and efficiency in handling the products of combustion. The arrangement of drums and tubes facilitates circulation and avoids condensation. The arrangement of the furnace secures a fine focusing effect and carries the heating-gases close to the heating-surfaces and in constant contact therewith. The furnace is constructed in separate sections that may be operated independently, which greatly facilitates cleaning and repair, decreases the danger in case of accident, and insures the equal or desired distribution of the heating-gases. The construction of the division-walls, which divide the furnace into separate compartments of water tubes or boxes, materially increases the heating-surface for the generation of steam. The arrangement of the baffles is such that they may readily be changed or made to conform to the requirements of the peculiar character of fuel employed to secure its complete combustion within the furnace and the utilization of a high degree of its energy in the generation of steam.

The principle and construction of my invention will more fully appear by reference to the accompanying drawings, of which—

Figure 1 is a vertical sectional view on the line *a a* of Fig. 2. Fig. 2 is a vertical sectional view on the line *b b* of Fig. 1. Fig. 3 is a vertical sectional view on the line *c c* of Fig. 4. Fig. 4 is a vertical sectional view on the line *d d* of Fig. 3, the tubes and bridge-wall on the left being removed for the purpose of illustration. Fig. 5 is a vertical sectional view at right angles to the drums in illustration of a modified form of the inven-

tion. Fig. 6 is a view of the detail of the division-walls.

In the construction the steam-and-water drum 1 is connected with each of the water-drums 2, which may be of any of the forms shown, by the downcomers 3 and the water-circulating and steam-generating tubes 4. Each of the drums 2 is connected with a corresponding steam-and-water drum 1' by a bank of water-circulating and steam-generating tubes 5 and by down-comers similar to 3, and each of the drums 1' is connected with the drum 1 by tubes, as 6, 6', and 6".

The feed-water may be introduced by the pipes 13, placed in the water-drums 2 and baffled by the plates 13'. Baffle-plates 18 are placed in the drums 1 and 1', and plates 18' and dry-pipe 19 are placed in the drum 1 to guard against priming. The steam-and-water drums are provided with the take-off and escape-valve connections 20 and 20'.

The spaces between the drums 1 and 1' are closed by the dome or roof baffles 7, placed above the tubes 6 and composed of any suitable refractory material adapted to insulate or confine the heated gases of combustion. Flame bridges or baffles 8, made of any suitable refractory material and having their domes shaped as may be found best adapted for the complete combustion of the fuel employed, are placed between the banks of tubes 4 and 5 and rise from the drums 2. The interior of these bridges may be filled with material that can readily be removed to permit access. Baffles 9 extend downward from the drums 1' along the outer tubes of the banks 5.

A division-wall 10 (composed of refractory material, water tubes or boxes, or a combination thereof) extends at right angles to the direction of the drums and separates the furnace into two distinct compartments. A second division-wall 22 (composed of refractory material, water tubes or boxes, or a combination thereof) extends at right angles to the division-wall 10 and may be employed to further divide the furnace parallel to the bridges. In the construction of these division-walls in the form of the invention illustrated in Fig. 1 a combination of refractory material and tubes 11, connecting the water-drums with

the steam-and-water drums, are employed; but, as illustrated in Figs. 3 and 4, the drums 1 and 1' may be connected with the drums 2 by water-legs 11' and 11'' and water-boxes 10' and 10'' may be expanded into these water-legs at the angle desired to form such division-wall. As illustrated in Figs. 5 and 6, the division-wall 22 may be constructed of water-tubes connecting the drum 1 with a drum 24 and the spaces between the tubes filled with refractory tile 25. It will be understood that this division-wall may be formed of a single row of tubes.

The drums 2 rest on hollow supports 15 and the drum 24 rests upon the hollow support 26, which serve, with the doors 15' and the duct 26', to supply air to the grates 14 and are especially useful in connection with forced draft. These grates 14, extending between the drums 2, are provided with bridges 14' for protecting the drums 2 and tubes 4 from burning out. Air-ducts 27 are formed in the containing-walls 28 to supply air to the combustion-chamber above the grate-surface. The walls 28, surrounding the boiler and furnace, are provided with manholes 29 and doors 30 to permit access. The drums 1 and 1' may be supported by hangers 31, and it will be understood that the usual mechanical devices, as the hand-hole caps for access to the tubes and the manholes for access to the drums, will be employed.

In the operation of the furnace the gaseous products of combustion rise from the main combustion-chamber A, pass into the chamber B, and thence pass downward along the outer bank of tubes, escaping by the passage C to the breeching D, following the course of the arrows and imparting their energy to the drums and tubes, which are located in the direct path thereof. The heated products of combustion are focused by the arrangement of the baffles and carried close along the water-circulating and steam-generating system in constant contact therewith. In the water-circulating and steam-generating system the flow is from the water-drums 2 upward through the banks of tubes 4 and 5 to the steam-and-water drums 1 and 1', within the furnace, thence back to the water-drums by the downcomers 3, without the furnace. The water and steam circulates through this system with great facility, and as the heating-surfaces are arranged to receive the full energy of the gases the tendency to condensation is minimized.

Having thus described my invention, I claim—

1. In the combination of a boiler and furnace, a combustion-chamber, a water-drum, a steam-and-water drum, a bank of tubes connecting said drums, a second steam-and-water drum, a bank of tubes connecting said water-drum with said second steam-and-water drum, a bridge-wall between said banks of tubes, and a baffle closing the space between

said steam-and-water drums, substantially as specified.

2. In the combination of a boiler and furnace, a combustion-chamber, a water-drum, a steam-and-water drum, a bank of tubes connecting said drums, a second steam-and-water drum, a bank of tubes connecting said water-drum with said second steam-and-water drum, one or more downcomers connecting said steam-and-water drums with said water-drum, tubes connecting said steam-and-water drums, and a bridge-wall between said banks of tubes, substantially as specified.

3. In the combination of a boiler and furnace, a combustion-chamber, a pair of steam-and-water drums, a bank of tubes extending from each of said steam-and-water drums to a point of communication, a bridge-wall between said banks of tubes extending toward said steam-and-water drums, and a baffle extending between said steam-and-water drums, substantially as specified.

4. In the combination of a boiler and furnace, a combustion-chamber, a pair of steam-and-water drums, a bank of tubes extending from each of said steam-and-water drums, a water-drum connecting said banks of tubes, one or more downcomers connecting said steam-and-water drums with said water-drum, tubes connecting said steam-and-water drums, a bridge-wall between said banks of tubes, and a baffle extending between said steam-and-water drums.

5. In the combination of a boiler and furnace, a combustion-chamber, a water-drum, a steam-and-water drum, a bank of tubes connecting said water-drum with said steam-and-water drum, one or more downcomers connecting said steam-and-water drum with said water-drum, a second steam-and-water drum, a bank of tubes connecting said water-drum with said second steam-and-water drum, tubes connecting said steam-and-water drums, a roof-baffle closing the space between said steam-and-water drums, a bridge-wall between said banks of tubes, and a baffle for directing the heating-gases downward along said second bank of tubes, substantially as specified.

6. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a second bank of tubes leading from each of said water-drums, a steam-and-water drum connected with each of said second banks of tubes, a bridge-wall between the banks of tubes connected with each water-drum, a combustion-chamber, and means for directing the gaseous products of combustion into contact with said tubes and drums, substantially as specified.

7. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water

drum, a second bank of tubes leading from each of said water-drums, a steam-and-water drum connected with each of said second banks of tubes, a bridge-wall between the banks of tubes connected with each of said water-drums, tubes connecting said steam-and-water drums, and baffles closing the spaces between said steam-and-water drums, substantially as specified.

8. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a second bank of tubes leading from each of said water-drums, a second steam-and-water drum connected with each of said water-drums by said second banks of tubes, a bridge-wall between the banks of tubes connected with each of said water-drums and extending therefrom toward said steam-and-water drums, baffles closing the spaces between said steam-and-water drums, a combustion-chamber between said bridge-walls, and baffles for directing the heating-gases downward along said second banks of tubes, substantially as specified.

9. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a second bank of tubes leading from each of said water-drums, a second steam-and-water drum connected with each of said water-drums by said second banks of tubes, downcomers connecting said steam-and-water drums with said water-drums, tubes connecting said steam-and-water drums, a bridge-wall between the banks of tubes connected with each water-drum, baffles closing the spaces between said steam-and-water drums, a combustion-chamber between said baffle-walls, and baffles for directing the heating-gases downward along said second banks of tubes, substantially as specified.

10. In the combination of a boiler and furnace, a water-drum, a steam-and-water drum, a bank of tubes connecting said water-drum with said steam-and-water drum, a second steam-and-water drum, a bank of tubes connecting said water-drum with said second steam-and-water drum, a bridge-wall between said banks of tubes, a wall forming with said bridge-wall a combustion-chamber, and means for directing the gases from said combustion-chamber into contact with said tubes and drums, substantially as specified.

11. In the combination of a boiler and furnace, a water-drum, a steam-and-water drum, a bank of tubes connecting said water-drum with said steam-and-water drum, a second steam-and-water drum, a bank of tubes connecting said water-drum with said second steam-and-water drum, downcomers connecting said water-drum with one or more of said steam-and-water drums, tubes connecting said steam-and-water drums, a bridge-wall between said banks of tubes, a wall ex-

tending downward from one of said steam-and-water drums and forming with said bridge-wall a combustion-chamber, and means for directing the gases from said combustion-chamber into contact with said tubes and drums, substantially as specified.

12. In the combination of a boiler and furnace, a water-drum, a steam-and-water drum, a bank of tubes connecting said water-drum with said steam-and-water drum, a second steam-and-water drum, a bank of tubes connecting said water-drum with said second steam-and-water drum, a bridge-wall between said banks of tubes, a baffle extending between said steam-and-water drums, a wall extending downward from one of said steam-and-water drums and forming with said bridge-wall a combustion-chamber, a baffle extending downward from the other of said steam-and-water drums and forming with said bridge-wall an escape-pass, substantially as specified.

13. In the combination of a boiler and furnace, a water-drum, a steam-and-water drum, a bank of tubes connecting said water-drum with said steam-and-water drum, a second steam-and-water drum, a bank of tubes connecting said water-drum with said second steam-and-water drum, downcomers connecting said water-drum with one of said steam-and-water drums, tubes connecting said steam-and-water drums, a bridge-wall between said banks of tubes, a baffle extending between said steam-and-water drums, a wall extending downward from one of said steam-and-water drums and substantially parallel to said bridge-wall, a combustion-chamber formed by said walls, a baffle extending downward from the other of said steam-and-water drums and forming with said bridge-wall an escape-pass, substantially as specified.

14. In the combination of a boiler and furnace, a water-drum, a steam-and-water drum, a bank of tubes connecting said water-drum with said steam-and-water drum, a second steam-and-water drum, a bank of tubes connecting said water-drum with said second steam-and-water drum, a bridge-wall between said banks of tubes, a wall substantially parallel with said bridge-wall, a second wall substantially at right angles to said bridge-wall, said walls forming two combustion-chambers, and means for directing the gases from said combustion-chambers into contact with said tubes and drums, substantially as specified.

15. In the combination of a boiler and furnace, a water-drum, a steam-and-water drum, a bank of tubes connecting said water-drum with said steam-and-water drum, a second steam-and-water drum, a bank of tubes connecting said water-drum with said second steam-and-water drum, downcomers connecting said steam-and-water drums with said water-drum, tubes connecting said steam-and-water drums, a bridge-wall between said banks of tubes, a baffle extending between

said steam-and-water drums, a wall containing water-passages extending downward from one of said steam-and-water drums and substantially parallel to said bridge-wall, a second wall containing water-passages extending substantially at right angles to said bridge-wall, said walls forming two combustion-chambers, and a baffle extending downward from the other of said steam-and-water drums, substantially as specified.

16. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a second bank of tubes leading from each of said water-drums, a second steam-and-water drum connected with each of said water-drums by said second banks of tubes, a bridge-wall between the banks of tubes connected with each of said water-drums, a division-wall which separates the furnace into two distinct compartments, and means for directing the gaseous products of combustion into contact with said tubes and drums, substantially as specified.

17. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a second bank of tubes leading from each of said water-drums, a second steam-and-water drum connected with each of said water-drums by said second banks of tubes, downcomers connecting said water-drums with said steam-and-water drums, tubes connecting said steam-and-water drums, baffles extending between said steam-and-water drums, a bridge-wall between the banks of tubes connected with each of said water-drums, and a division-wall substantially parallel to the direction of said bridge-walls, substantially as specified.

18. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a second steam-and-water drum and a bank of tubes therefor connected with each of said water-drums, downcomers connecting said water-drums with said steam-and-water drums, tubes connecting said steam-and-water drums, baffles extending between said steam-and-water drums, a bridge-wall between the banks of tubes connected with each of said water-drums, and a division-wall substantially at right angles to the direction of said bridge-walls, substantially as specified.

19. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a second bank of tubes leading from each water-drum, a second steam-and-water drum connected with each of said water-drums, by said second banks of tubes, tubes connecting said steam-and-water drums, downcomers connecting said steam-and-water

drums with said water-drums, baffles extending between said steam-and-water drums, a bridge-wall between the banks of tubes connected with each of said water-drums, a division-wall substantially parallel to the direction of said bridge-walls, and a division-wall substantially at right angles to the direction of said bridge-walls, substantially as specified.

20. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a second bank of tubes leading from each of said water-drums, a second steam-and-water drum connected with each of said water-drums by said second banks of tubes, tubes connecting said steam-and-water drums, downcomers connecting said steam-and-water drums with said water-drums, baffles extending between said steam-and-water drums, bridge-walls between the banks of tubes connected with the respective water-drums, a division-wall comprising water-passages substantially parallel to the direction of said bridge-walls, a division-wall comprising water-passages substantially at right angles to the direction of said bridge-walls, and baffles extending downward from said second steam-and-water drums, substantially as specified.

21. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a baffle extending from each of said water-drums toward said steam-and-water drum, and an escape-passage between said steam-and-water drum and each of said baffles, substantially as specified.

22. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a bridge-wall extending from each of said water-drums toward said steam-and-water drum, a division-wall forming with said bridge-walls two distinct combustion-chambers, and an escape from each of said combustion-chambers between said steam-and-water drum and the respective bridge-walls, substantially as specified.

23. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of said water-drums with said steam-and-water drum, a bridge-wall extending from each of said water-drums toward said steam-and-water drum, downcomers connecting said steam-and-water drum with said water-drums, escape-passages between said steam-and-water drum and each of said bridge-walls, and a division-wall comprising water-passages substantially at right angles to said bridge-walls, substantially as specified.

24. In the combination of a boiler and furnace, a pair of water-drums, a steam-and-water drum, a bank of tubes connecting each of

said water-drums with said steam-and-water drum, a bridge-wall extending from each of said water-drums toward said steam-and-water drum, a division-wall substantially at
5 right angles to the direction of said bridge-walls, and a division-wall substantially parallel to the direction of said bridge-walls, substantially as specified.

In testimony whereof I have heretunto set my hand in the presence of the subscribing witnesses.

JNO. A. STEVENS.

Witnesses:

GEO. M. STEVENS,
WM. E. CARLETON.