

(No Model.)

2 Sheets—Sheet 1.

G. A. OTIS.
FEED WATER HEATER.

No. 362,395.

Patented May 3, 1887.

Fig. 1.

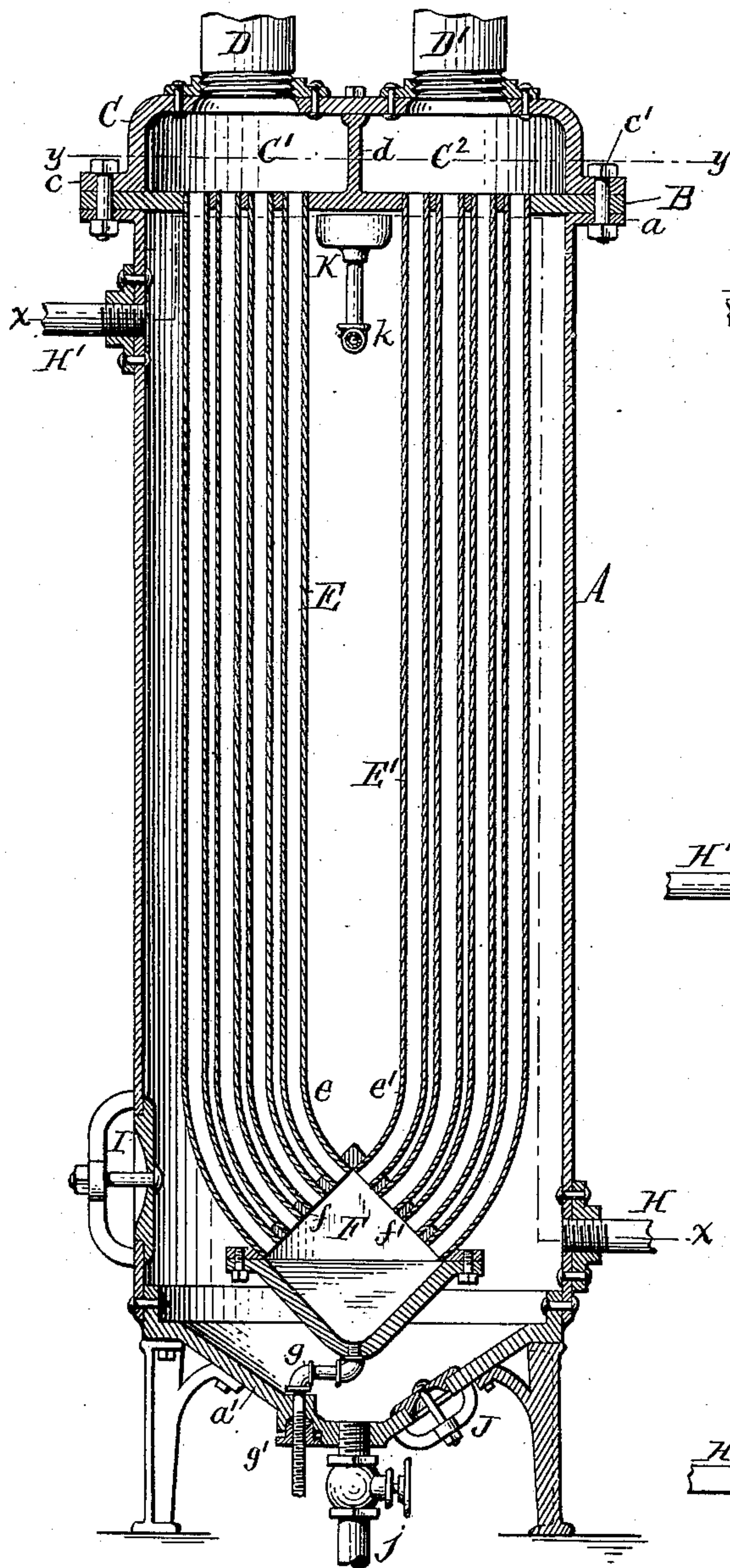


Fig. 6.

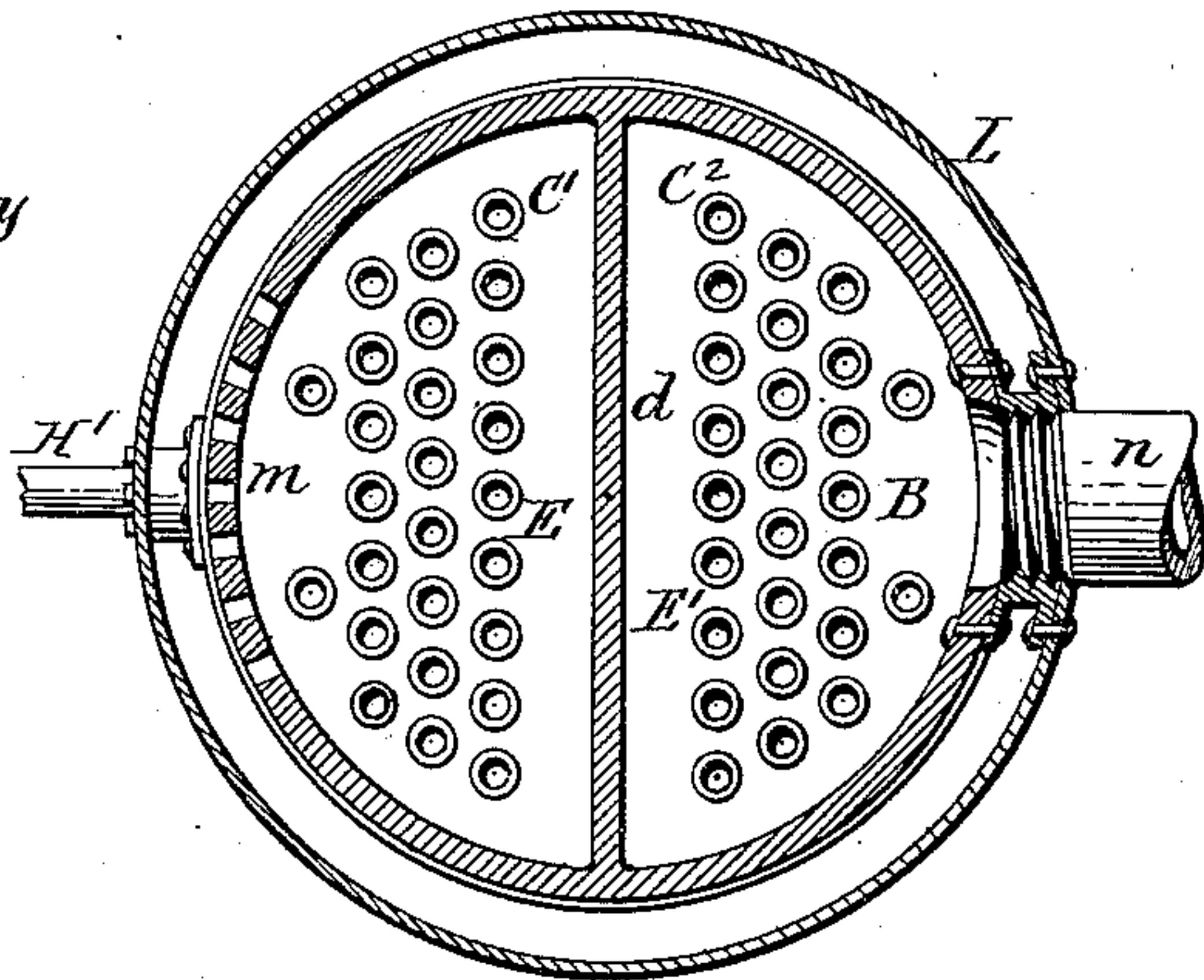


Fig. 2.

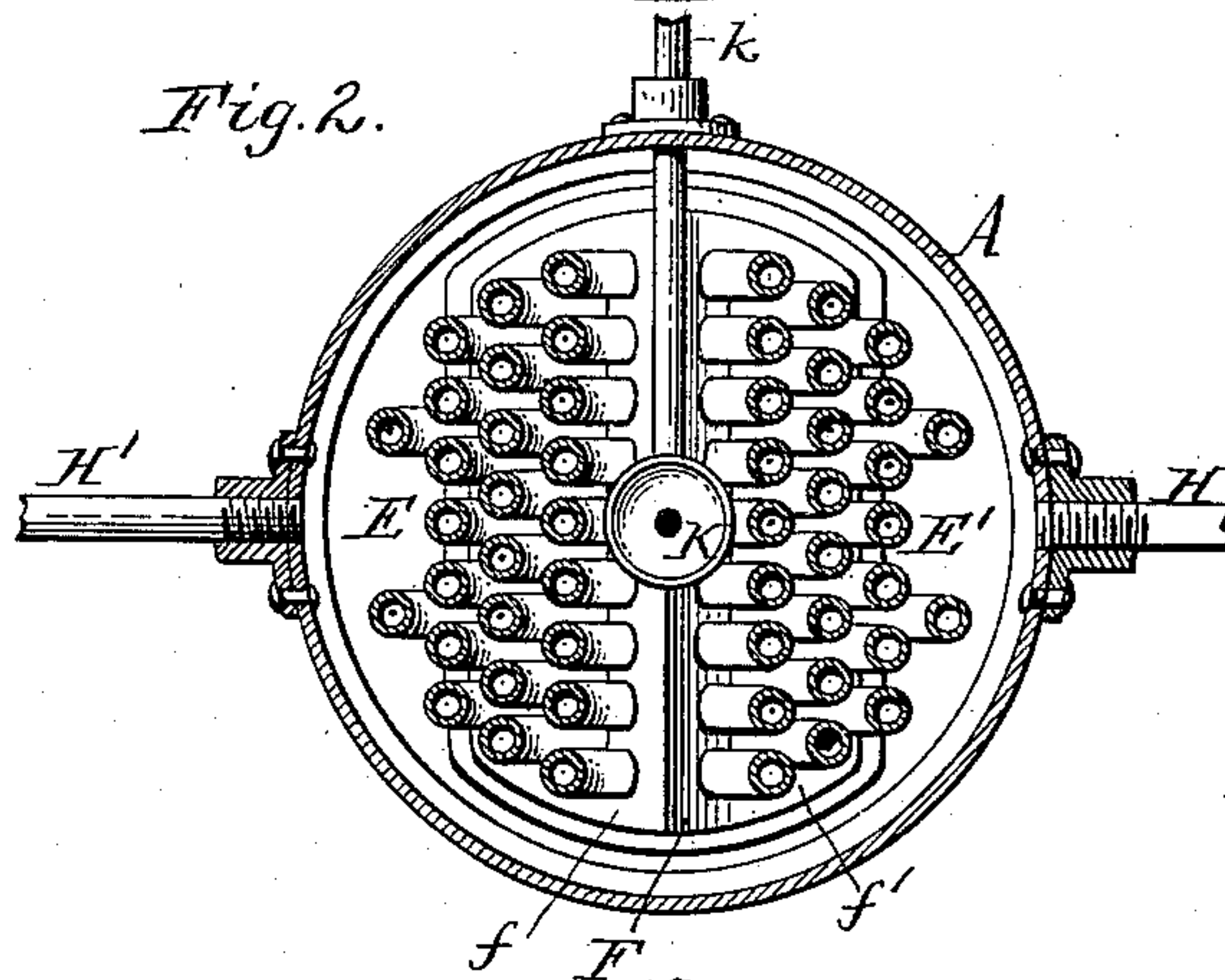
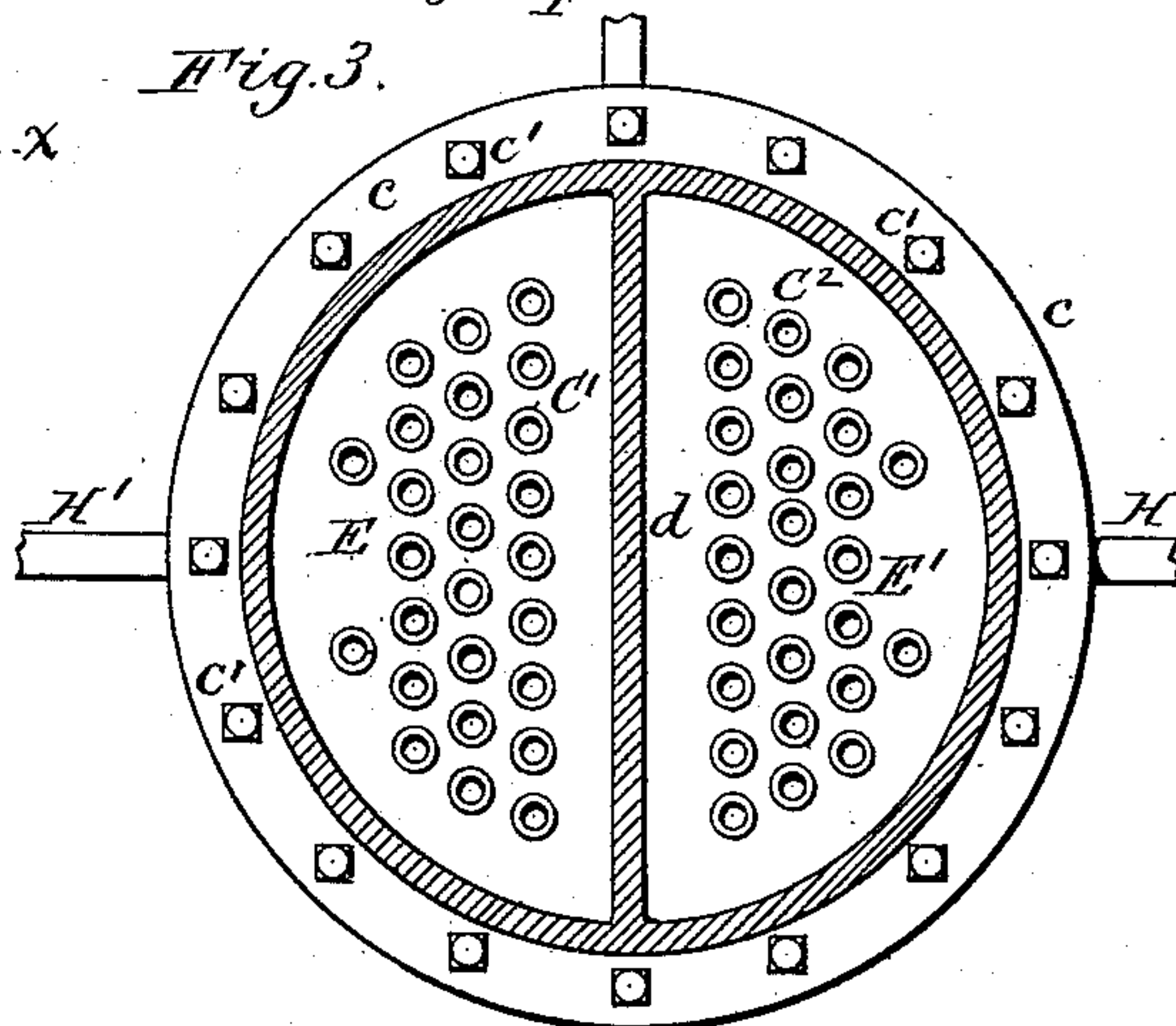


Fig. 3.



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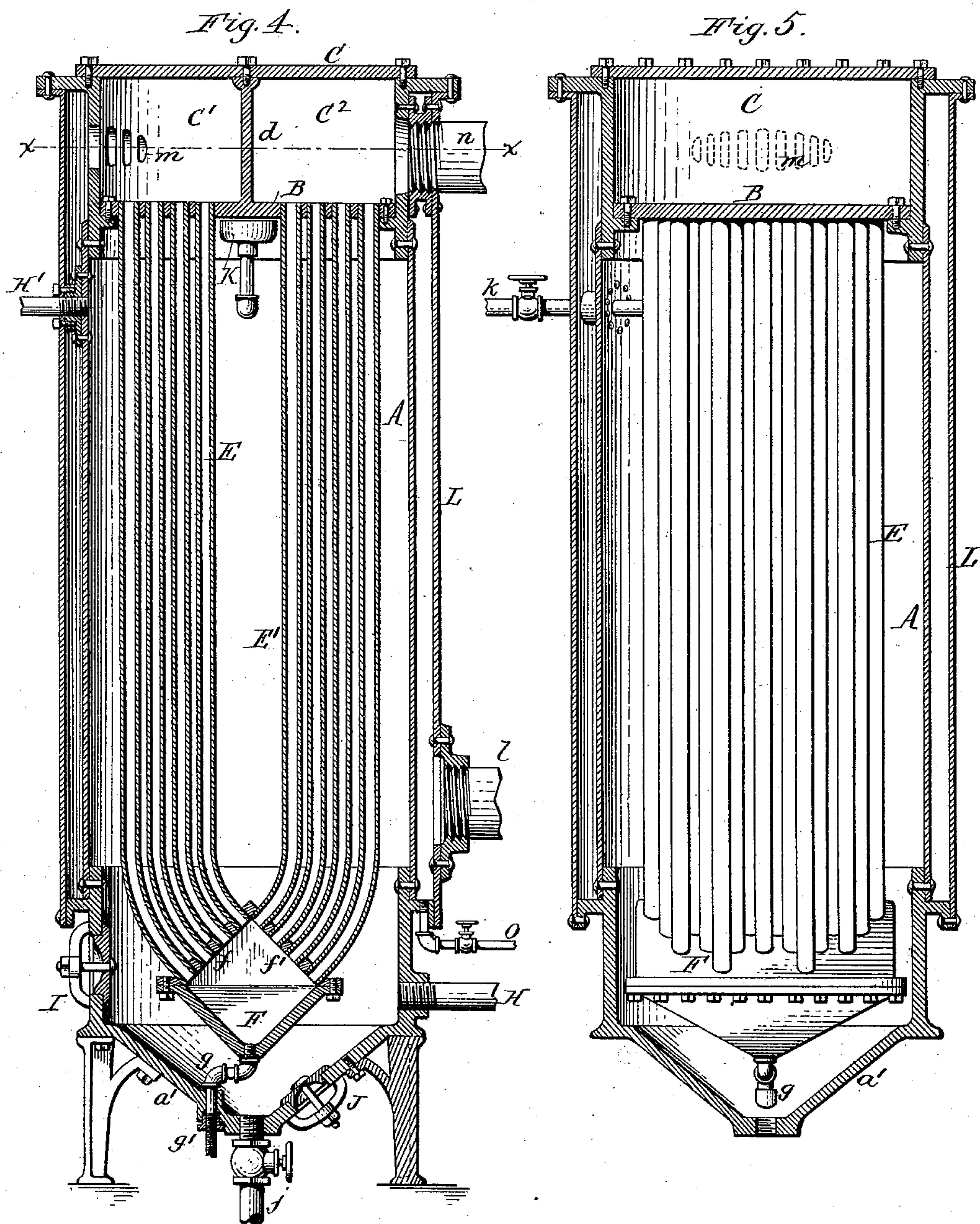
(No Model.)

2 Sheets—Sheet 2.

G. A. OTIS.
FEED WATER HEATER.

No. 362,395.

Patented May 3, 1887.



Witnesses:

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Geo. J. Buchheit Jr.

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UNITED STATES PATENT OFFICE.

GEORGE A. OTIS, OF BUFFALO, NEW YORK.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 362,395, dated May 3, 1887.

Application filed January 29, 1887. Serial No. 225,855. (No model.)

To all whom it may concern:

Be it known that I, GEORGE A. OTIS, of the city of Buffalo, in the county of Erie and State of New York, have invented new and useful
5 Improvements in Feed-Water Heaters, of which the following is a specification.

This invention relates to that class of feed-water heaters in which the steam passes through a series of tubes which are surrounded by the
10 water to be heated.

The object of my invention is to heat the feed-water to a high temperature; to free the feed-water from scum, mud, and sediment; to discharge the condensation from the steam-passages and to render all parts of the heater
15 easily accessible.

My invention consists of the improvements which will be hereinafter fully set forth, and pointed out in the claims.

20 In the accompanying drawings, consisting of two sheets, Figure 1 is a sectional elevation of my improved feed-water heater in its simplest form. Figs. 2 and 3 are horizontal sections in lines *x x* and *y y*, Fig. 1, respectively. Figs. 4 and 5 are vertical sections at
25 right angles to each other of my improved feed-water heater provided with an outer steam-jacket. Fig. 6 is a horizontal section in line *x x*, Fig. 4.

30 Like letters of reference refer to like parts in the several figures.

In Figs. 1, 2, and 3, A represents the upright cylindrical shell of the heater, preferably constructed of boiler-iron, and provided
35 at its upper end with an external flange, *a*, and at its lower end with a conical or tapering bottom, *a'*, which is preferably constructed of cast-iron.

B represents the upper flue sheet or plate
40 arranged horizontally on the top flange, *a*, of the shell A.

C represents the upper steam-chamber surmounting the flue-sheet B, and provided at its lower edge with an external flange, *c*, which
45 rests on the marginal portion of the flue-sheet. The chamber C and flue-sheet B are secured to the top flange, *a*, of the shell by bolts *c'*. The chamber C is divided into an inlet-compartment, C', and an outlet-compartment, C²,
50 by a vertical partition, *d*, formed diametrically on the flue-sheet.

D represents the inlet-pipe, through which the exhaust-steam enters the inlet-compartment C', and D' represents the outlet-pipe, through which the uncondensed residue of the
55 exhaust-steam escapes from the outlet-compartment C².

E E' represent two series or groups of steam-pipes communicating, respectively, at their upper ends with the inlet-compartment C' and
60 the outlet-compartment C², and at their lower ends with a steam-and-water chamber, F, arranged transversely in the lower portion of the shell A. The upper portion of the chamber F is composed of two flue-sheets, *ff'*, which
65 incline outwardly from a central ridge, and in which the lower ends of the tubes E and E' are respectively secured. The lower portions, *e e'*, of the tubes E E' are bent inwardly to meet the flue-sheets *ff'* at right angles. The ends
70 of the tubes are expanded into the respective flue-sheets, and the bends in the tubes permit each tube to expand and contract without materially affecting the other tubes. The bottom or lower portion of the chamber F is inclined
75 toward a discharge pipe, *g*, through which the water of condensation escapes from this chamber. The lower portion of the pipe *g* passes vertically through a stuffing-box, *g'*, formed in the bottom *a'* of the shell.
80

H represents the inlet-pipe through which the cold water enters the shell A, near the bottom thereof, and H' is the outlet-pipe through which the heated water escapes from the shell A, near the top thereof. The water-
85 inlet pipe H is arranged opposite the ascending steam-pipes E' at the coolest point of the shell, and the water-outlet pipe H' near the descending pipes E at the hottest point of the shell.

I represents a man-hole formed in the lower portion of the shell A opposite the chamber F, and J is a hand-hole formed in the bottom
90 *a'* below the chamber F.

j is a blow-off pipe connected with the bottom *a'* at the lowest point thereof.
95

The exhaust-steam enters the inlet-compartment C' through the pipe D, descends through the pipes E to the chamber F, and ascends thence through the pipes E' to the outlet-compartment C², from which the uncondensed residue of the exhaust-steam escapes through the
100

the pipe D'. The water of condensation from the compartments C' C² and pipes E E' collects in the chamber F, from which it is discharged by the pipe g. The chamber F forms an enlargement in the steam-passages, which facilitates the separation of the water of condensation from the steam.

K represents a scum-pan arranged between the two groups of pipes E E' immediately below the flue-sheet B and above the hot-water discharge-pipe H'.

k represents the discharge-pipe extending from the bottom of the scum-pan outwardly through the side of the shell A. The heavy mud and sediment, which enter the shell with the water through the pipe H, are separated from the water, as the latter becomes heated, and descend and accumulate on the bottom a' of the shell, from which they are removed from time to time through the blow-off pipe j. The light scum which rises to the surface of the water in the shell A, above the level of the hot-water escape-pipe H', is removed from time to time through the scum-pan K and pipe

l. The inclined upper surfaces of the chamber F prevent the sediment from settling on the same and direct the sediment downwardly toward the bottom a' of the shell. Any hard or solid sediment which cannot be blown off can be easily removed upon opening the man-hole I in the side of the shell.

Upon removing the bolts c' and detaching the waste pipe g from the bottom a' the upper flue-sheet, B, can be raised with the pipes E E' and the chamber F far enough to afford access to the scum-pan, when, upon detaching the latter from the shell, the tube-sheet B, pipes E E', and chamber F can be together removed from the shell.

In the construction represented in Figs. 4, 5, and 6, the shell is surrounded by a steam-jacket, L, to which the exhaust steam is supplied by a pipe, l, entering the side of the jacket near its bottom. This jacket L communicates with the inlet-compartment C' by openings m, formed in the side of the compartment. The steam escapes from the outlet-compartment C² through a pipe, n, connected with the side of the compartment. The jacket L causes the exhaust steam to envelop the shell and heat the same from the outside, and increases the heating-surface to that extent. The water of condensation is discharged from the jacket L through a pipe, O.

I claim as my invention—

1. The combination, with the shell, of a steam-inlet compartment and a steam-outlet compartment, arranged side by side at the upper end of the shell, two groups of steam-pipes extending downwardly into the shell from said

steam inlet and outlet compartments, a water-chamber arranged in the shell and connecting the lower ends of the two groups of pipes, and a waste-pipe by which the water is discharged from said chamber, substantially as set forth.

2. The combination, with the shell, of a steam-inlet compartment and a steam-outlet compartment arranged side by side at the upper end of the shell, a water-chamber arranged in the lower portion of the shell, and two groups of curved pipes connecting said inlet and outlet compartments with said water-chamber, substantially as set forth.

3. The combination, with the shell, of a steam-inlet compartment and a steam-outlet compartment arranged side by side at the upper end of the shell, a water-chamber, F, arranged in the lower portion of the shell and provided with outwardly-inclined top plates, f f', and two groups of steam-pipes, E E', secured with their upper ends, respectively, to said inlet and outlet compartments and having their lower ends bent inwardly and secured to the inclined top plates of the chamber F, substantially as set forth.

4. The combination, with the shell A, of a horizontal flue-sheet, B, secured detachably to the upper end of the shell, two groups of steam-pipes, E E', secured to said flue-sheet and extending downwardly into the shell, and a water-chamber, F, connecting the lower ends of the pipes E E', whereby the flue-sheet pipes and water-chamber can be together removed from the shell, substantially as set forth.

5. The combination, with the shell A, provided with a conical bottom, a', blow-off pipe j, water-inlet pipe H, and water-outlet pipe H', of the removable flue-sheet B, provided with a partition, d, a chamber, C, surmounting the flue-sheet and provided with steam inlet and outlet pipes D D', depending steam-pipes E E', secured with their upper ends to the flue-sheet B, and a water-chamber, F, connecting the lower ends of the pipes E E' and provided with a water-pipe, g, substantially as set forth.

6. The combination, with the shell provided with water inlet and outlet pipes, of steam inlet and outlet compartments arranged at the upper end of the shell, two groups of steam-pipes extending from said inlet and outlet compartments into the shell, and a scum-pan arranged in the shell between the two groups of steam-pipes, substantially as set forth.

Witness my hand this 27th day of January, 1887.

GEORGE A. OTIS.

Witnesses:

JNO. J. BONNER,
CARL F. GEYER.