

(No Model.)

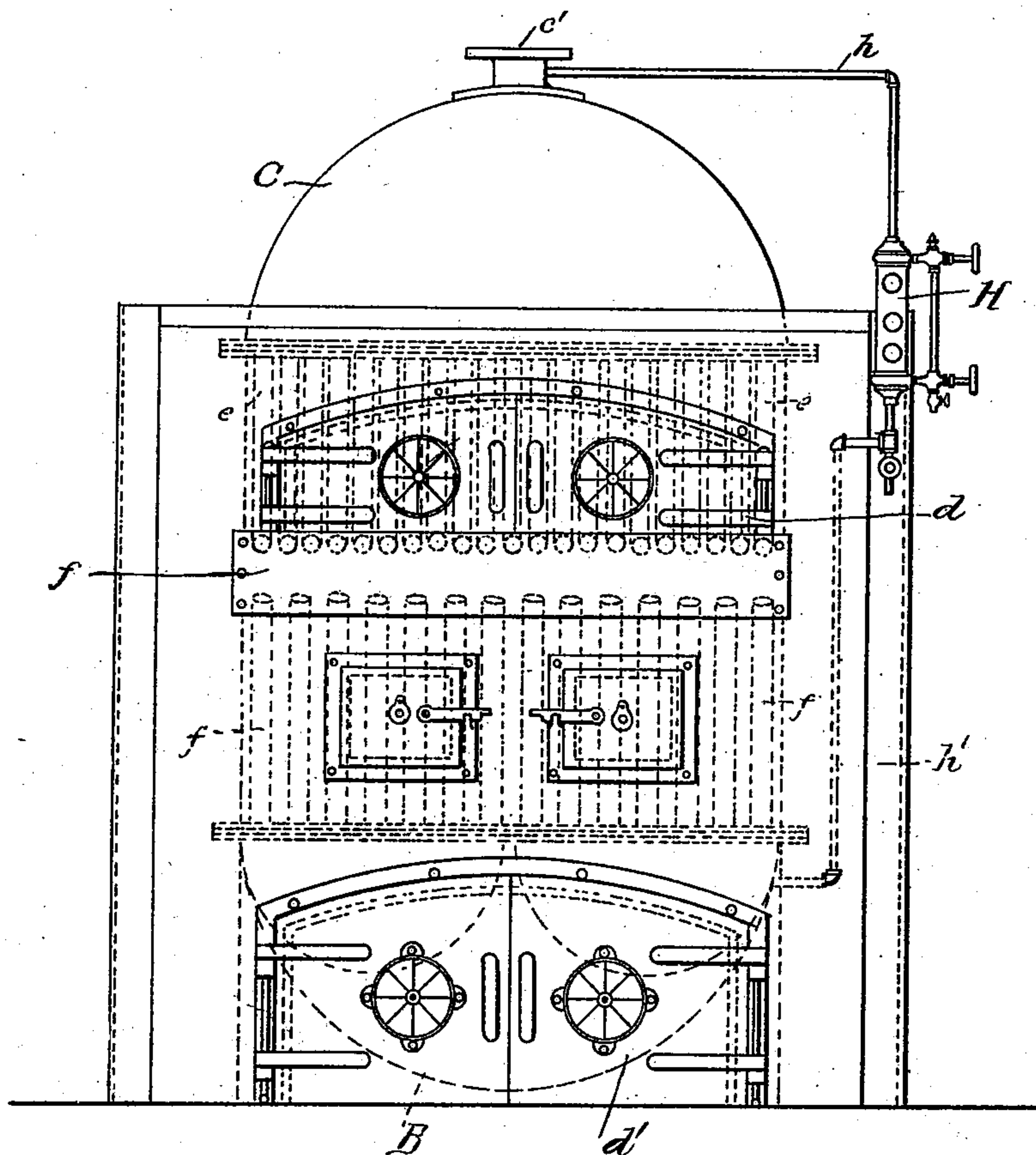
A. W. & L. COLWELL.
STEAM BOILER.

4 Sheets—Sheet 1.

No. 553,513.

Patented Jan. 28, 1896.

Fig. 1



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(No Model.)

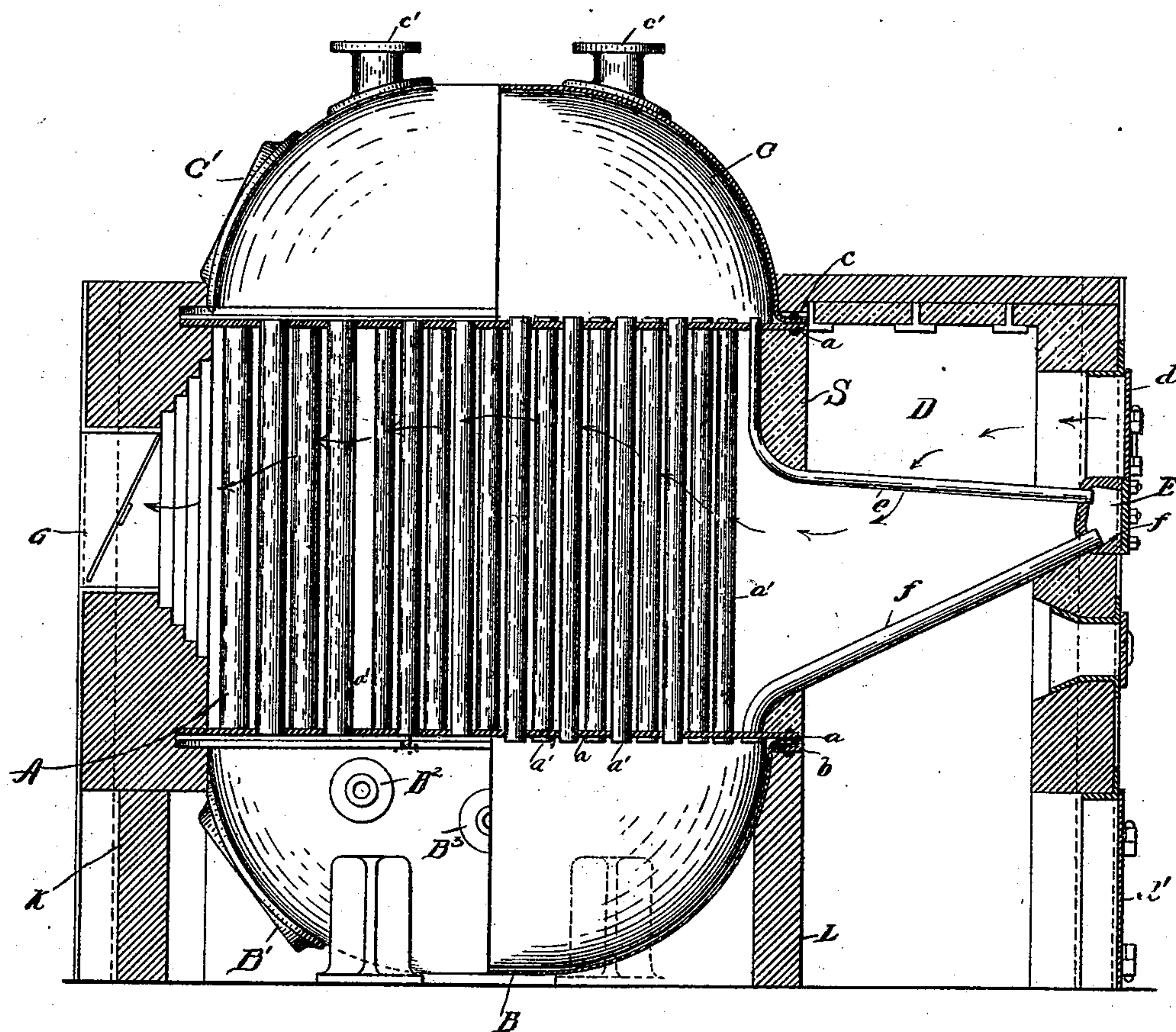
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Fig. 2.



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Fig. 3

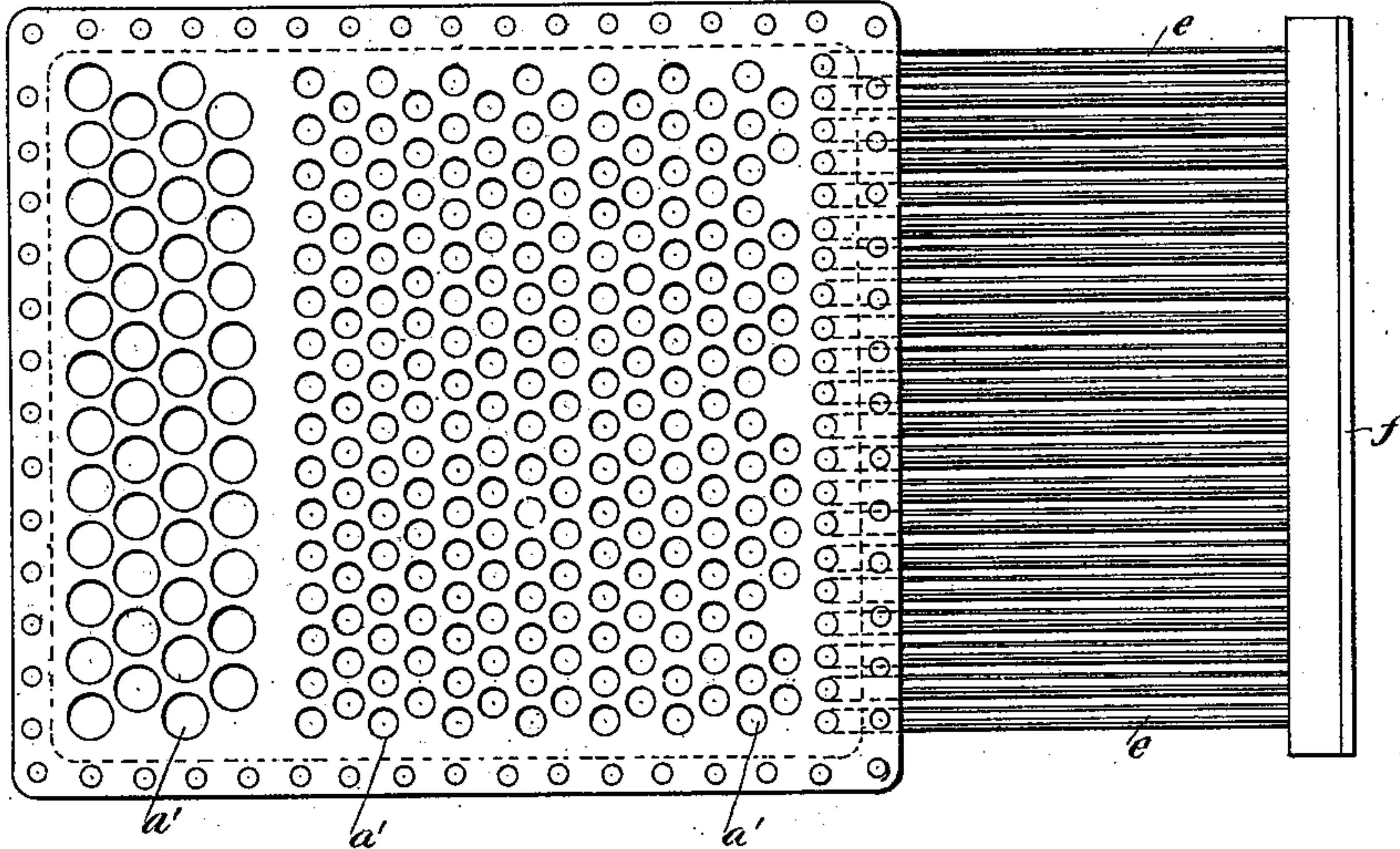
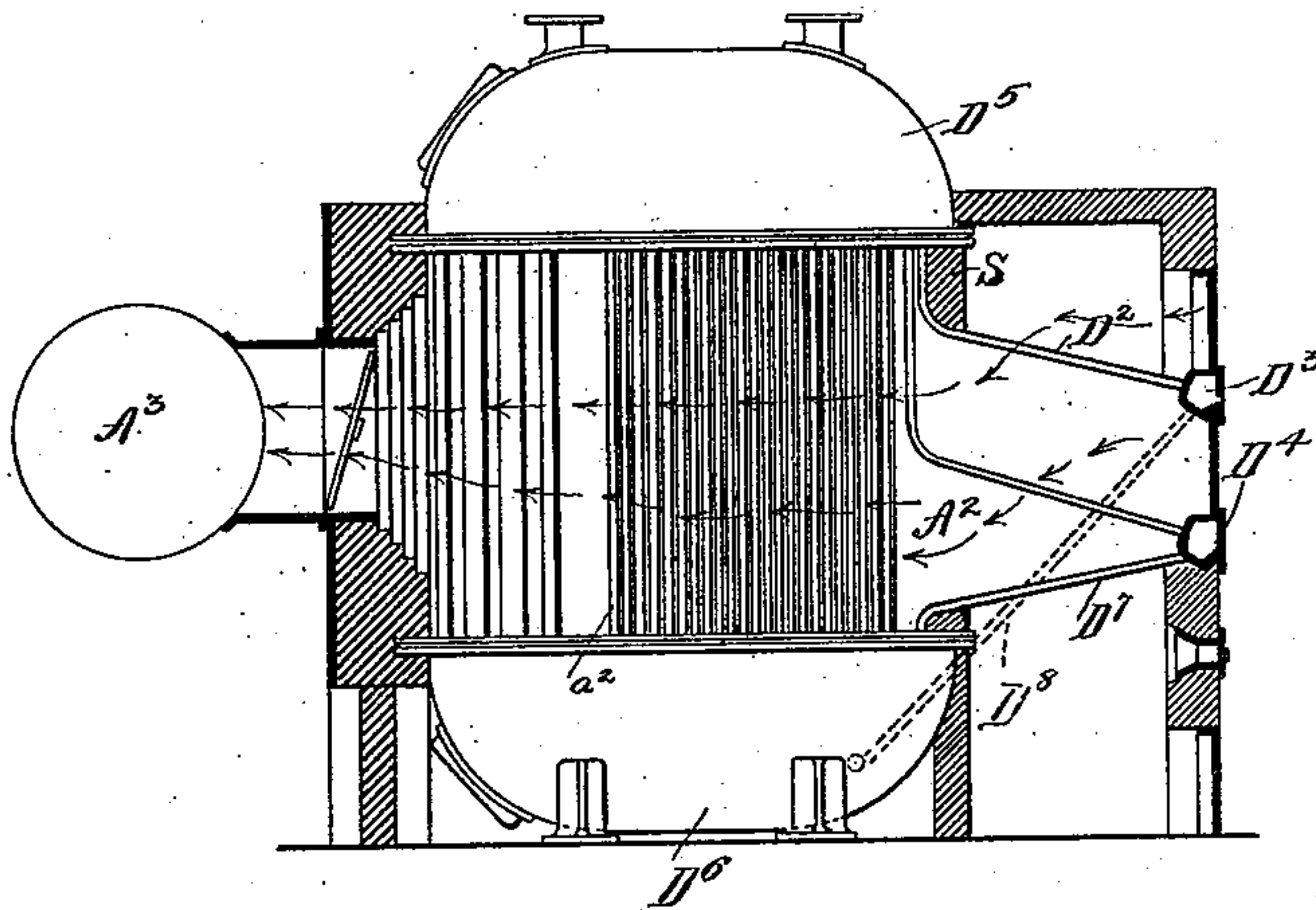


Fig. 4



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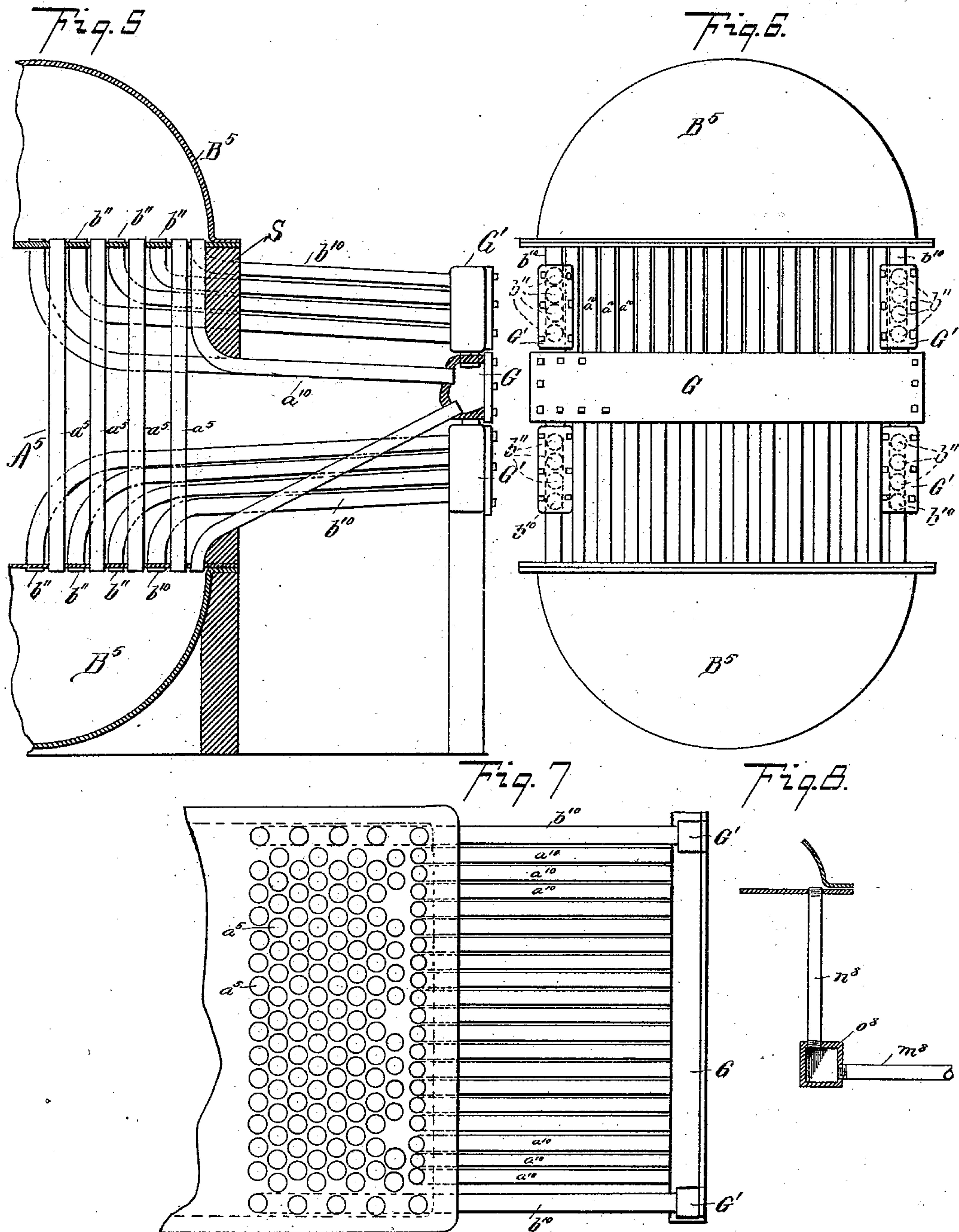
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UNITED STATES PATENT OFFICE.

AUGUSTUS W. COLWELL AND LEWIS COLWELL, OF NEW YORK, N. Y.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 553,513, dated January 28, 1896.

Application filed March 28, 1895. Serial No. 543,443. (No model.)

To all whom it may concern:

Be it known that we, AUGUSTUS WARREN COLWELL and LEWIS COLWELL, residents of the city, county, and State of New York, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

Our invention relates to steam-boilers, and has for its object to produce a steam-boiler with a great steaming capacity which can be contained within a limited space.

Our invention has for its further object the production of a steam-boiler which can be readily set up and tested.

Our invention consists in the construction and arrangement hereinafter set forth and claimed.

The invention will be understood by reference to the accompanying drawings, in which—

Figure 1 is a face view of a boiler contained within its surrounding brickwork and showing the water grate-bars and supply-pipes in dotted lines. Fig. 2 is a transverse vertical longitudinal section on line 2 2 of Fig. 1, the same being in one-half section. Fig. 3 is a plan view of the boiler proper, showing the arrangement of the water-tubes and grates with box. Fig. 4 is a transverse vertical longitudinal section of a modification. Fig. 5 is a fragmentary vertical section of a type of our boiler especially adapted for a marine boiler. Fig. 6 is a front elevation of the same. Fig. 7 is a plan view of Figs. 5 and 6 with the upper dome removed, and Fig. 8 is a section of a modification of the grate.

Our improved boiler aforesaid is made in three sections. The central section A consists of a series of tubes whose construction and arrangement will be hereinafter set forth, and which are mounted in tube-plates *a*. The section B is a water dome or receptacle secured to the lower tube-plate, *a*, by its lips or flanges *b*.

C is the third section of the boiler, and consists of a steam-dome secured to the opposite or upper tube-plate, *a*, of the central section by its lip, rim, or flange *c*. The domes can be made rounding both ways, as shown in dotted lines in Fig. 1, thus avoiding stays.

D is a fire-box or furnace which heats the boilers and is provided with doors *d* above

the floor of the grate for the reception of the coal and ash-doors *d'* for the removal of the ashes.

The tubes *a'* have their ends inserted in apertures in the plates *a* and are expanded therein so as to hold them firmly in place. Of these tubes *a'* those farthest from the fire-box D are largest, and those nearest the fire-box D are smaller and placed closer together. The water-tubes *a'* are so arranged and proportioned that they are more closely assembled and of smaller diameter where they stand nearest the fire than at a distance therefrom for the purpose of exposing a greater amount of surface to the heat where it is strongest and also of allowing the products of combustion where they approach the outlet or chimney greater freedom of movement.

E is a water-box, with which communicates a series of tubes *e* leading from the steam-dome C. The water-dome B is also in communication with the water-box E through the tubes *f*, the tubes *e* serving as grate-bars upon which the coal is burned.

G is the flue or exit for the gases and spent products of combustion which come from the fire-box D downward through and between adjacent grate-bars *e*, thence around the water-tubes *a'* and into the flue G.

The steam-dome C is provided with exit-passages or steam-nozzles *c'* for conducting the steam away from the boiler and with a manhole C'. The water-dome B is also provided with a manhole B', with a feed port or tube B², and a blow-off port or tube B³.

The boiler may also be provided with the usual gage H and connections *h h'*. The boiler proper may be bricked in or covered in any suitable manner, such as by means of walls K and L or any insulating-cover.

Our boiler thus constructed presents many advantages, among which are facility of entering and setting up in a cramped place without noise. This setting up or assembling can be variously accomplished, but is preferably done as follows: The tube-plates duly perforated are placed in the proper position, the tubes are inserted and then expanded at their ends so as to be firmly secured to their tube-plates. The bottom and top domes are then placed against the tube-plates and bolted securely with machine-bolts. We then roll the

boiler into its natural vertical position and test it. This gives us an opportunity of observing any leaks or weak points, which we can correct before the casing or covering is put around the boiler. A further advantage of our arrangement is that with the down-draft through the water-tube grate-bars with a sufficient supply we burn a very large amount of coal per square foot of grate and get a larger number of units of heat from the fuel than by any other system of combustion of which we are aware, and the products of combustion coming in direct contact with the vertical uptake-tubes make a very rapid circulation of the water in the tubes.

The easy separation of the water and steam in the large upper dome, whether assisted by means of diaphragms or other appliances, is most perfect. The water passing to the rear has a downward course through the large tubes in the rear, making a rapid and perfect circulation. The effect of this upon any precipitate is that it will be thrown to the bottom by the eddies, where it can be drawn off at intervals through the blow-off pipe. The walls allow no flame to strike the bottom dome to cake mud deposits.

The boiler being compact and set low, the center of gravity is low, making it a desirable feature for marine purposes. The boiler also presents every facility for rapid and thorough cleaning, and the system of combustion admits of burning soft coal or any other fuel with the least attention and the greatest economy, with a very small proportion of ash. Usually we also provide a bonnet f' on the front of the water-box, which we can remove for the purpose of examining the bars in case the lodgment of a precipitate in the water-box or water-bars should be suspected. In action the boiler is filled with water to a height, say, slightly above the upper end of the upright water-tubes a , so that the latter may be always filled with water. After the fire has been started the circulation will be in an upward direction through those of said water-tubes which are nearest the fire and which are of smallest diameter, likewise through the tubes that enter the water-box from the lower dome and extend from said water-box upwardly into the upper dome. The descent of the circulating water is through the larger upright pipes which are farthest away from the fire.

In the modification shown in Fig. 4 we have provided two sets of grates D' D^2 which communicate with water-boxes D^3 D^4 , as before, and with the steam-dome D^5 , the water-boxes D^3 D^4 also communicating with the water-dome D^6 by the usual supply-pipes D^7 D^8 . The middle section A^2 is constructed of the usual tubes a^2 arranged with the smaller tubes nearest together and nearest the fire, as in Figs. 1, 2 and 3.

A^3 is the flue which carries off the products of combustion.

It will be noted that instead of merely du-

plicating the grates we may use three or four grates, or any desired number. We may also use the updraft with common bars.

In the modification shown in Figs. 5, 6 and 7 the boiler is provided with the usual steam and water domes B^5 B^5 and middle section A^5 consisting of the tubes a^5 . In addition to these features the boiler is provided with bent-tube grate-bars a^{10} , which communicate with the water-box G and the dome B^5 . It will be noticed that the vertical portion of these tubes is short, so that the weight of the vertical column of water will not be very great, which will permit the steam generated in the tubes a^{10} to pass through the vertical column of water without driving the water out of the tubes. This feature may be also embodied in the construction shown in the other modifications. The boiler is further provided with water sides to the fire-box and to the ash-pit box, these water sides consisting of tubes b^{10} having short vertical portions or uptakes b^{11} , which tubes communicate with the dome B^5 and are connected by water-box headers G' G' , which water-box headers are in turn connected to the water-box G .

One great advantage of the use of our boiler for a marine boiler is that upon cooling the shrinking of the tubes causes the deposit thereon to loosen and fall out of the tubes into the lower chamber, whence it may be readily removed.

Now as regards the grate-bars we would have it understood that the essential feature of our invention, as far as it relates to these grate-bars, is to have the water-tube grate-bars upon which the fire rests inclined, and to provide these grate-bars with a short uptake, making but a slight pressure of water-column. The steam then immediately separates itself in the chamber and fresh water flows in and completes the circulation. This object may be variously attained—for instance, as shown in Figs. 1 to 7, wherein the construction is shown as a bent tube; but we would have it understood that this structure may be departed from without departing from the spirit of our invention. For instance, we may employ the construction shown in Fig. 8, wherein m^8 indicates an inclined water-tube grate-bar, of which there may be any desired number, and n^8 indicates the uptake thereof, of which there may be any desired number. These grate-bars and uptakes may be connected to a suitable water box or header o^3 , or the structure may be otherwise varied to suit the requirements of practice or the necessities of any particular situation.

We would also have it understood that while we have shown and described specific forms of our invention we do not mean to thereby limit ourselves to the forms thus shown, as the construction may be greatly varied by inclining the middle section more or less, and also by making downtakes return outside of the middle section.

We are aware that a boiler having domes

connected by upright water-tubes has been devised heretofore, and that downdraft water-tube grates have also been devised; so, therefore, we do not claim these structures broadly; but we have found in boilers having domes connected by upright water-tubes that a downdraft is especially efficacious, as by thus constructing the boiler there is no danger of cold air striking the upright tubes and causing them to shrink and pull away from their fastenings in the domes. Various means for obtaining this hot downdraft may be employed, one of which we have shown as a fire-box or grate located in front of the upright tubes and a shield between the upright tubes and the fire-box.

What we claim, and desire to secure by Letters Patent, is—

1. A boiler consisting of domes, a section connecting the domes consisting of upright water-tubes in communication with the domes, and means for producing a down draft in the boiler consisting of a grate or grates located in front of the tubes, a fire-door above the floor of the grate, and a shield S between the fire-box and the upright tubes.

2. In a boiler, the combination of a steam-dome and a water-dome, a section connecting the domes consisting of a series of upright water-tubes attached to the domes by each end and in communication therewith, the tubes nearest the fire being nearer together and of smaller diameter than the tubes farthest from the fire, and a grate or grates in front of the tubes.

3. In a boiler, the combination of a central section composed of upright water-tubes, end sections consisting of a steam-dome above the tubes and a water-dome below the tubes, the said tubes being connected to the said domes, combined with a water-box as E and water-tube grate-bars as e, the said grate-bars being connected directly to the steam-dome and in communication therewith, substantially as described.

4. The combination of a water-box as E, water-tube grate-bars e, water-tubes f, and a steam-dome and a water-dome, the said grate-

bars and tubes connecting directly with the domes and with the water-box, substantially as described.

5. In a marine boiler, the combination of vertical water-tubes in communication with a steam dome, a series of water-tube grate-bars forming the floor of the grate, a series of water-tubes forming the sides of the grate or furnace, each individual grate-bar and tube being connected to the steam dome by its own independent conduit, substantially as described.

6. In a boiler, the combination of vertical water-tubes, a water-tube grate located in a fire-box in front of and above the middle line of the tubes, and means for producing a downdraft through the grate and carrying the flames and products of combustion straight through between the vertical tubes, consisting of a passage around the tubes and a shield S between the tubes and the fire-box, substantially as described.

7. In a boiler, the combination with water-tubes of a grate located in a fire-box and consisting of inclined water-tube grate-bars having short vertical uptakes, another grate located in the same fire-box below the first grate and consisting of inclined water-tube grate-bars, and vertical uptakes located in the rear of the first named uptakes with a free space between the uptakes, and means for causing a down draft through the grates, consisting of a shield S between the fire-box and the remainder of the boiler.

8. In a boiler, the combination of a steam dome, vertical water tubes, inclined water-tube grate-bars forming the floor of a grate, tubes forming the sides of the grate, and a water-box header, the said tubes forming the sides of the grate being connected to the water box and to the steam dome by bent water conduits, substantially as described.

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