

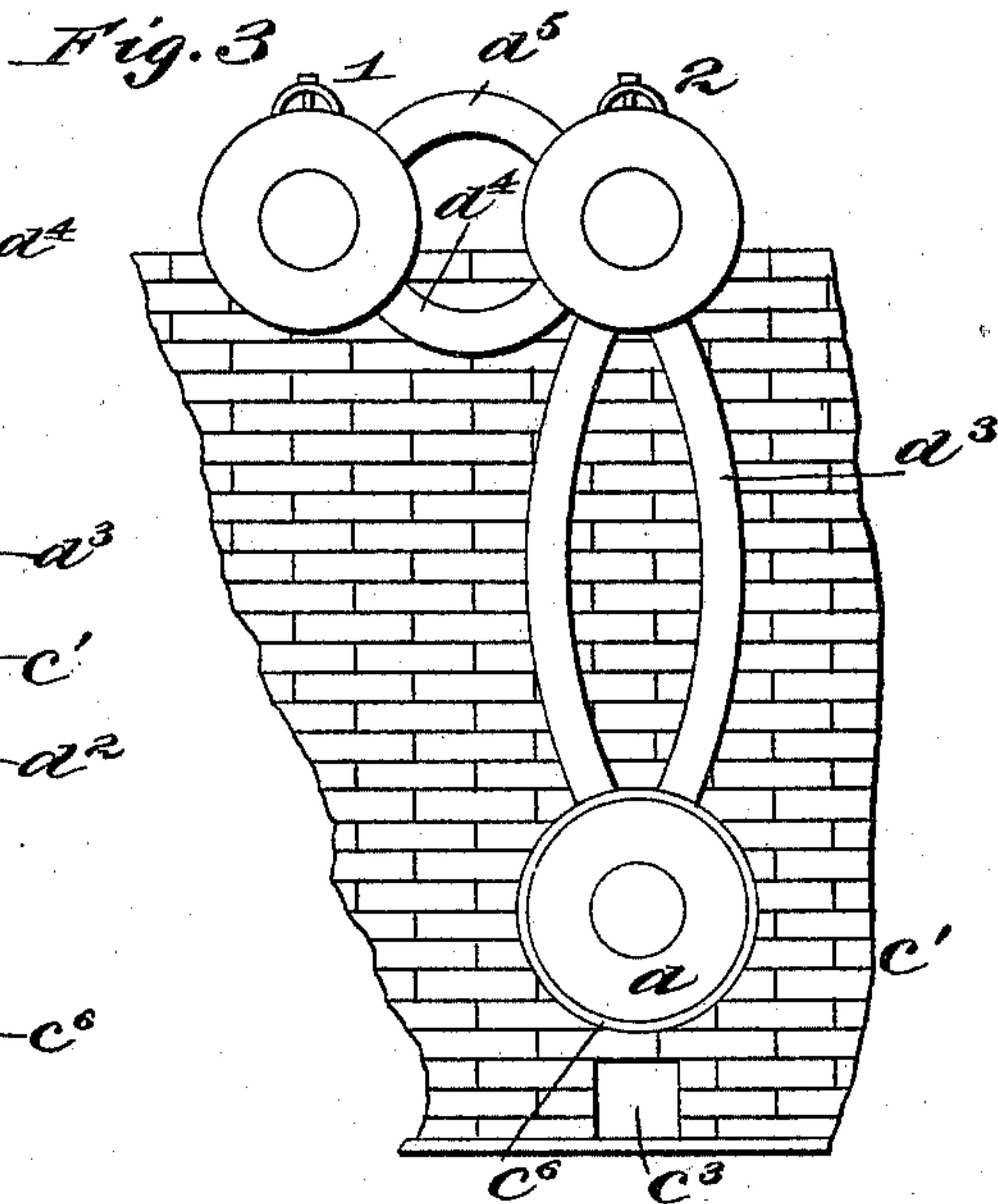
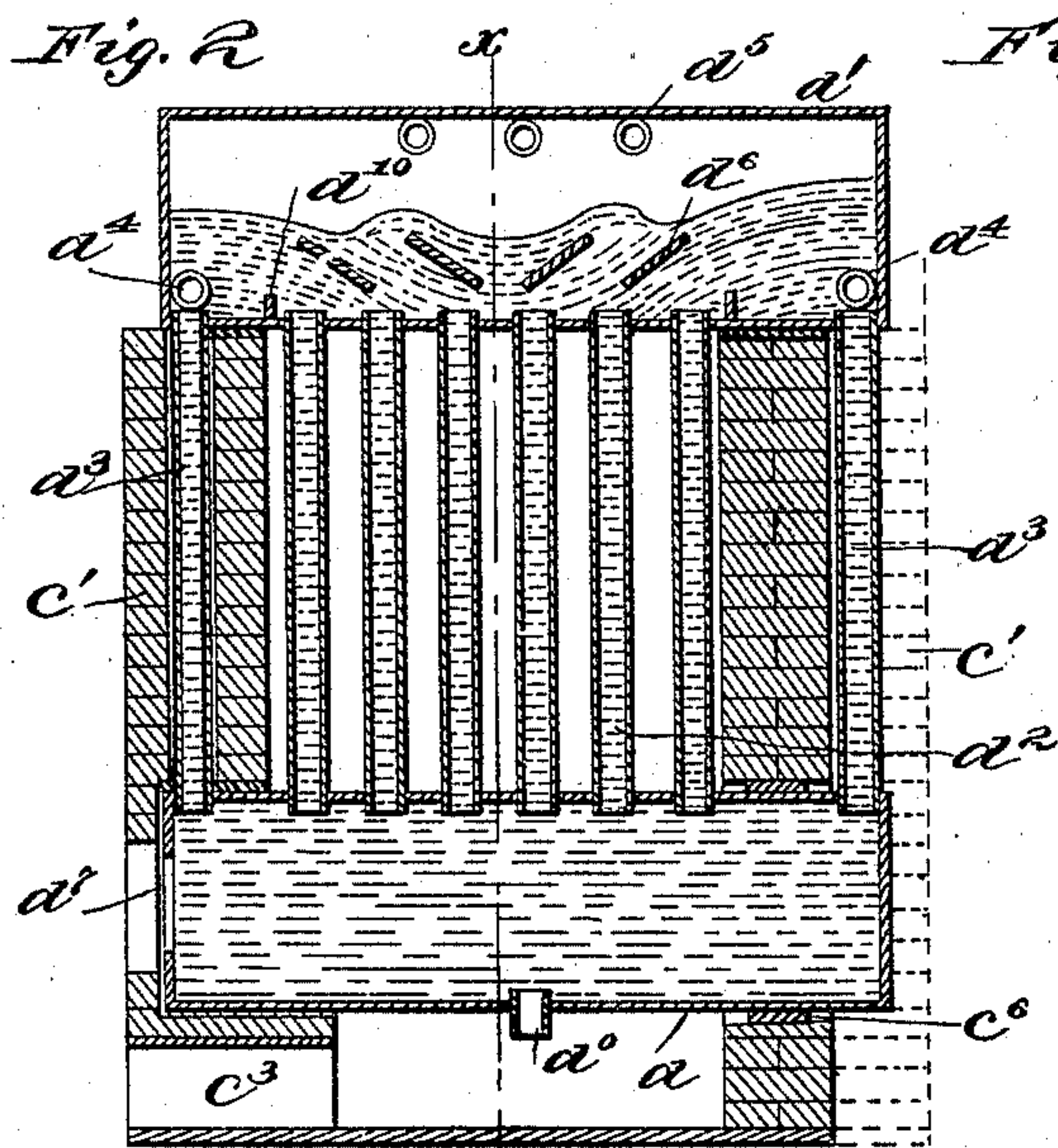
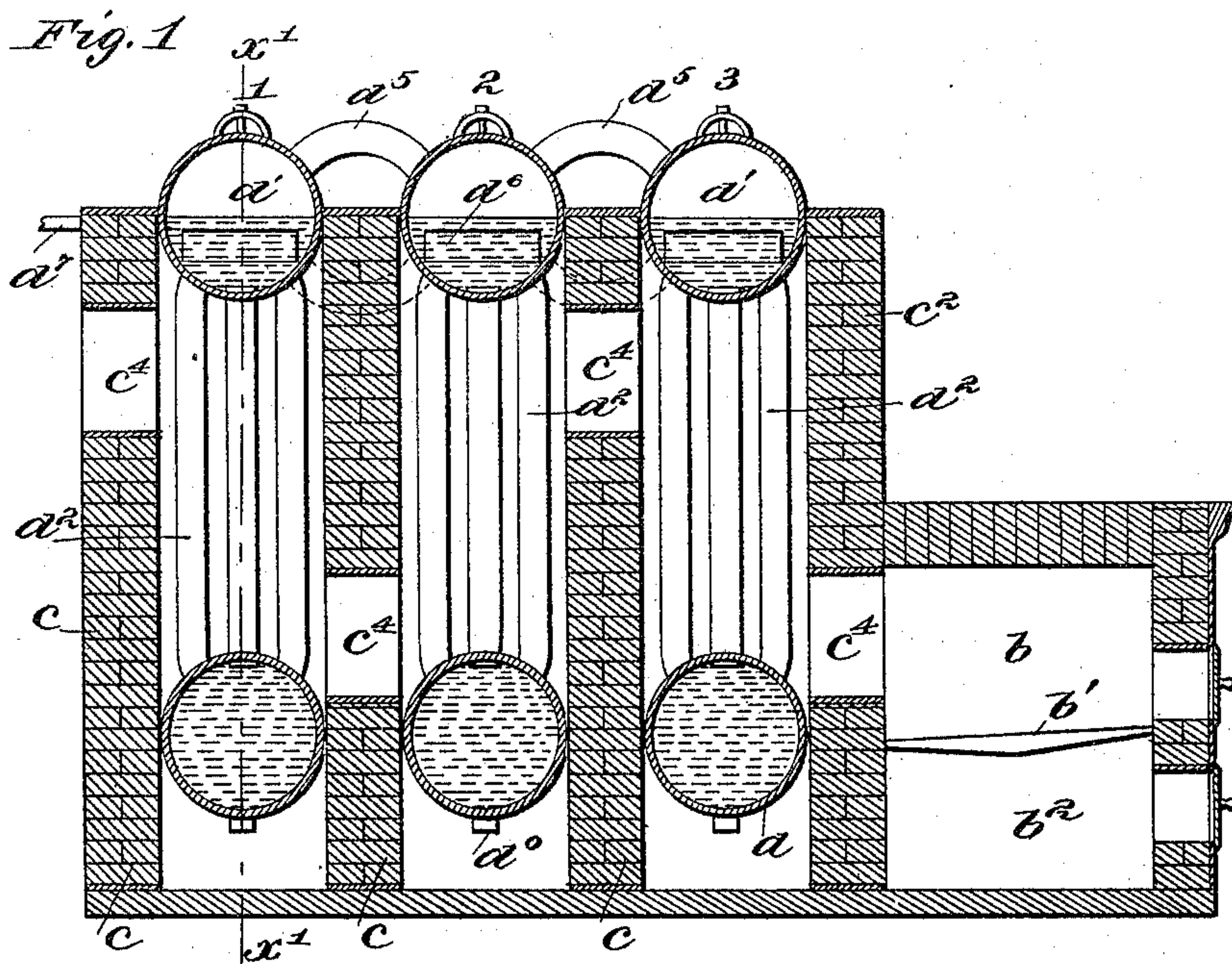
(No Model.)

2 Sheets—Sheet 1.

A. S. KROTZ.
WATER TUBE STEAM BOILER.

No. 585,680.

Patented July 6, 1897.



Witnesses.

Leonard Henthall Dyer
Archie G. Reese

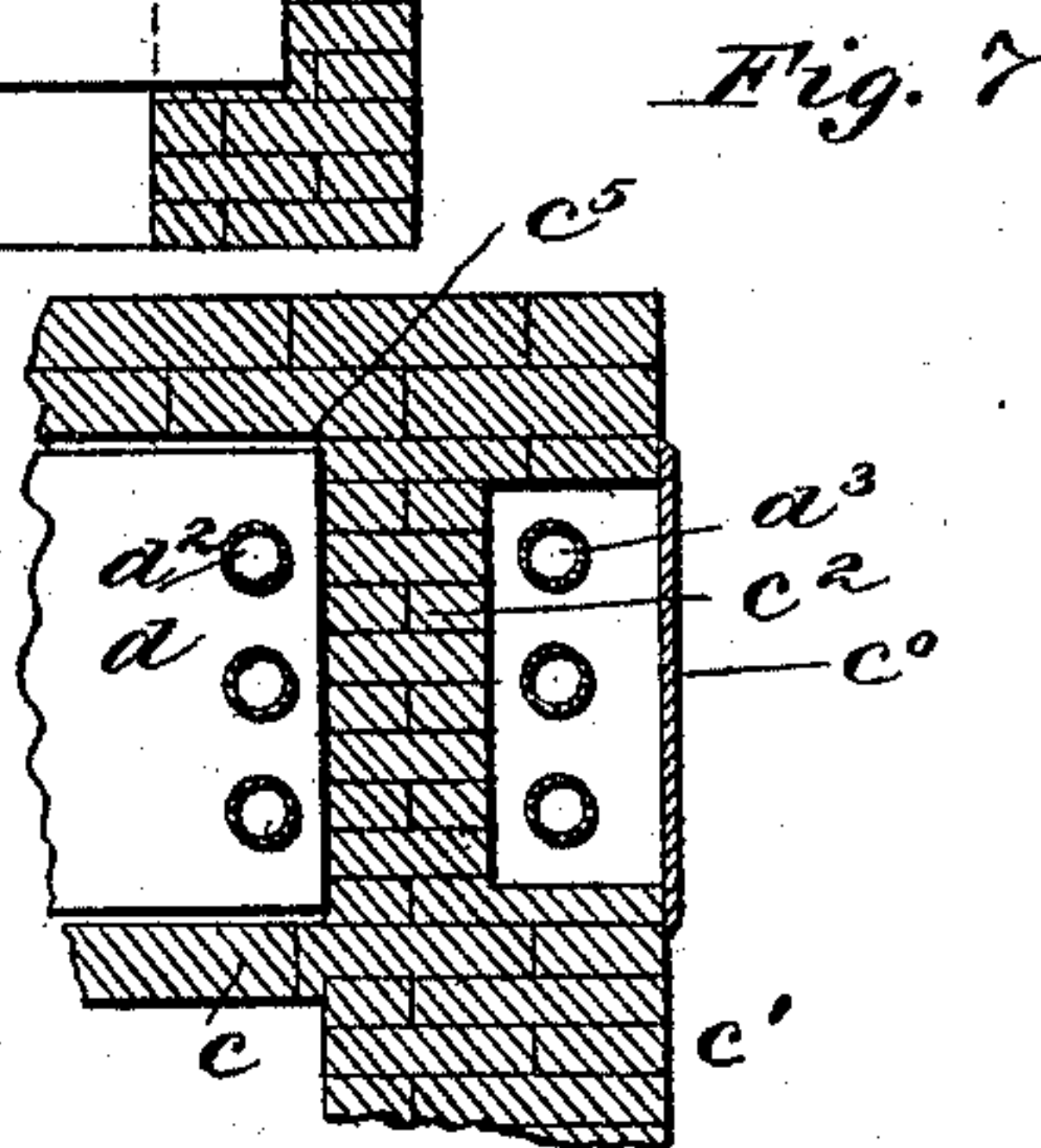
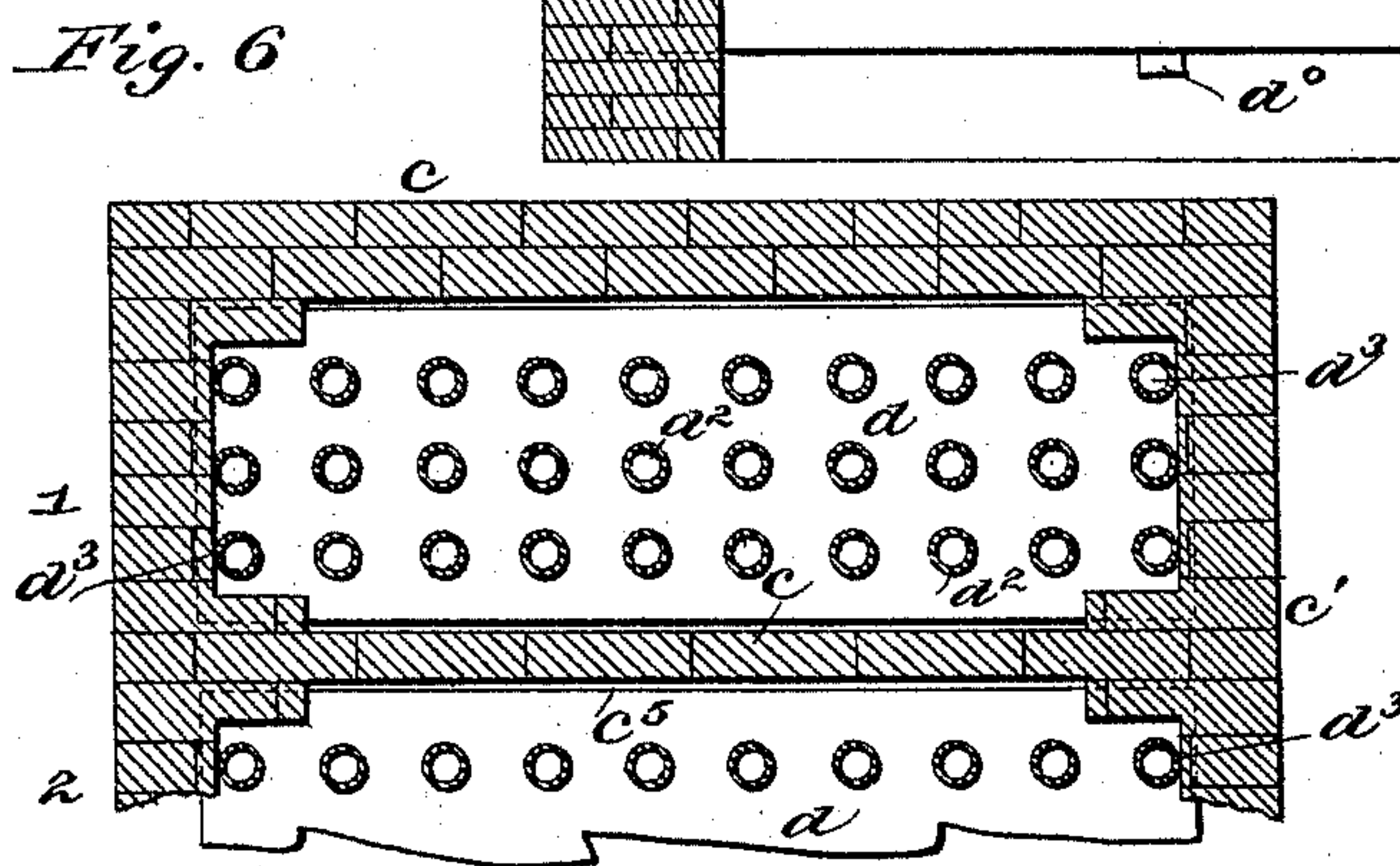
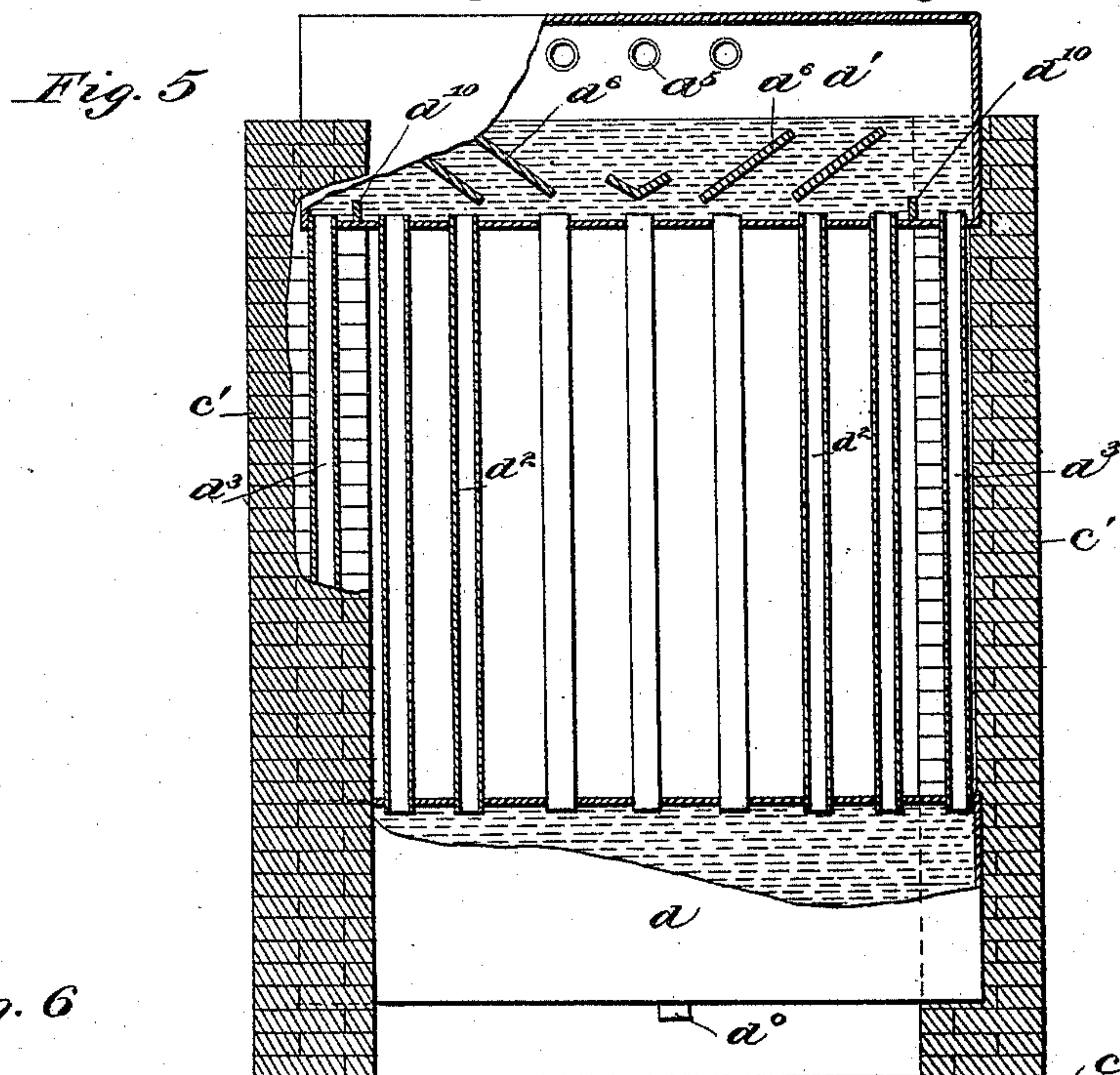
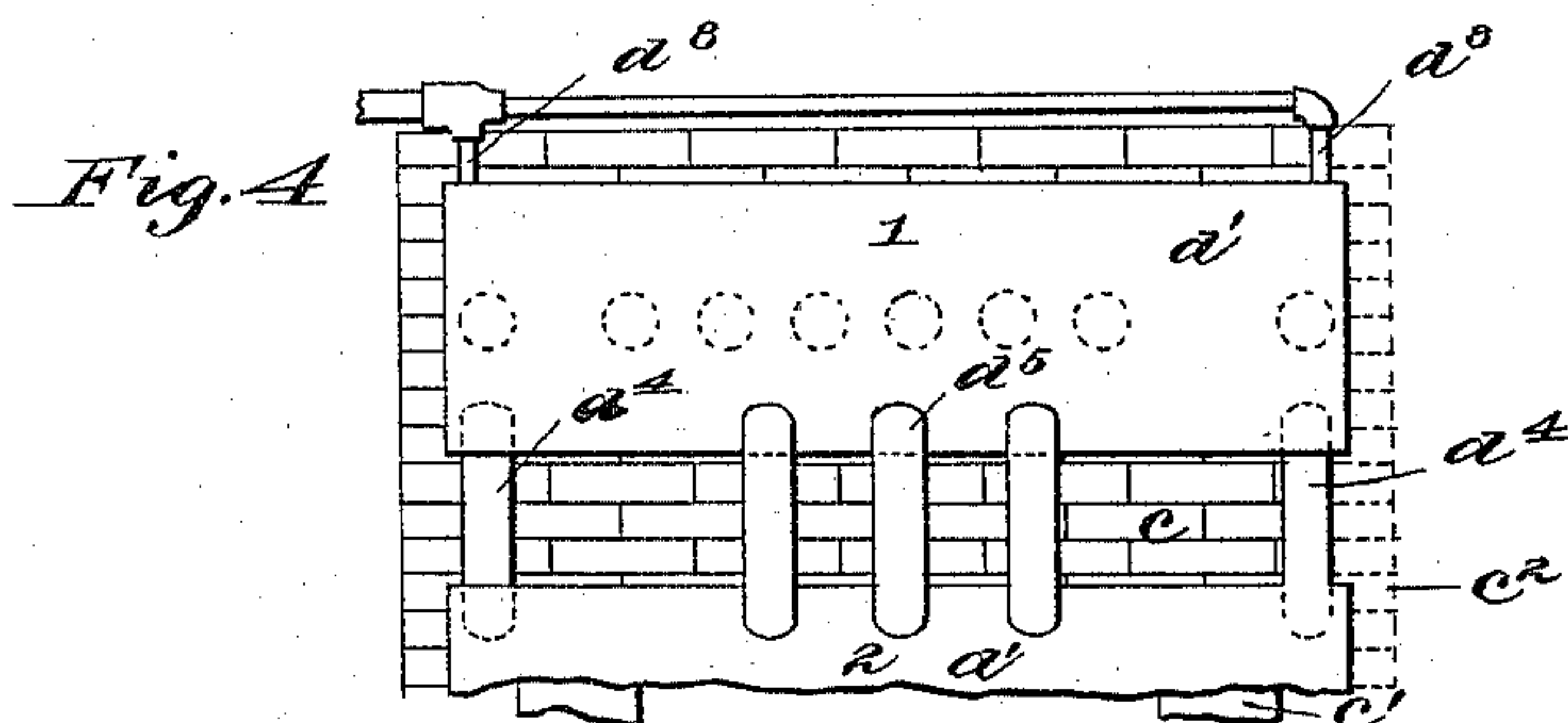
Inventor,
Alvaro S. Krotz

By J. F. Coleman
Attorney.

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UNITED STATES PATENT OFFICE.

ALVARO S. KROTZ, OF SPRINGFIELD, OHIO, ASSIGNOR TO WALTER S. LUCAS, OF CHICAGO, ILLINOIS.

WATER-TUBE STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 585,680, dated July 6, 1897.

Application filed April 6, 1896. Serial No. 586,431. (No model.)

To all whom it may concern:

Be it known that I, ALVARO S. KROTZ, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Water-Tube Steam-Boilers, of which the following is a specification.

My invention relates to certain new and useful improvements in water-tube steam-boilers.

The particular object I have in view is to produce a cheap, economical, safe, and durable boiler. I accomplish these results, first, by arranging the boiler in separate sections (which I term "banks") placed vertically within vertical surrounding walls; second, by providing a circulating medium within each bank, preventing water-spray, so common in water-tube boilers, and also providing means for producing an uneven water-level—namely, highest over the down-current tubes and lowest in that part of the drums where the steam is discharged to or from the drums; third, by partially or wholly protecting the down-current tubes from the heat; fourth, by supplying the feed-water to the farthest bank from the furnace and at or near the upper ends of the circulating-tubes, and feeding the other banks likewise, but from the water of circulation from its succeeding bank, this increasing circulation; fifth, by the use of vertical banks and vertical separating-walls, and out of contact with the tubes and bottom drums, so that the accumulation of soot is below the bottom drums and removable from side doors.

In the accompanying drawings, Figure 1 is a vertical sectional view of my improved boiler, the section being taken on the line x of Fig. 2. Fig. 2 is a transverse sectional view on the line x' in Fig. 1. Fig. 3 is a partial side view with outer wall removed, as shown on the right of Fig. 2. Fig. 4 is a partial top view showing feed-pipe connections, Figs. 5 and 6 showing a modified form of protecting the down-current tubes from the heat, also more clearly showing the action of the deflecting-plates. Fig. 7 is a horizontal sectional view showing a further modification of the manner of protecting the down-tubes.

Like parts are represented by similar letters of reference in the said views.

In the said drawings, b represents a fire-box, b' the grate-bars, and b^2 the ash-pit.

Between each set of drums and their connecting-tubes I construct walls c , extending to the same height and connected to the side walls c' . This forms a series of narrow ways or rooms, into which are located the banks Nos. 1, 2, and 3, respectively. The bottom drums d being of a smaller diameter than the distance between the walls c , an opening c^5 is provided. Drums d and d' and tubes d^2 d^3 form a complete bank. The end tubes d^3 are partially or wholly protected from the heat either by placing walls c' between them and the interior of the structure, in which case a wall c^2 may be provided, or a recess is made within the inner side of walls c' , within which the tubes d^3 are located, as shown in Figs. 5 and 6. When the tubes d^3 are placed outside the walls c' , they may also be placed in a recess in the outer side of wall c' , as shown in Fig. 7, in which case a piece of sheet metal or other material c^0 is used for protecting the tubes from external harm. This construction is preferable to the wall c^2 .

A flexible packing c^6 is placed around the drums d and with the opening in the walls c' , so as to allow a slight movement and yet prevent air-leak. The tubes d^3 are preferably curved, as shown in Fig. 3, allowing of independent contraction and expansion. The banks are supported by the drums d' resting on the side walls.

Deflecting-plates d^6 are placed crosswise within the drums d' and below the water-line and in such a position to deflect the current of rising steam and water toward the ends of the drums, banking the water up over the down-current tubes d^3 , thus preserving a lower water-line near the center and preventing the throwing of water into the steam-pipes. The banks are connected together by water and steam pipes d^4 d^5 . The water-tubes d^4 , likewise the feed-pipes d^8 , are connected on a line (or nearly so) with the down-current tubes d^3 , so that the feed-water upon entering the first bank first flows down the tubes d^3 , aiding the circulation, the partition d^{10} preventing it

from flowing into the tubes d^2 , likewise the feeding of water from bank No. 1 to bank No. 2 and from bank No. 2 to bank No. 3. Each drum is provided with the usual manhole.
 5 The banks are provided with blow-off connections d^0 .

Below the drums d and through the side walls c' c^2 I place doors or openings c^3 for the removal of soot and ashes. The cross-walls
 10 c each have an archway or opening c^4 , but in opposite ends, through which the gases pass.

It is obvious that if the tubes D^2 were extended through and into the drum D' and bent toward the circulating-tubes D^3 the same results would be accomplished.
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Having thus described my invention, I claim—

1. In a water-tube boiler, the combination with a series of banks each consisting of tubes
 20 to which are connected a steam and a mud drum, the drums extending through the side walls, a recess within the outside of the side walls, and located between the ends of said steam and mud drums, of the same bank, said
 25 recess being in line with the generating-tubes, and down-current tubes located within said recess and connecting the drums together of the same bank.

2. In a water-tube boiler, the combination
 30 with a bank of tubes to which are connected a steam and a mud drum, the drums extending through the side walls, a recess within the outside of the side walls and located between the ends of said steam and mud drums, and
 35 down-current tubes located within said recess and connecting the drums together, and a metal or sheet covering over said recess.

3. In a water-tube boiler, the combination with upper and lower drums connected to-
 40 gether by tubes, the banks thus formed being supported crosswise between the side walls, by the upper drums resting on their ends upon the side walls, the end tubes being partially protected from the heat by being located
 45 within a recess within the inside of the walls over which the ends of the drums pass, substantially as shown and described.

4. In a water-tube boiler, the combination with upper and lower drums connected to-
 50 gether by tubes, a part of the tube being located within a recess within the inside of the side or end walls, and deflecting-plates in the upper drum placed at an angle over the generating-tubes and below the water-line, and
 55 a cross partition-wall placed between the generating and circulating tubes the top of said partition-wall being below the water-line.

5. In a water-tube boiler the combination with a series of banks consisting of up-cur-
 60 rent and down-current circulating-tubes, the down-current tubes being partially or wholly protected from the heat, deflecting-plates suspended crosswise in the drum and at an angle and above the generating-tubes and below the
 65 water-line, and a partition-wall placed between the circulating and generating tubes

the top of said partition being below the water-line, substantially as shown and described.

6. In a water-tube boiler, the combination with a series of banks of tubes, each bank con-
 70 nected to a mud-drum below and a steam-drum above, deflecting plates or guides suspended crosswise in the drum and placed at an angle above the up-current tubes, said
 75 plates being turned or leaned toward the down-current tubes, and a division-wall between the outside row or rows of tubes and the generating-tubes, the upper portion of the division-wall being below the water-line,
 80 and feed or equalizing pipes entering the drum within the space occupied by the down-current tubes.

7. In a water-tube boiler, the combination with a series of banks of tubes connecting to-
 85 gether mud and steam drums, the tubes at the end being a distance from the succeeding tubes and between which a wall is located, said drums extending through, or over the
 90 wall, said end tubes being parallel with the wall but on a curve crosswise with the drums, substantially as and for the purpose specified.

8. In a water-tube boiler, the combination with double side walls upon which are sup-
 95 ported a series of banks each consisting of steam-drums a mud drum or drums, and up-current and down-current water-circulating tubes connecting the drums together, the down-current circulating-tubes being located
 100 between the double walls, the said banks placed parallel with each other, but crosswise with the double side walls the ends of the drums passing through the inner side walls.

9. In a water-tube boiler, the combination with a series of banks, each consisting of two
 105 drums and up-current and down-current circulating-tubes connecting the drums together, said banks being surrounded by vertical walls, the ends of the top drums resting on the side walls and supporting the bank,
 110 feed-water connections to the farthest bank from the furnace and equalizer connections between the banks, substantially as and for the purpose specified.

10. In a water-tube boiler, the combination with a series of banks, each consisting of two
 115 drums and their connecting-tubes, means as described for producing circulation, the banks being surrounded by vertical separating or cross walls and end walls, and connected to-
 120 gether by water-feeding pipes between the upper drums and in that part of the drums to which are connected the down-current tubes, the feed-water entering the farthest bank from the furnace and enter the space
 125 occupied or drained by the down-current tubes of said farthest bank, steam-pipe connections above the water-line and between all the top drums, openings through the cross-walls at opposite ends, and a space between
 130 the cross-walls on a line with the bottom drums greater than the diameter of said bottom drums.

11. In a water-tube boiler, the combination
with a plurality of batteries, each consisting
of two drums and their connecting-tubes,
means as described for producing circulation,
5 the banks being supported independently on
the side walls and separated by vertical cross-
walls out of contact with the sides of the bot-
tom drums, and steam and water connection
between the upper drums, the feed-in pipes
10 entering over the space drained by the down-
current tubes.

12. In a bank for water-tube boilers con-
sisting of steam and mud drums connected

together by up-current and down-current cir-
culating-tubes, the down-current tubes be- 15
ing separated from the up-current tubes by a
partition-wall, the top of said wall being be-
low the water-line and feed-in-water connec-
tions into the space occupied by said down-
current tubes. 20

In testimony whereof I have hereunto set
my hand this 3d day of April, A. D. 1896.

ALVARO S. KROTZ.

Witnesses:

OLIVER H. MILLER,
LINN COCHRAN, Jr.