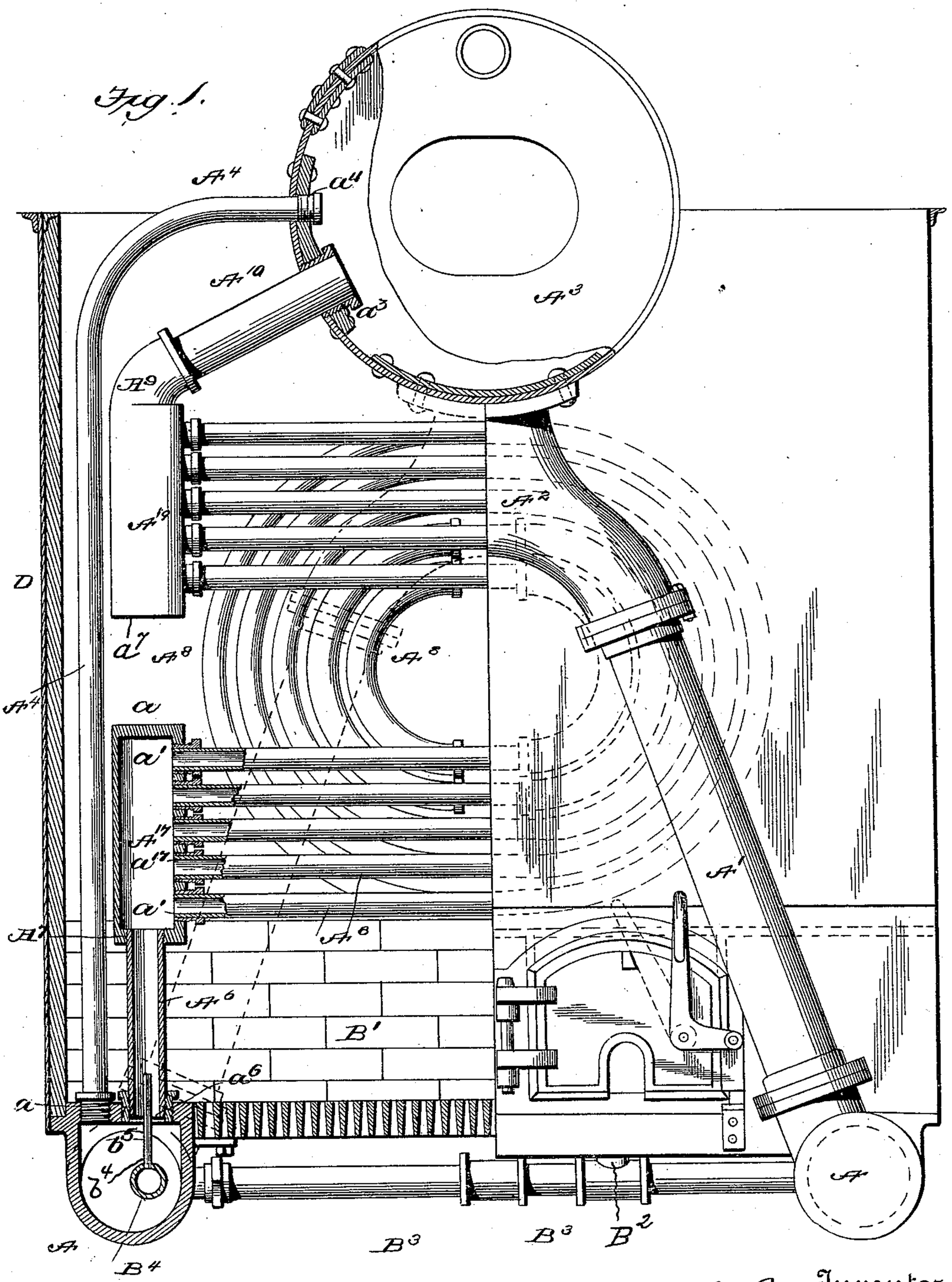
(No Model.) 4 Sheets—Sheet 1.

J. J. BROWN.

TUBULAR BOILER.

No. 521,150. Patented June 12, 1894.

Fig. 1.



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WASHINGTON, D. C.

(No Model.)

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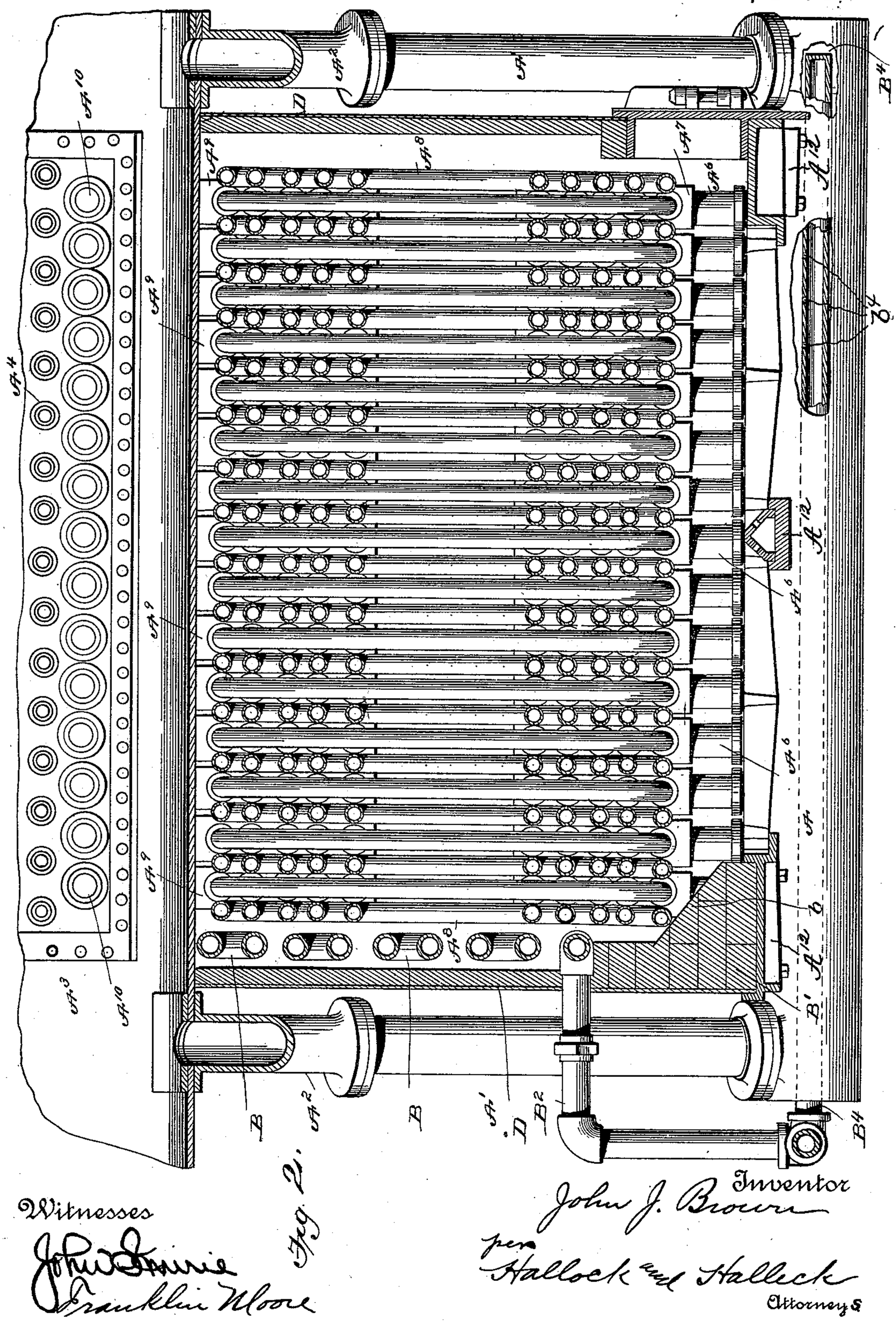

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

J. J. BROWN.

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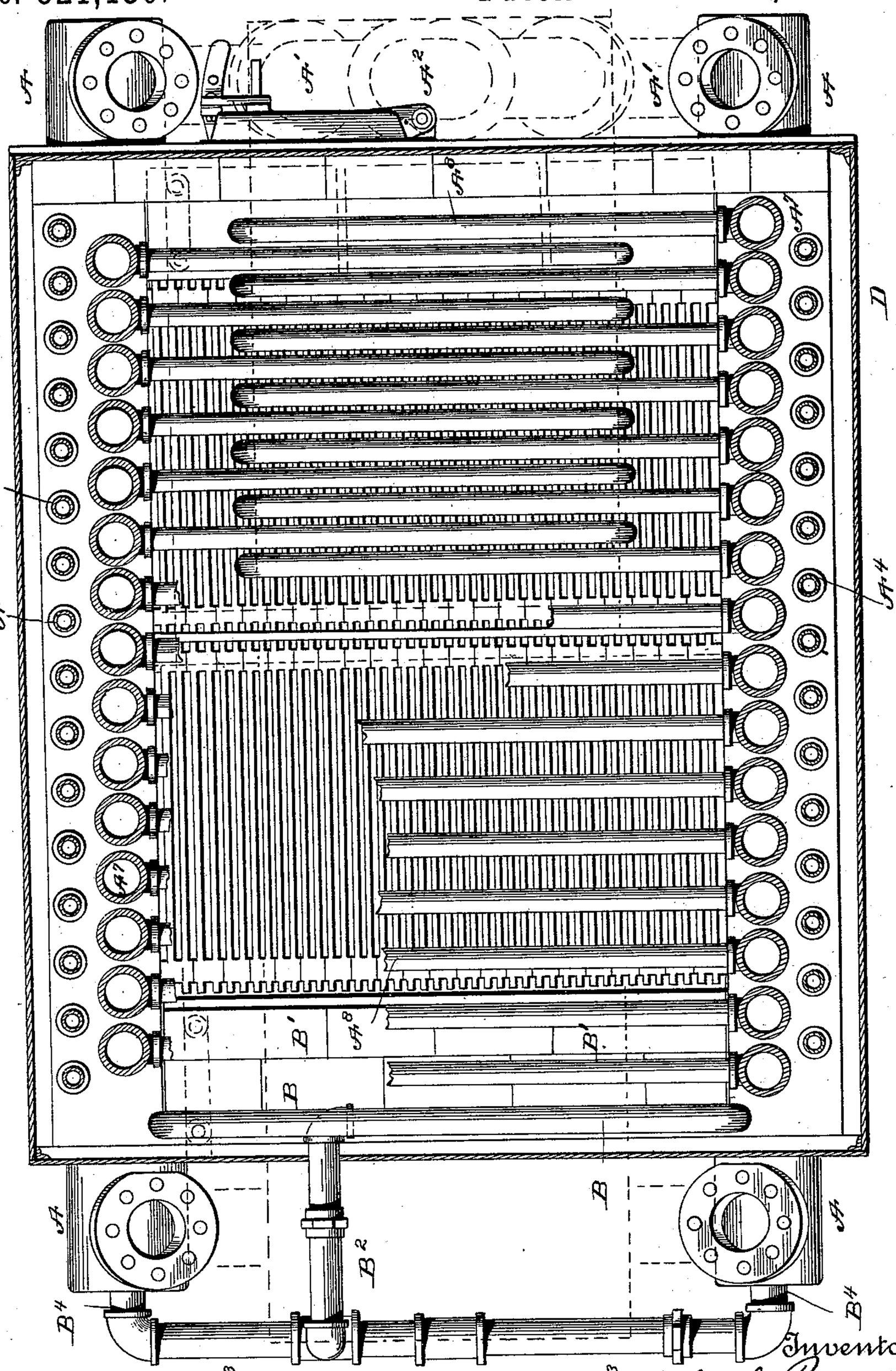

Fig. 3.

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(No Model.)

4 Sheets—Sheet 4.

J. J. BROWN.

TUBULAR BOILER.

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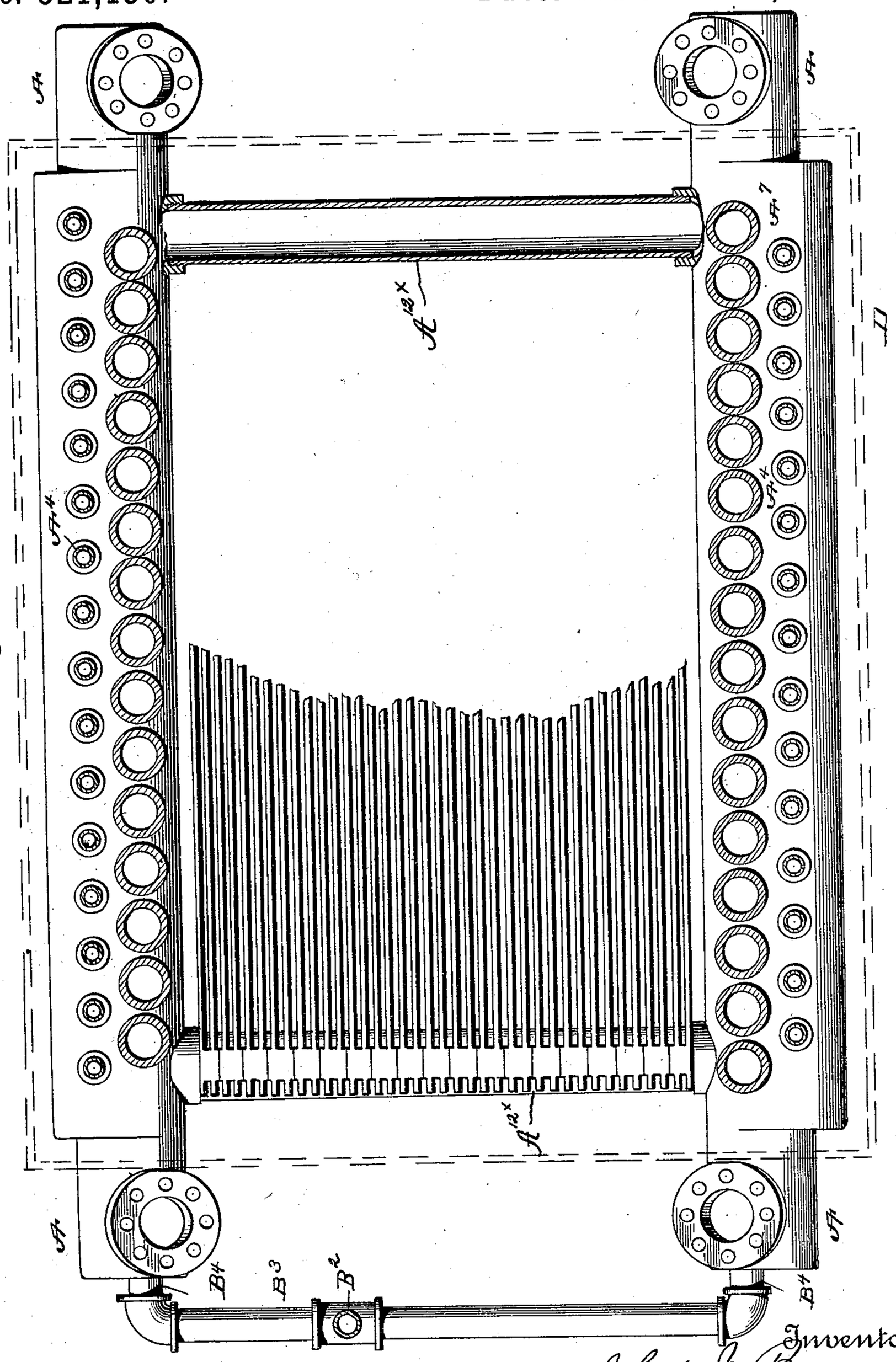

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UNITED STATES PATENT OFFICE.

JOHN JAMES BROWN, OF BALTIMORE, MARYLAND.

TUBULAR BOILER.

SPECIFICATION forming part of Letters Patent No. 521,150, dated June 12, 1894.

Application filed August 3, 1893. Serial No. 482,260. (No model.)

To all whom it may concern:

Be it known that I, JOHN JAMES BROWN, a citizen of the United States, residing in the city of Baltimore and State of Maryland, have invented certain new and useful Improvements in Tubular Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to tubular boilers.

The object of the invention is to improve upon the general construction of this class of devices; and to that end the nature of the invention consists of constructions and combinations all as will hereinafter be set forth in the specification and pointed out in the claims reference being had to the accompanying drawings, in which—

Figure 1, is a front view of the boiler with smoke cap removed and part of the face broken away to show the interior of the boiler; Fig. 2, a median longitudinal section excepting through the bent tubes projecting from the right hand side of the boiler said tubes being shown in elevation; Fig. 3, a horizontal section taken on the right hand side of the figure above the bent tubes and on the left hand side between the lower side and between the lower parts of the bent tubes, the standard pipes being removed from one end and shown in dotted lines at the other end and Fig. 4, a skeleton view showing a modification of the manner of connecting the manifolds or base pipes.

A represents the manifolds or base pipes on each side of the furnace at or below the line of the grate bars, and connected together by bars A^{12}, as shown in Figs. 1, 2 and 3, or by tubes $a^{12\times}$ as shown in Fig. 4, said bars or tubes supporting the grate or grate bars. The upper side of the manifolds A are provided with two series of openings, a and a^6 one on the outer side and the other on the inner side thereof, the openings a on the outer side being opposite the spaces between the openings a^6 on the inner side.

A^3 is a steam drum or reservoir supported by the manifolds by means of pipes located outside of the boiler. The steam drum has in each side two rows of openings marked a^3 and a^4. The openings in the upper row are opposite the spaces between the lower row and the openings a^4 are in the same vertical plane as openings a in the manifolds A while openings a^3 occupy a similar position relative to openings a^6 in the manifolds. The standards supporting the steam drum are also channel ways for the return of the water from the drum to the manifolds and may be of any desired construction. The preferred form is made of pipes A′ inclined inwardly from the manifolds toward each other and secured together at their upper ends by a three way coupling Y or (A^2) that is secured by its stem to the under side of the steam drum.

It has heretofore been customary in this type of boiler in forming the up channel ways to connect the steam drum and manifolds by means of tubes or headers leading directly from one to the other. The objection to such a construction lies in the fact that the opposite ends of the tubes or headers are subjected to different temperatures. The lower end of the tube or header receives the cooler water while the upper end of the tube or header receives the water after it has been subjected to the heat of the fire box. The result is unequal expansion of the tube or header resulting generally in leakage at the joints and often in the warping and cracking of the pipes. To overcome this objection the headers in my boiler between the drum and manifold are made in three parts to wit sections A^7 projecting from the inner row of openings in the manifolds, and sections A^9 projecting from the lower row of openings a^3 in the steam drum and bent tubes A^8 connecting the sections A^7 and A^9. The sections A^7 and A^9 project toward each other but have an open space of sufficient distance between them to permit of their expanding without danger of their meeting. So also can they move independently of each other as the connection between the two is such that if one should expand or contract its movements would not be imparted to the other but would be taken up by the tubes A^8. It is therefore clear that no matter what the temperature may be of the water on entering sections A^7 and the amount of heat it may receive during its course through tubes A^8, and after its

entrance into headers A^9 before passing into the drum, all of these parts will be free to adapt themselves to the different temperatures to which they are subjected without regard to the difference in the expansion and contraction of one another, thus avoiding all danger of strains, warps and cracks.

The form of the sections is immaterial but for convenience in making I prefer to make them in two parts.

In the drawings I have shown the sections A^7 as made of a casting A^{17} and a tube A^6 which is secured by one end to one of the openings a^6 in the manifolds A, and by the other to the casting A^{17}. This casting is provided with a series of openings a^{17} arranged in a vertical row and is closed at the end to divert the water into said openings. The sections A^9 are also preferably formed of two parts a casting A^{10} and a tube A^{10}. The tube is secured by one end to the drum and carries the casting at the other. The casting is also provided with a series of vertical openings like those marked a^{17} on casting A^{17} and its lower end a^7 is closed so that the water passing therein will flow upward into tube A^{10} and from thence into the drum. There are as many of the openings a^{17} in the sections as may be desired—the same number being in each section. The tubes A^8 which connect the two sections are secured to the latter by nipples or other holding devices screwed into said openings a^{17}. The tube A^8 which is secured to the lowermost opening a^{17} of the section A^7 is bent in such a manner that its other end can be and is secured to the topmost opening in the section A^9. The second tube is secured respectively to the second lowermost opening in section A^7 and the second or next to the top opening in the section A^9 and so on until all are secured forming a nest with the innermost tube A^8 secured to the upper opening in section A^9. By this arrangement of the tubes A^8 the cold or cooler water entering the section A^7 is deflected into the tubes by the closed end. The intense heat in the fire box will draw the water into the tubes A^8. The hottest water will rise to the topmost opening and will have a short circuit to reach section A^9. The coldest water will enter the tube A^8 connecting with the lowest opening a^{17} in section A^7 and will have the longest circuit to travel before reaching section A^9. By this arrangement of sections and tubes the water entering the header A^7 is so distributed that the coldest water will have to travel farther than the warmest before entering the header A^9 and after reaching the latter is met by an ascending current of hot water diverted in that direction by the closed end a^7 and passed therewith into the drum or reservoir A^3 where the steam separates from the water which then descends to the manifolds A through the channels formed by couplings A^2 and standards A′. The sections on one side of the furnace are opposite the spaces between the sections on the other side of the furnace so that the tubes A^8 on one side project between the tubes of the opposite side and form a sort of a crown sheet over the fire.

On each side of the furnace between the casting D D and the headers and opposite the space between the headers is a second row of tubes A^4 having their lower ends secured to the opening a in the outer side of the manifold and their upper ends secured to the steam drum at a^4. These tubes while subjected to a great heat are not subjected to the heat of the same intensity as the headers and the tubes connecting them as the sections A^7 are next to the fire and the tubes A^8 are immediately over the fire and sections A^9 protect the upper ends of the tubes A^4 from the intense heat that is deflected by the bottom of the steam drum. Again the tubes A^4 are not subjected to the cooling influence of the feed water which is introduced into the manifolds A and diverted by means which I shall now describe into the headers A^6.

At the rear end of the furnace is a coil of pipes B the lowermost resting upon a wall B′ having an inclined face b under the rear nests of tubes A^8 so that some of the products of combustion will be deflected against the coil of pipes B. These pipes have a connection with a suitable water supplying device (not shown) and an outlet pipe B^2 provided with two branches B^3 each having an extension B^4 running from the rear end to the front end of the manifolds. The end of the extension B^4 at the front end of the manifold is closed and a number of openings b^4 (see Fig. 2) equaling in area the area of the pipe, are formed in the upper side of the pipe about opposite the point where the headers are joined to the manifolds. The object of this construction is to avoid supplying the feed water in a volume but to sub-divide it into a number of jets at points opposite the headers so that it will not chill or check that part of the boiler into which it is admitted, as would be the case if the water were admitted at a single point in a stream the size of the bore of the pipe. If desired the openings b^4 may be enlarged and nipples b^5 inserted therein as shown in Fig. 1. These nipples project into the headers and insure the delivery of the feed water into the circulation and at a point where it will be taken up rapidly.

The tubes and a greater part of the drum are inclosed in a suitable casing D. If made of metal it is lined with fire brick, asbestus or other non-conducting material. When used for stationary work it may be inclosed in masonry in the usual manner. The upper part of the casing is made to converge to form a flue. If the boiler be a very long one a stop plate or draft guide may be placed above the shell tubes before passing out of the smoke stack. If a fire be made at both ends of such a boiler a similar plate is placed at each end of the furnace for the same purpose. The drum is provided with the usual dry pipe for taking the steam and man holes at one or both ends

for cleaning the drum. Other well known appliances such as a surface blower and scum pipe may also be attached thereto.

What I claim as new is—

1. In a boiler or steam generator the combination with the steam drum and the base of the boiler of a series of headers divided into two sections having an open space between one section connected with the base of the boiler and the other with the steam drum and connected together by two or more bent tubes, substantially as described.

2. In a boiler or steam generator the combination with the steam drum and the base of the boiler, of a series of headers divided into two sections having an open space between one part connected with the base of the boiler and the other with the steam drum and connected together by two or more bent tubes, the tubes of one side interlocking with the tubes on the other side to form a crown sheet substantially as described.

3. In a boiler or steam generator the combination with the steam drum and the base of the boiler, of a series of headers divided into two sections having an open space between, one section being connected with the base of the boiler and the other with the steam drum and each part having a series of openings arranged vertically and two or more bent tubes connecting said headers, the tube inserted in the lowermost opening of the lower part of the header being bent upon itself and secured in the topmost opening in the upper part of the header and the other tube or tubes being shortened and secured to the openings in the sections of the headers in the same manner as the lowermost tube substantially as described.

4. In a boiler or steam generator the combination of a header made or constructed in two parts or sections having an open space between, the said two parts or sections being connected by two or more tubes or pipes which are bent or so constructed with fittings as to return over themselves one end of the said bent tube being connected and secured to the lower part or section of the header and the other end to the top part or section of the header which is placed directly above the bent tubes forming the only direct connection by which the two parts or sections of the headers are connected the said headers forming the sides and the bent tubes the crown of the furnace substantially as described.

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

JOHN JAMES BROWN.

Witnesses:
M. F. HALLECK,
FRANKLIN MOORE.