No. 631,830. Patented Aug. 29, 1899.

G. S. STRONG.

BOILER.

(Application filed June 2, 1898.)

(No Model.) 6 Sheets—Sheet 1.

FIG. 3.

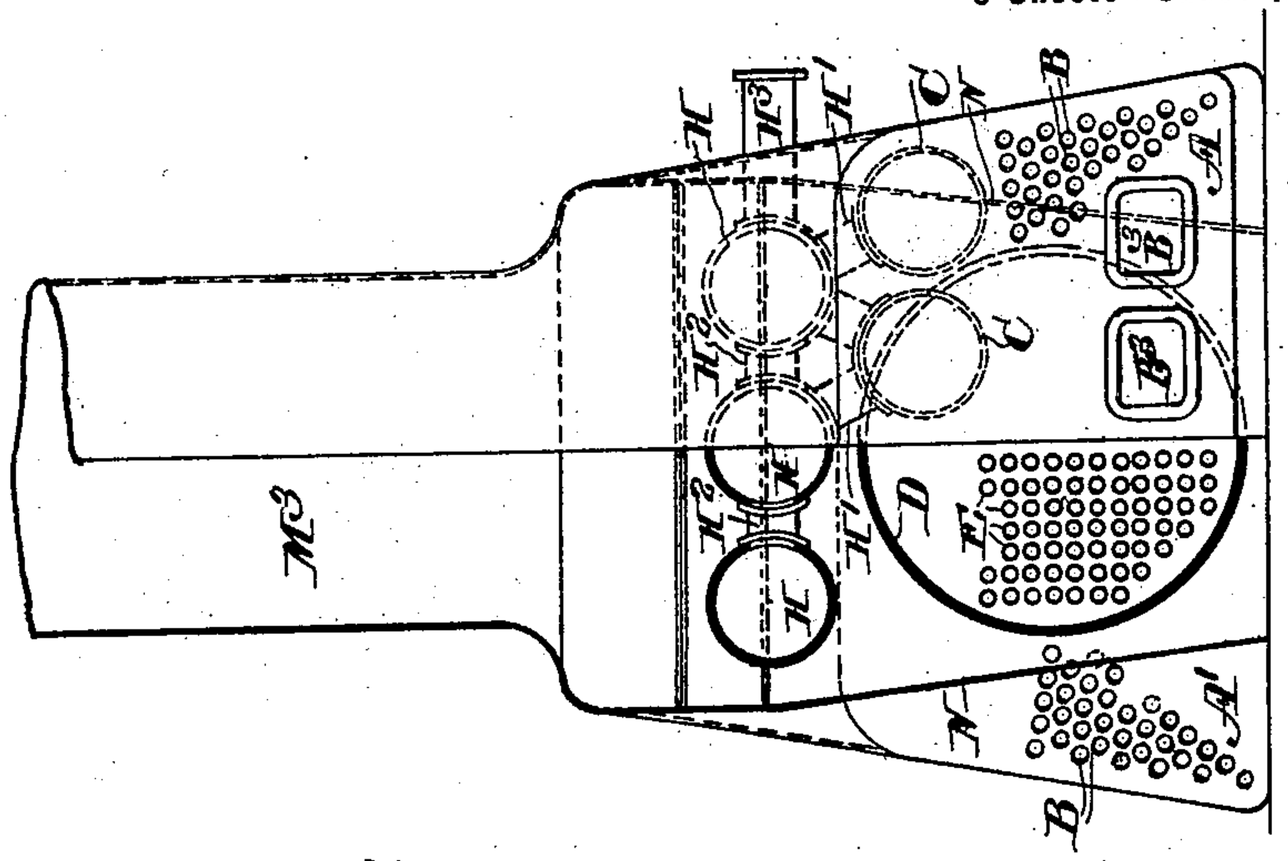


FIG. 1.

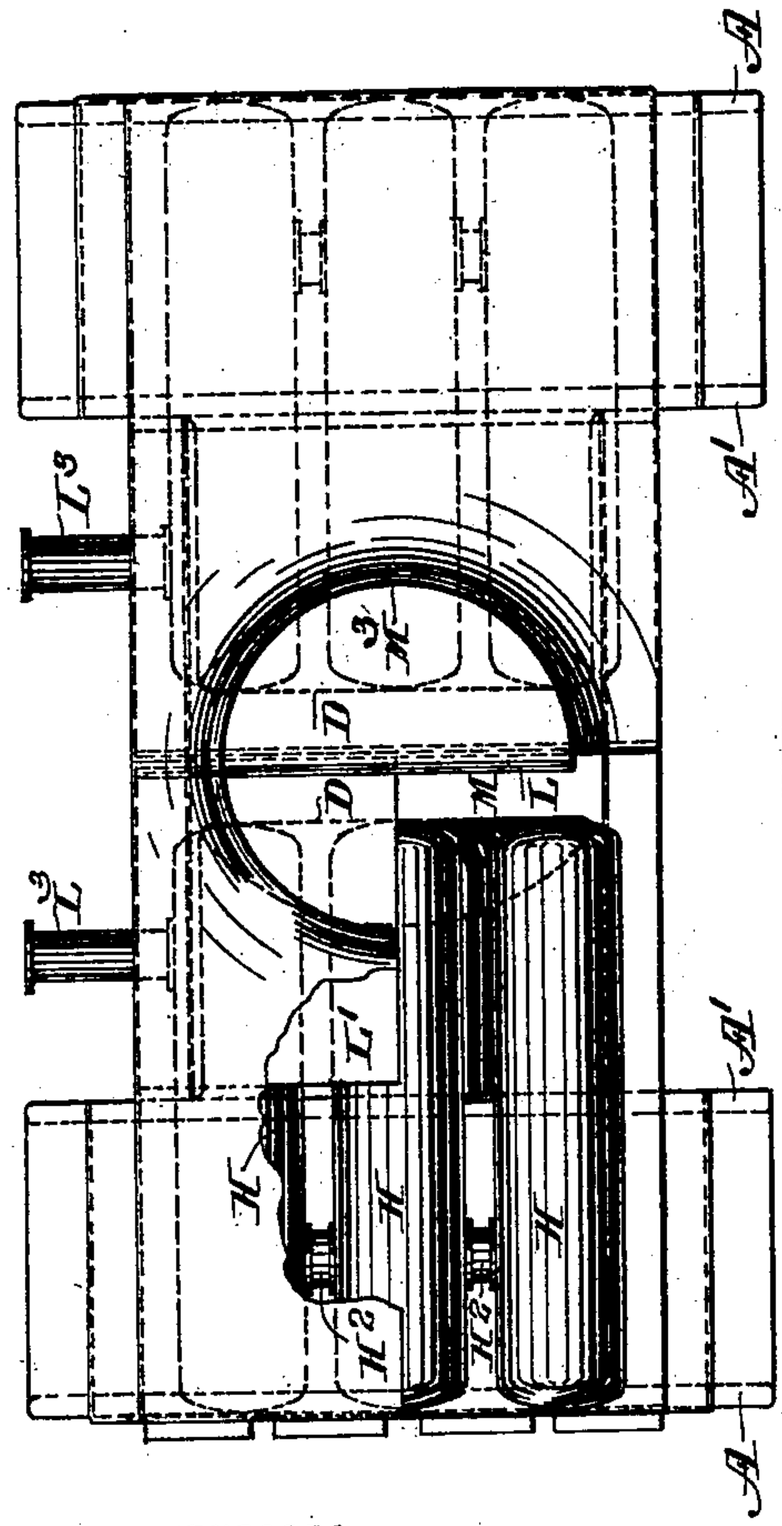
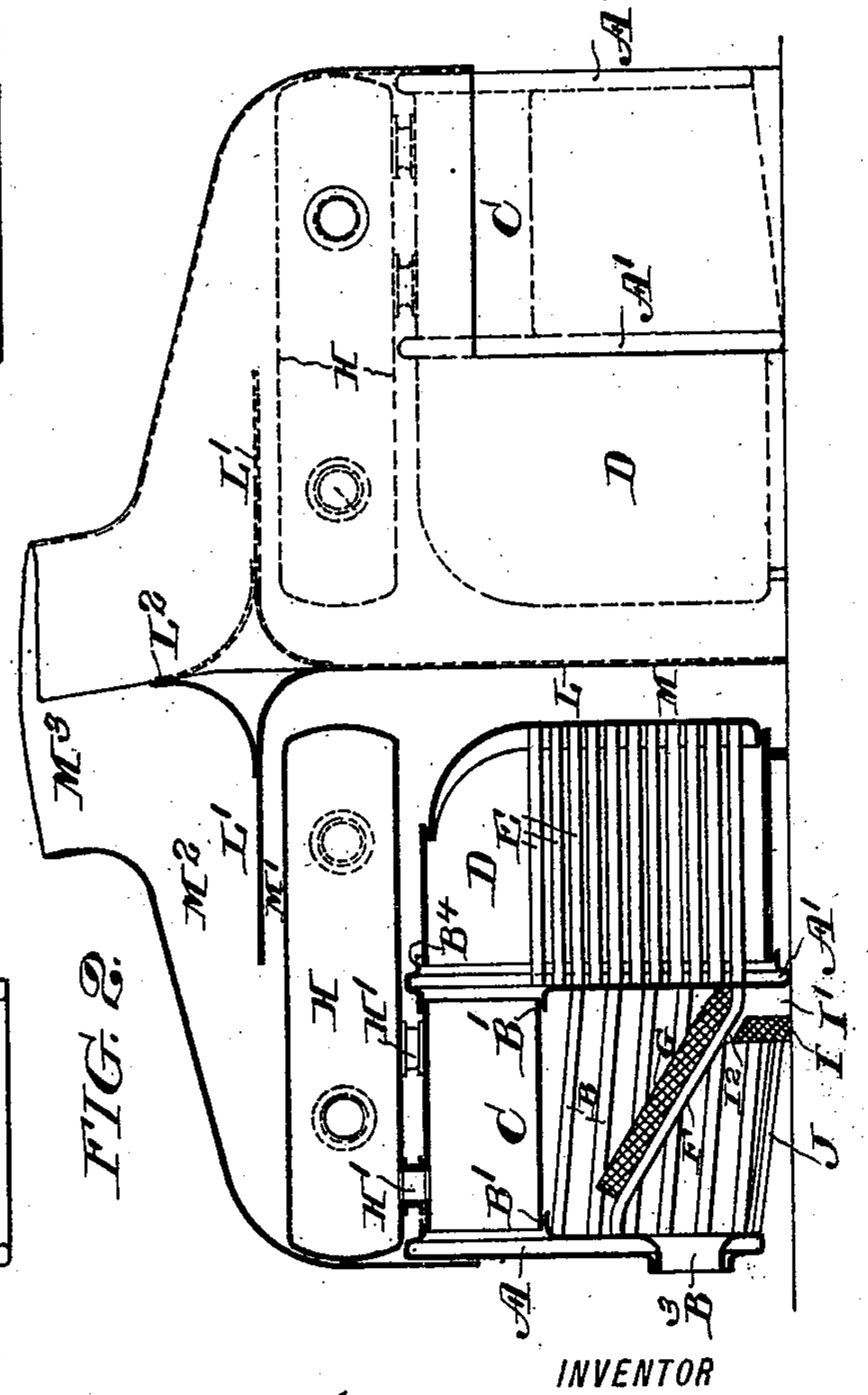


FIG. 2.



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No. 631,830. Patented Aug. 29, 1899.

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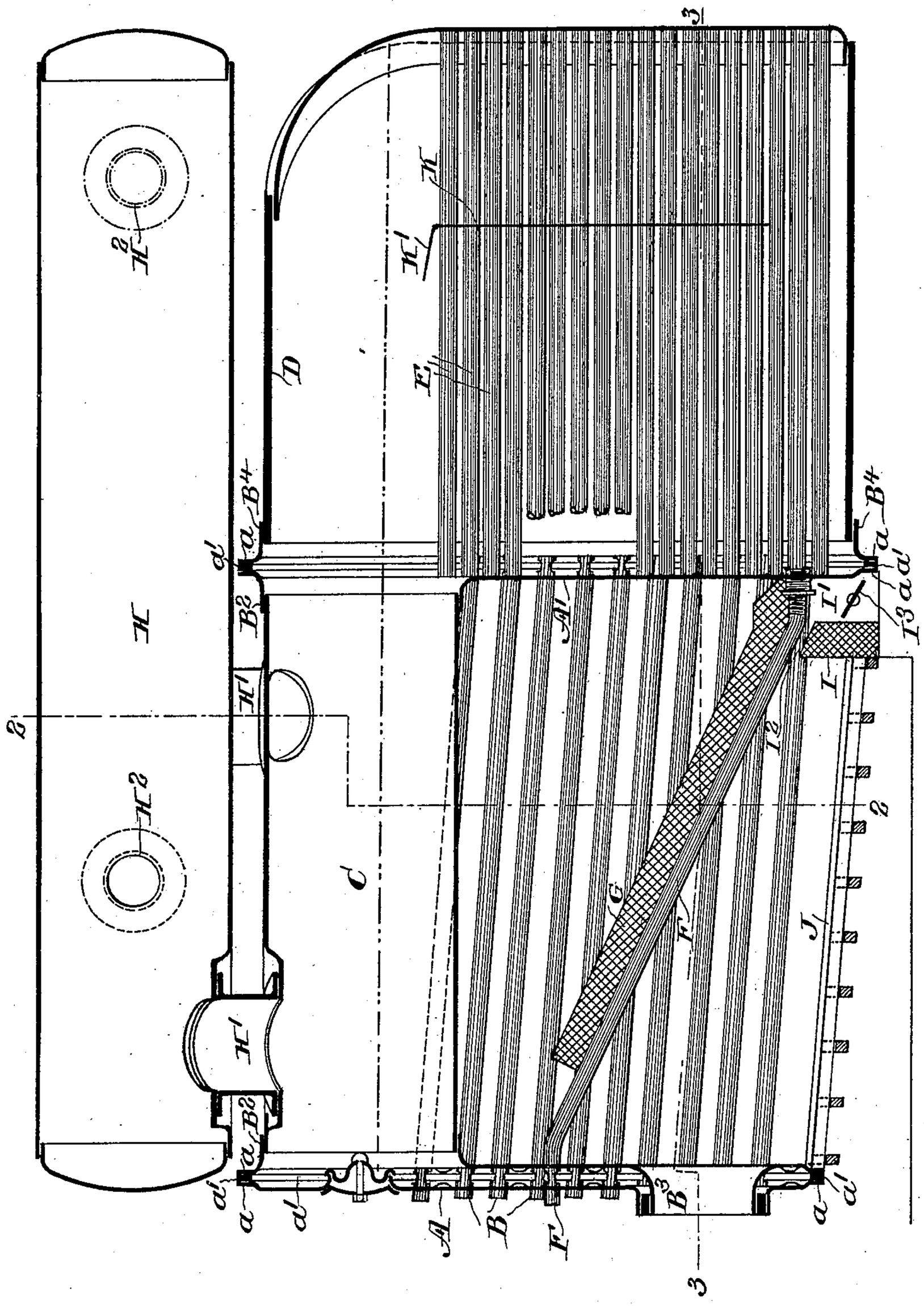
(No Model.) 6 Sheets—Sheet 2.

FIG. 4.



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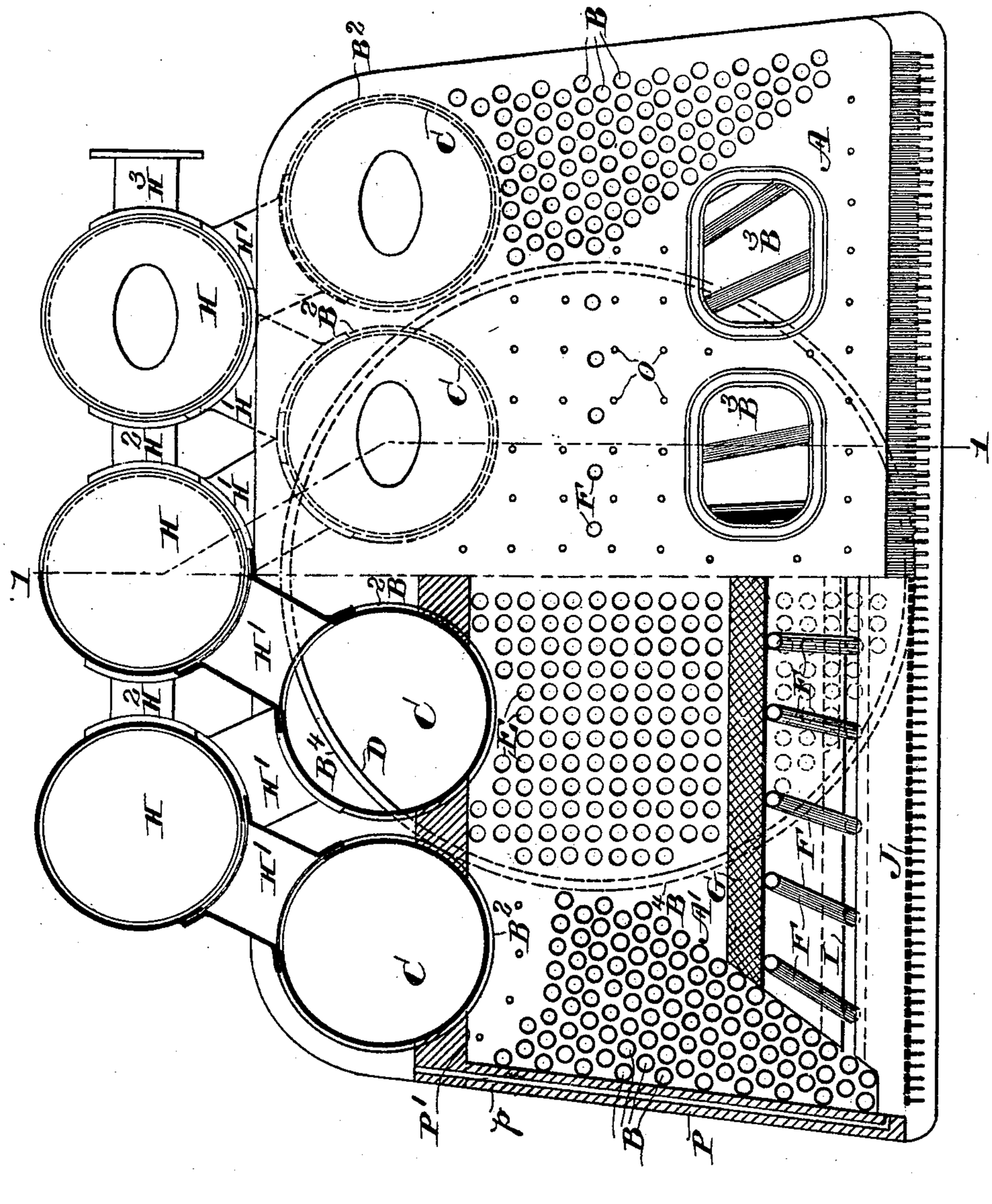
(Application filed June 2, 1898.)

(No Model.) 6 Sheets—Sheet 3.

FIG. 3.



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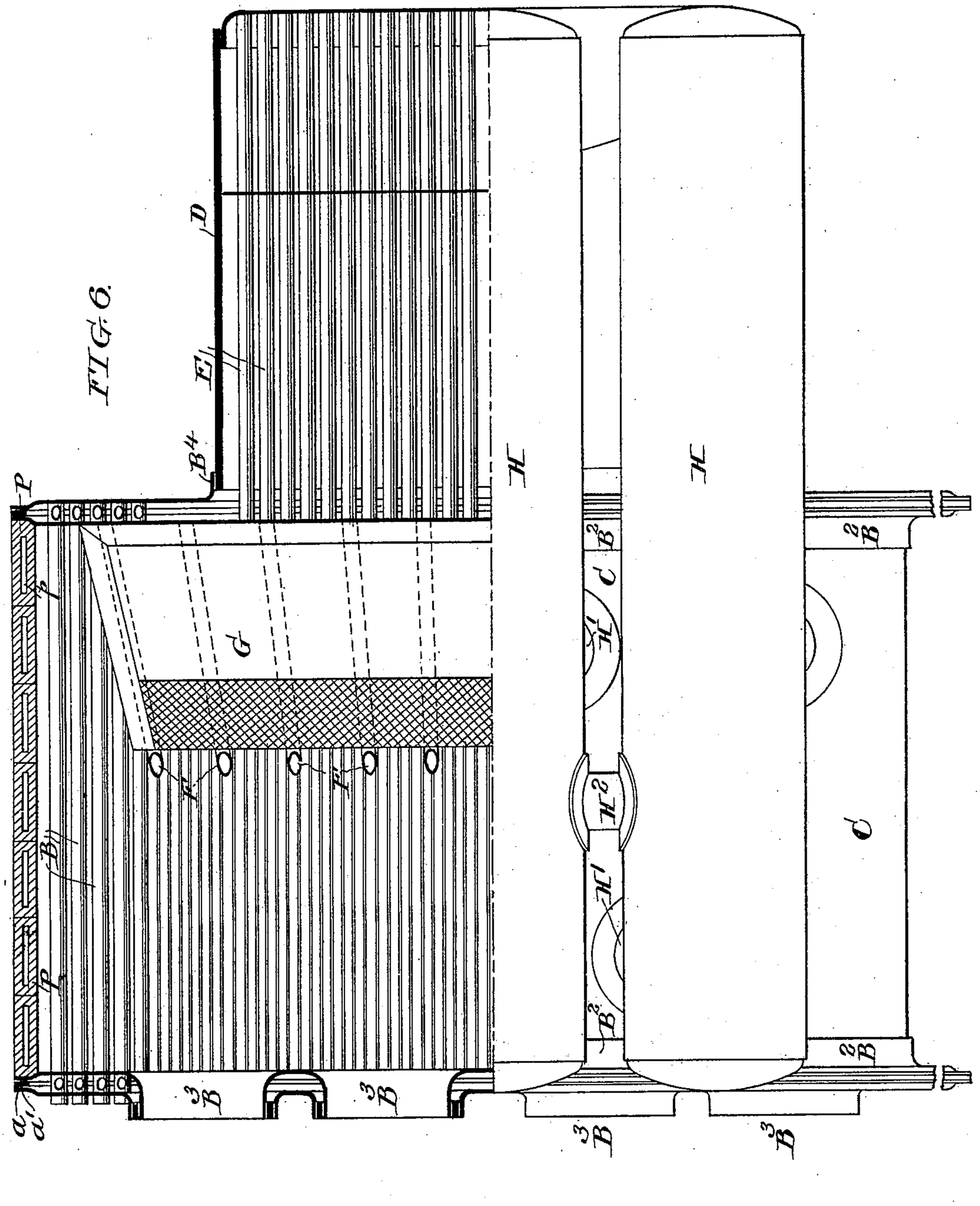
(No Model.) 6 Sheets—Sheet 4.

FIG. 6.



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(Application filed June 2, 1898.)

(No Model.) 6 Sheets—Sheet 5.

FIG. 7.

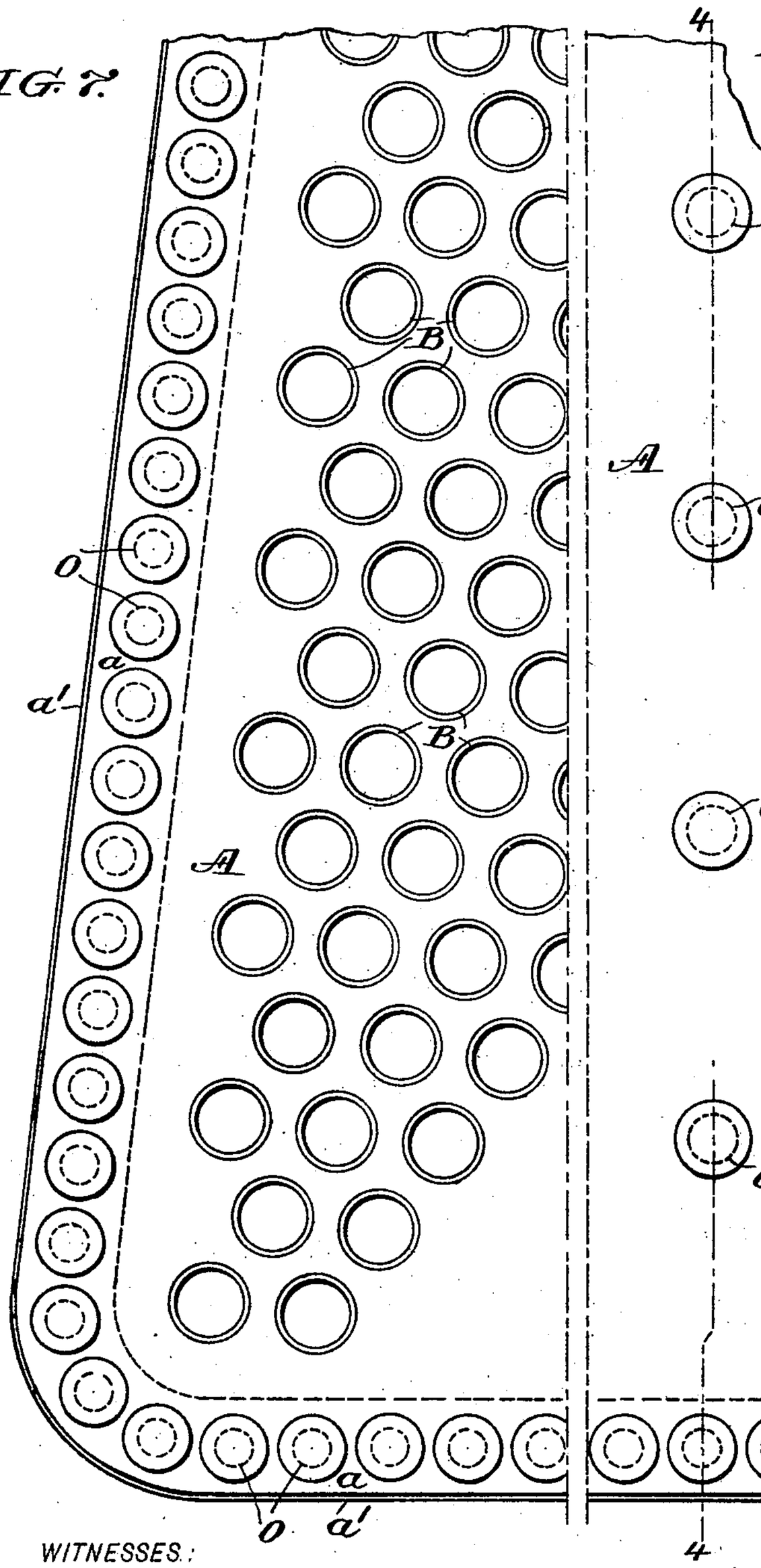
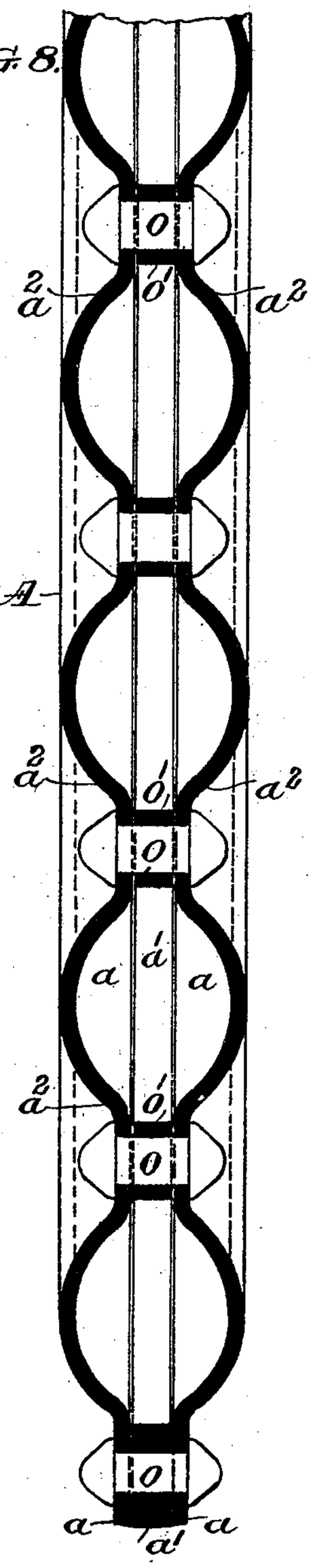


FIG. 8.



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No. 631,830. Patented Aug. 29, 1899.

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BOILER.

(Application filed June 2, 1898.)

(No Model.) 6 Sheets—Sheet 6.

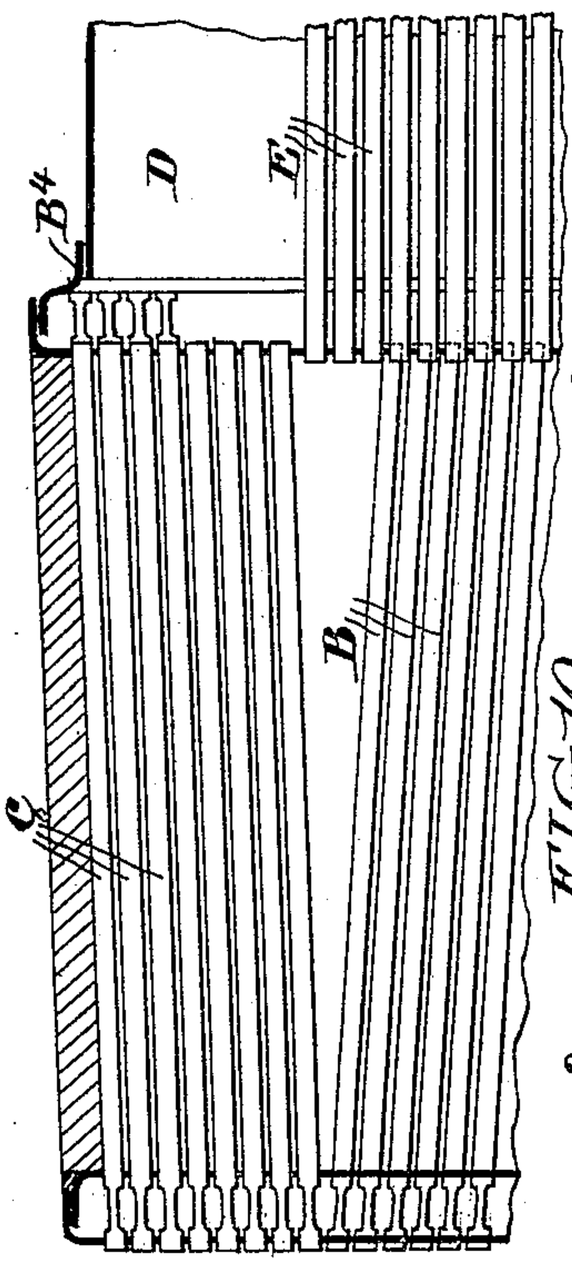

FIG. 10.

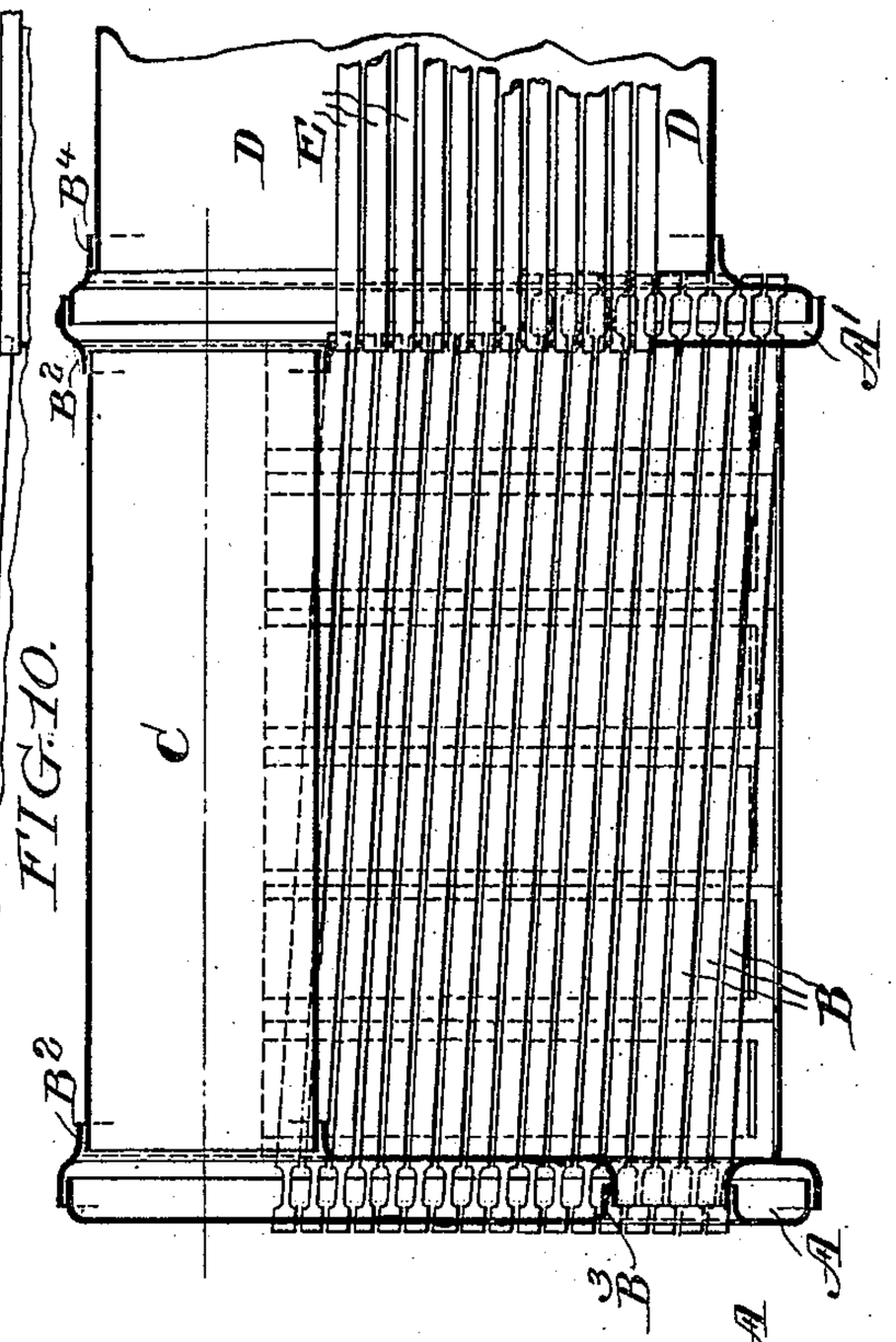

FIG. 11.

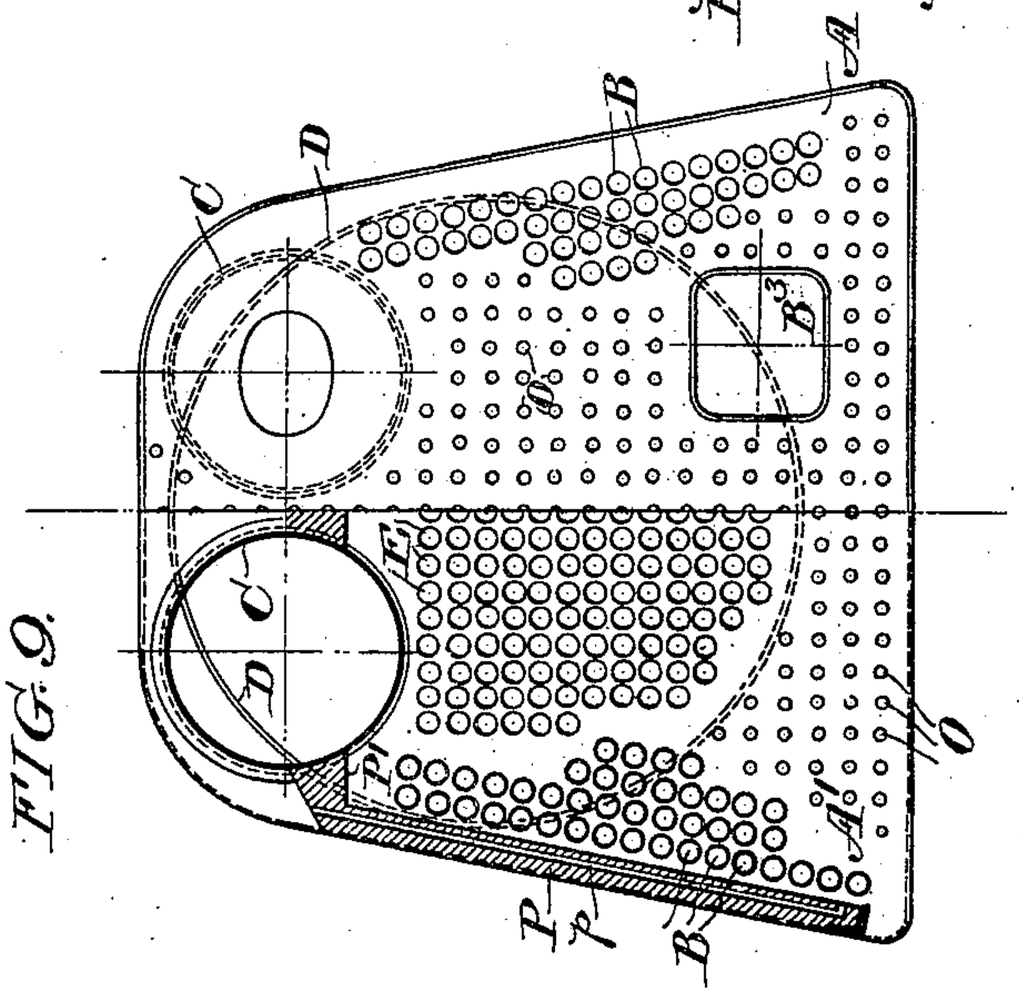

FIG. 9.

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UNITED STATES PATENT OFFICE.

GEORGE S. STRONG, OF NEW YORK, N. Y.

BOILER.

SPECIFICATION forming part of Letters Patent No. 631,830, dated August 29, 1899.

Application filed June 2, 1898. Serial No. 682,398. (No model.)

To all whom it may concern:

Be it known that I, GEORGE S. STRONG, a citizen of the United States of America, residing in the city, county, and State of New York, have invented a certain new and useful Improvement in Boilers, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My invention relates to the construction of boilers, and has for its object to provide a boiler with great steam-generating power and with efficient and ample provision for the circulation of water in the boiler. I have also in view the economy of space occupied by the boiler and a construction which will make possible the use of plates lighter than would be commonly required in boilers of similar capacity.

In many of its features my improved boiler is suitable for stationary use and also for use as a locomotive-boiler; but primarily in the present application I have adapted my boiler for marine purposes, and particularly designed it for such use as that of the boiler of a torpedo-boat.

The nature of my improvements will be best understood as described in connection with the drawings in which they are illustrated, and in which—

Figure 1 is a plan view showing two of my boilers arranged as for use in a torpedo-boat, a portion of the housing or covering being broken away to show the construction beneath. Fig. 2 is a side view, the part to the left in section, of the same construction shown in Fig. 1. Fig. 3 is a front view, the part to the left in section, of the same construction. Fig. 4 is a longitudinal section taken as on the section-line 1 1 of Fig. 5, showing the construction of my boiler in somewhat greater detail. Fig. 5 is a front view, the part to the left in section, as on the line 2 2 of Fig. 4. Fig. 6 is a plan view, the upper part in section, as on the line 3 3 of Fig. 4. Fig. 7 is a plan view showing, on an enlarged scale, the construction of the headers used in my boiler. Fig. 8 is a section taken as on the line 4 4 of Fig. 7. Fig. 9 is a front view, the part to the left in section, showing a modified construction of the boiler. Fig. 10 is a longitudinal section of the same modification, and Fig. 11 is a longitudinal section showing still another permissible modification.

A and A′ indicate, respectively, the front and rear headers, between which the fire-chamber of the boiler is situated, and which may be formed in any convenient way—for instance, as shown in Figs. 9 and 10—but preferably for use especially in the light marine boiler I form the headers as shown in Figs. 4, 6, 7, and 8—that is, with the peripheries of the front and back plates united by means of an Adamson seam and with the portions of the body of the plate which are not stayed by tubes internally dished at frequent intervals, as shown at a^2, Fig. 8, the dished portions being united by rivets O, passing through tubular stays O′. The Adamson seam, by which the edges of the plates are united, is well shown in Figs. 7 and 8, the flanges of the plates being indicated at a a and the interposed strip of the seam, (indicated at a',) O again indicating the rivets.

In my construction I unite the lateral sides of the headers A and A′ by two sets of tubes (indicated at B B) and forming, or rather partly forming, the sides of the fire-chamber. The outer row of these sets of tubes B is preferably made to support an outer non-conducting wall, which is preferably made, as shown, of hollow tiling P, formed with air-channels p, leading from near the top down into the fire-chamber near the bottom, as shown. The air-conduits serve not only to keep the outside of the tiling walls reasonably cool, but also utilize the heat for preheating the air, or rather a portion of it, which enters the fire-chamber. Preferably I make the two groups or sets of tubes B arch or incline inward over the grate, so as to afford an increased heating-surface as they extend upward, and preferably I increase the number of tubes at the upper part of each set, as shown, the plan I most approve for the marine boiler being that best indicated in Fig. 5.

I connect the upper part of the headers A and A′ by one or more conduits, forming, or rather partly forming, the top of the fire-chamber. I prefer to make these conduits in the form of drums, (indicated at C,) and preferably use at least two such drums, a construction utilizing two drums being shown in Figs. 9 and 10, while the marine boiler of

Figs. 4 and 5 is shown as embodying two such drums, the drums being united to the headers through outwardly-turned flanges B^2 B^2. In place of using drums C, I contemplate using in cases where heating-surface is desired to the maximum extent groups of tubes, as indicated at *c* in Fig. 11; but for most purposes drums, as indicated at C, will be found sufficient and most satisfactory.

B^3 B^3, &c., indicate the fire-doors, extending through the front header and preferably formed with Adamson seams, as indicated in Fig. 4.

D indicates a boiler-shell which is secured, as by flanges B^4, to the rear plate of the rear header A′, and E indicates fore tubes extending through the shell D and by means of which the products of combustion are conducted away from the fire-chamber formed between the headers. Preferably, and particularly for the utilization of my invention in a marine boiler, the front sheet of the rear header is utilized as a tube-sheet, through which the tubes E pass and into which they are expanded. As the fire-chamber is large and the grate-surface extensive it is necessary that the aggregate area of the tubes E should be correspondingly large, and that the tubes should be set closer together than is ordinarily the case, a construction which might tend to produce foaming in the shell D, and which renders it desirable, if not necessary, that a circulation of the water through the shell should be provided for, which will avoid the tendency to foam. Such a circulation I secure by means of the diaphragm-partition K, which divides the water-space of the shell into two chambers connecting at top and bottom, as shown, and results in a circulation of the water downward on the right-hand side of the partition and on the left-hand side of the partition partly upward around the tubes E and partly forward through the tubes B, the last-mentioned portion of the circulating water passing upward through the header A and rearward through the drums C and the upper part of the shell D. As shown, I have made the diaphragm K with a forwardly-extending flange K′ at top, such a construction being found desirable in promoting the desired circulation.

Where, as in the marine-boiler construction, as illustrated in Figs. 4 and 5, the lateral tube sets B B increase in number from the bottom upward, as shown, it is desirable that provision should be made for insuring that a considerable volume of the flame and products of combustion should be forced through the interspaces between these tubes, and I preferably accomplish this not only by arching the upper portion of the tube sets B over the grate, but by providing a deflecting-partition G, extending from a point above and at the rear of the grate forward and upward, as shown, and gradually diminishing in breadth. Such a partition should properly be constructed of fire-brick and supported, as shown, on water-tubes F F, extending between the front and rear headers. It will be obvious that with such a partition in place a large portion of the products of combustion will be forced over the side edges of the partition and among the tubes B B. In constructions using the partition G it is also desirable that provision should be made for introducing air above and at the rear of the grate and between it and the rear header, a bridge-wall I leaving an air-passage I′ between the bridge-wall and the rear-header which opens through a passage I^2 between the bridge-wall and the portion G. I^3 indicates a regulator by which the amount of air permitted to enter at this point can be governed.

In the marine type of boiler provision should be made by which the products of combustion after passing through the tubes E should return around the shell D over the upper part of the drum C and around the drums H—thus, for instance, as shown in Fig. 2. The provision of walls L and L′ at the rear and over the top of the boiler causes the gas to pass through the conduits M and M′ in which the boiler is situated, as shown, and thence over the top of the division-plate L′ through the opening M′ to the stack M^3. In the design shown where two boilers are placed back to back the partition L serves to separate the flue-space of the two boilers, and the two partitions L′ are conveniently connected at top by an upwardly-extending partition L^2, which directs the gases from both furnaces upward into the stack.

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

1. A boiler having in combination front and rear headers, as A A′, between which the fire-chamber is situated, one or more conduits connecting the headers at top and forming or partly forming the top of the fire-chamber, two sets of water-tubes, as B, connecting the headers at their lateral sides and forming the sides of the fire-chambers, a boiler-shell directly connected to the back plate of the rear header and through the said header in direct communication with the water-tubes and conduits connecting the headers, and a multiple series of fire-tubes extending through said shell through which the products of combustion from the fire-chamber pass.

2. A boiler having in combination front and rear headers, as A A′, between which the fire-chamber is situated, one or more conduits connecting the headers at top and forming or partly forming the top of the fire-chamber, two sets of water-tubes, as B, connecting the headers at their lateral sides and forming the sides of the fire-chamber, a boiler-shell directly connected to the back plate of the rear header and through said header in direct communication with the water-tubes and conduits connecting the headers, and a multiple series of fire-tubes extending through said shell from the front plate of the rear header through

which the products of combustion from the fire-chamber pass.

3. A boiler having in combination front and rear headers, as A A′, between which the fire-chamber is situated, one or more conduits connecting the headers at top and forming or partly forming the top of the fire-chamber, two sets of water-tubes, as B, connecting the headers at their lateral sides and forming the sides of the fire-chamber, a boiler-shell directly connected to the back plate of the rear header and through said header in direct communication with the water-tubes and conduits connecting the headers, a multiple series of fire-tubes extending through said shell through which the products of combustion from the fire-chamber pass and hollow-tile walls for the fire-box supported on the tubes B and forming air-channels leading into the fire-box.

4. A boiler having in combination front and rear headers, as A A′, between which the fire-chamber is situated, one or more conduits connecting the headers at top and forming or partly forming the top of the fire-chamber, two sets of water-tubes, as B B, connecting the lateral sides of the headers and arching over the grate, a boiler-shell directly connected to the back plate of the rear header and through the said header in direct communication with the water-tubes and conduits connecting the headers, and a multiple series of fire-tubes extending through said boiler-shell.

5. A boiler having in combination front and rear headers, as A A′, between which the fire-chamber is situated, one or more conduits connecting the headers at top and forming or partly forming the top of the fire-chamber, two sets of water-tubes, as B B, connecting the lateral sides of the headers and arching over the grate, said set of tubes increasing in number and extending inward over the grate at their upper sections, a boiler-shell directly connected to the back plate of the rear header, and a multiple series of fire-tubes extending through said boiler-shell.

6. A boiler having in combination front and rear headers, as A A′, between which the fire-chamber is situated, one or more conduits connecting the headers at top and forming or partly forming the top of the fire-chamber, two sets of water-tubes, as B B connecting the lateral sides of the headers and arching over the grate, a deflecting-arch as G extending forward and upward over the grate and between the sets of tubes B B, a boiler-shell directly connected to the back plate of the rear header, and a multiple series of fire-tubes extending through said boiler-shell.

7. A boiler having in combination front and rear headers, as A A′, between which the fire-chamber is situated, one or more conduits connecting the headers at top and forming or partly forming the top of the fire-chamber, two sets of water-tubes, as B B, connecting the lateral sides of the headers and arching over the grate, a deflecting-arch, as G, extending forward and upward over the grate and between the sets of tubes B B, an air-opening as I′ I² at the rear end thereof, a boiler-shell, directly connected to the back plate of the rear header, and a multiple series of fire-tubes extending through said boiler-shell.

8. A boiler having in combination front and rear headers, as A A′, between which the fire-chamber is situated, one or more conduits connecting the headers at top and forming or partly forming the top of the fire-chamber, two sets of water-tubes, as B B, connecting the lateral sides of the headers, a boiler-shell directly connected to the back plate of the rear header, a multiple series of fire-tubes extending through said boiler-shell, and a deflector-plate K arranged across the shell to promote a circulation of the water in it and around the fire-tubes.

9. A boiler having in combination front and rear headers, as A A′, between which the fire-chamber is situated, two or more steam and water drums connecting the headers at top and forming or partly forming the top of the fire-chamber, one or more steam-drums situated above the steam and water drums and each, connected with two of such drums, two sets of water-tubes connecting the lateral sides of the headers and forming or partly forming the sides of the fire-chamber, a boiler-shell D secured to the rear plate of the rear header and through the said header in direct communication with the water-tubes and conduits connecting the headers, and fire-tubes extending through said shell.

10. A boiler-header, as A or A′, having its front and rear walls united at the edge through a filling-piece against which edge flanges of the plates rest and having said plates inwardly dished at intervals, and the dished portions secured together by rivets passing through tubular stays.

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