

J. BAIRD.  
STEAM BOILER.

No. 458,818.

Patented Sept. 1, 1891.

Fig. 2.

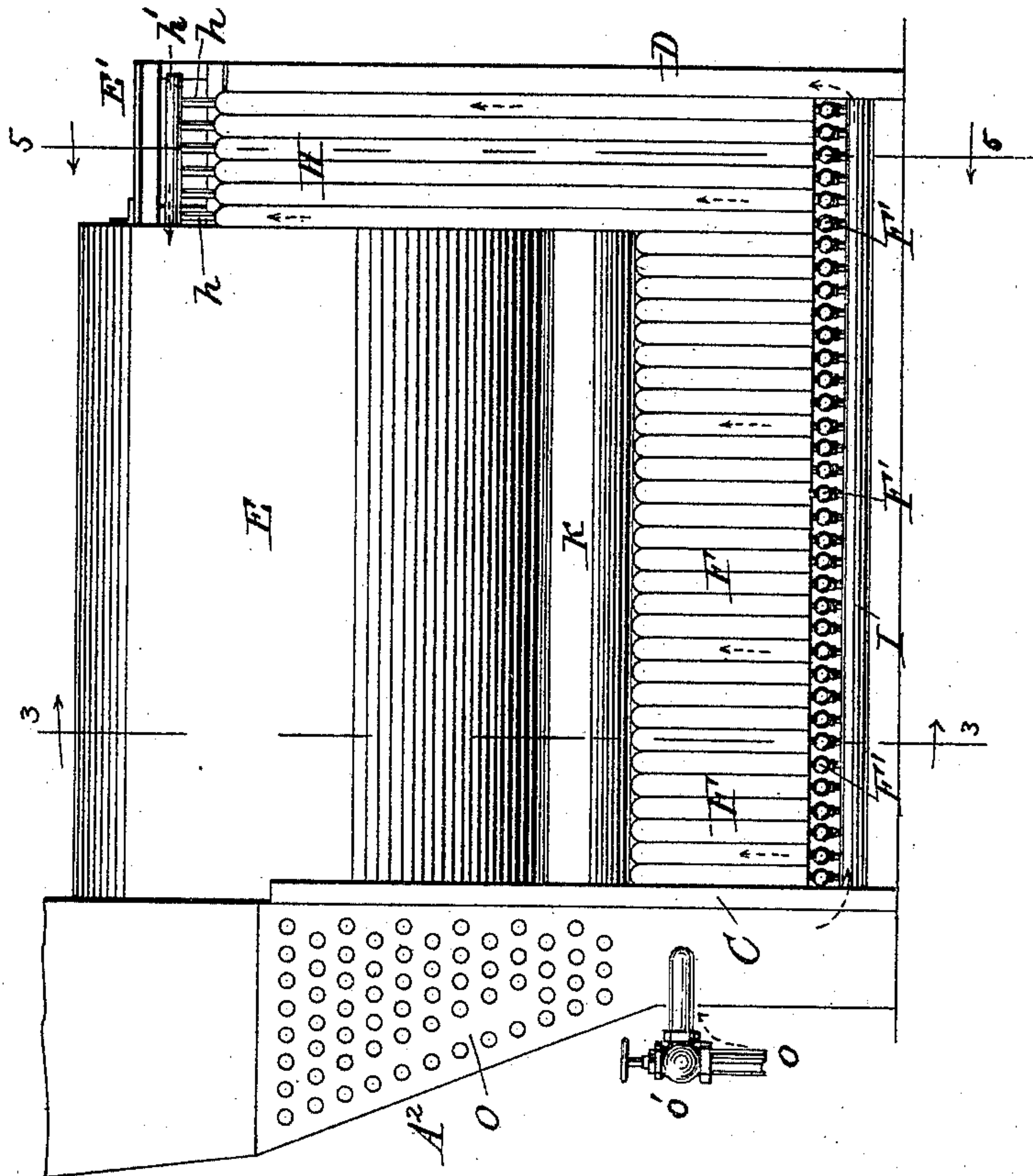
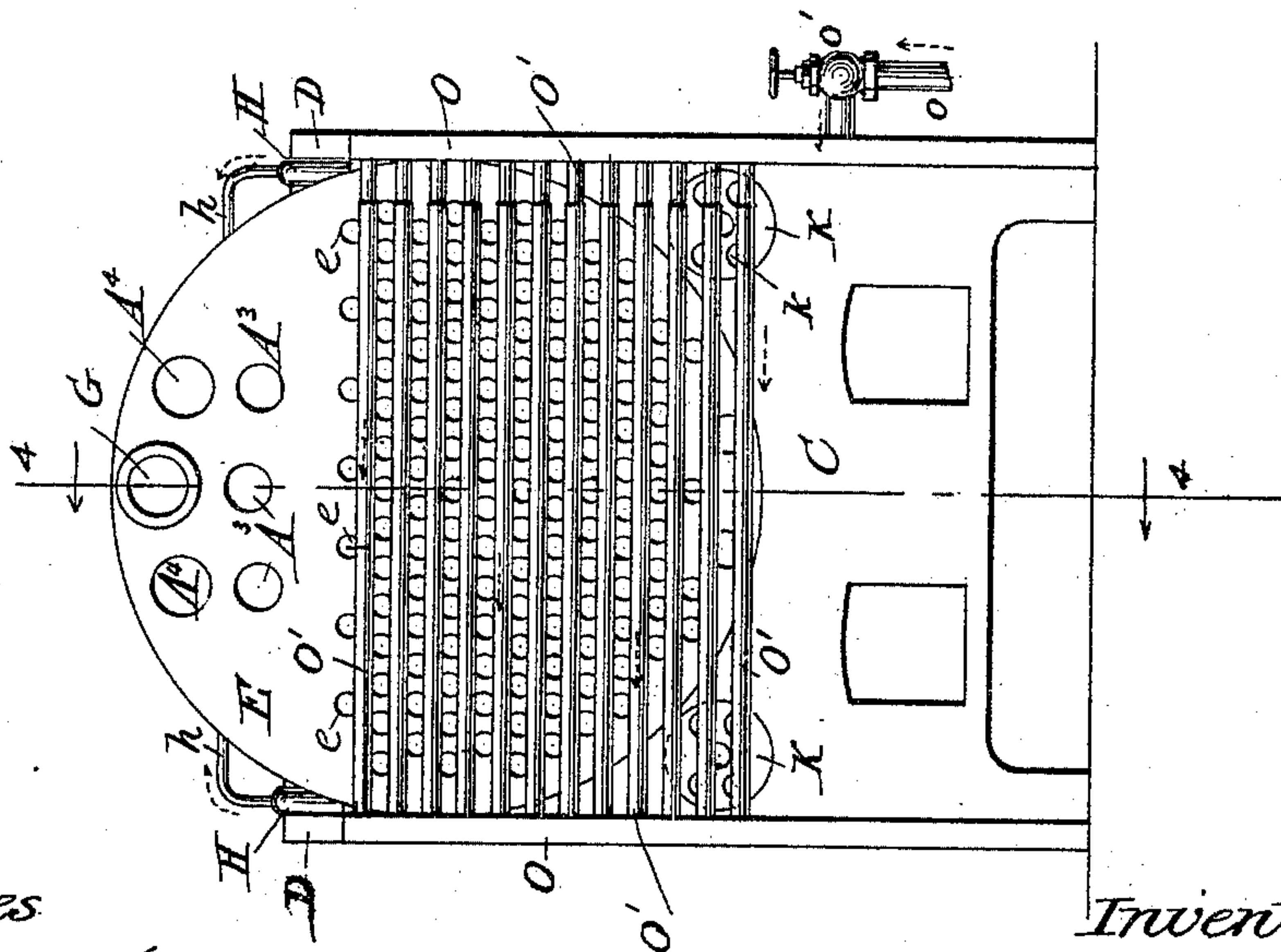


Fig. 1.



Witnesses

*Sidney P. Mellingworth*  
*Baltus D. Long*

Inventor

JOHN BAIRD  
by his attorneys

Baldwin Davidson & Wright

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Fig. 4.  
ON LINE 4-4

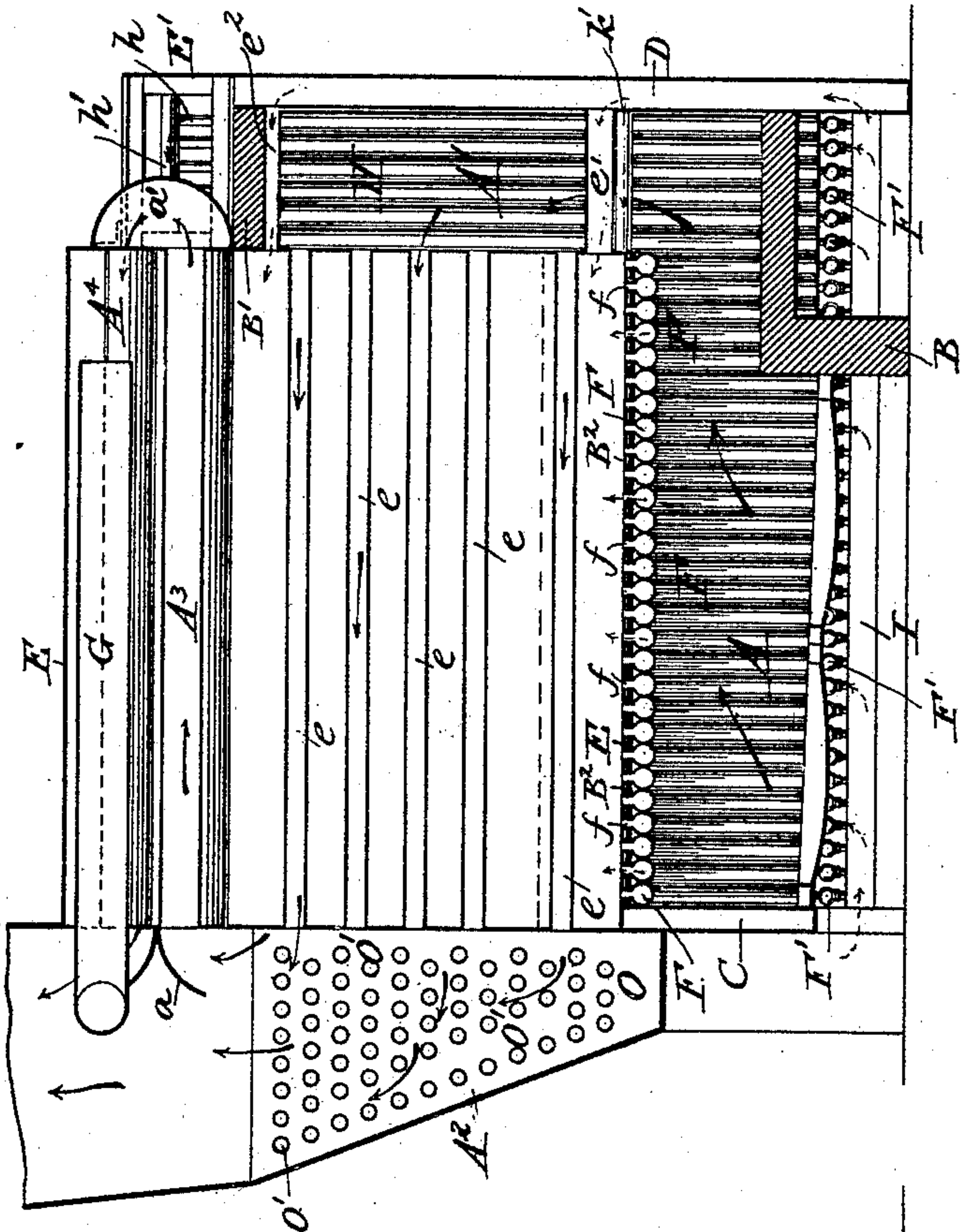
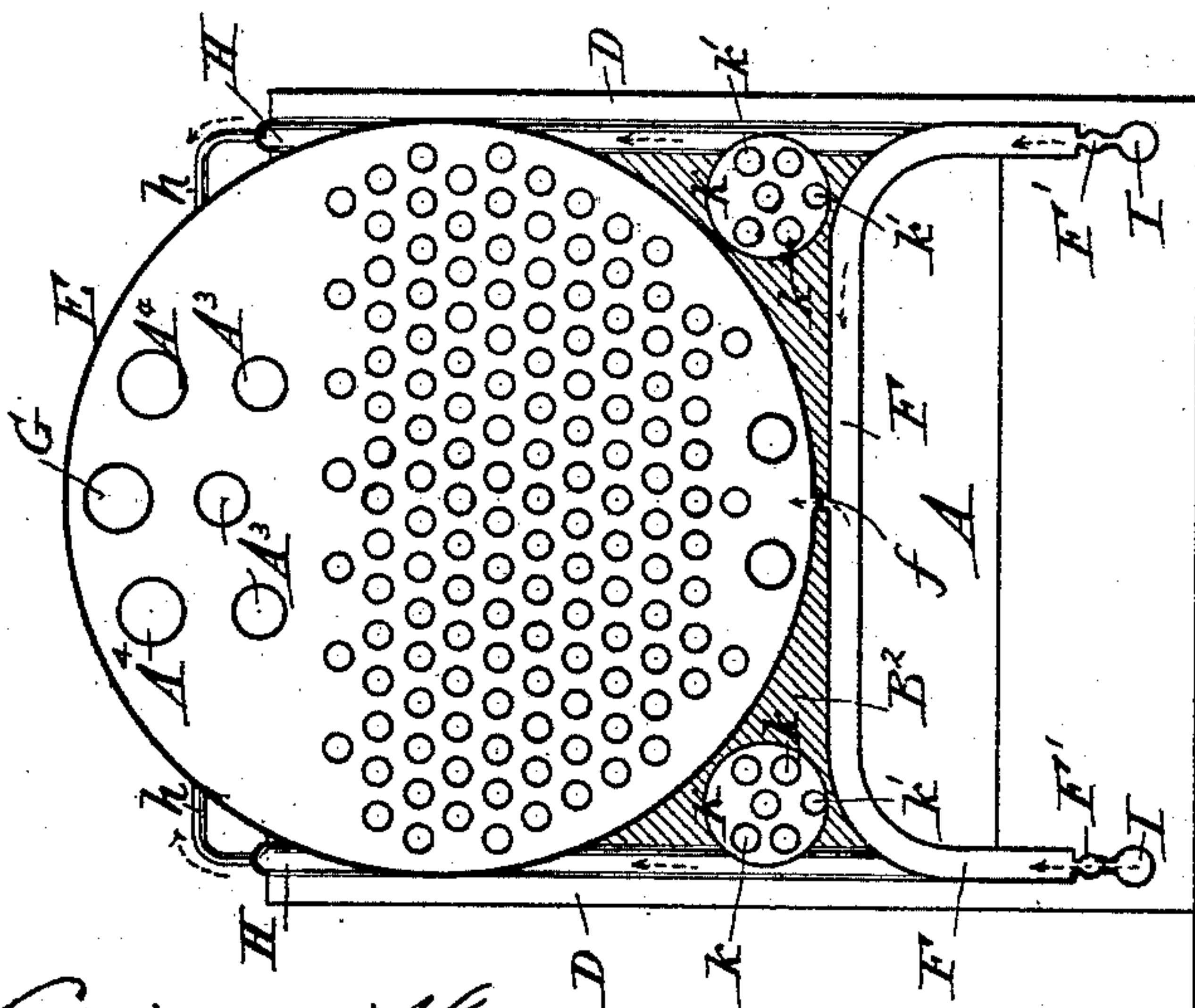


Fig. 3.  
ON LINE 3-3



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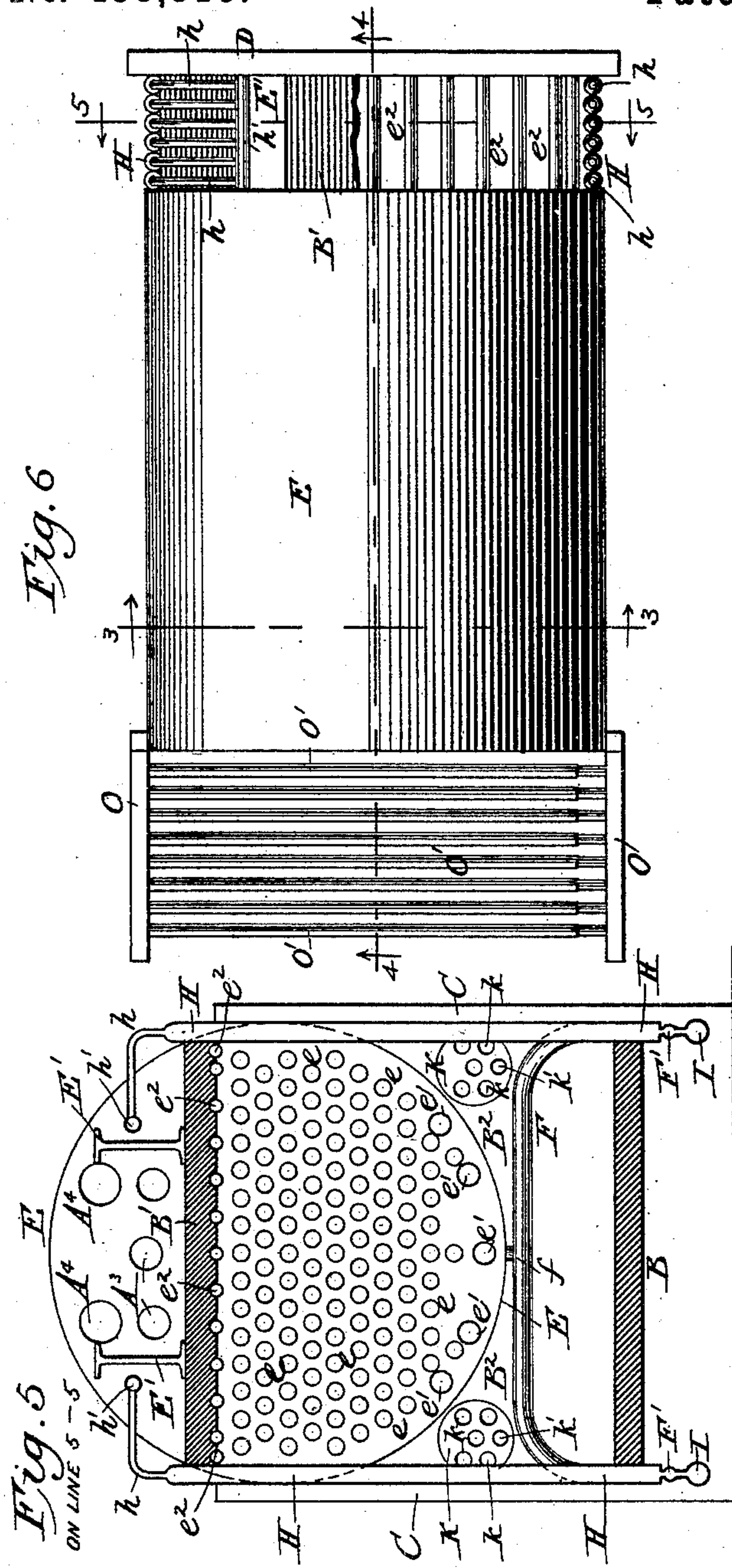


Fig. 6

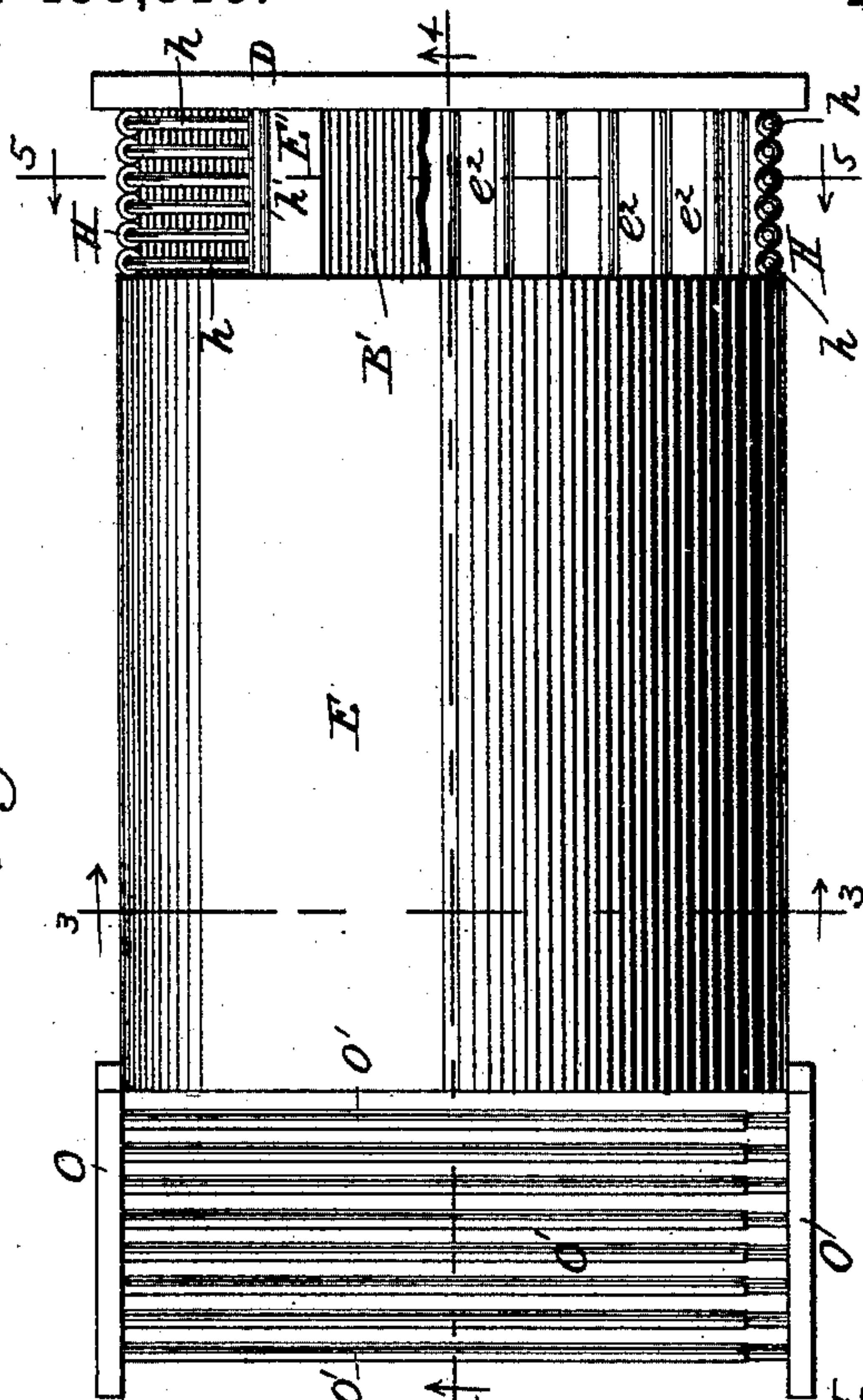


Fig. 8

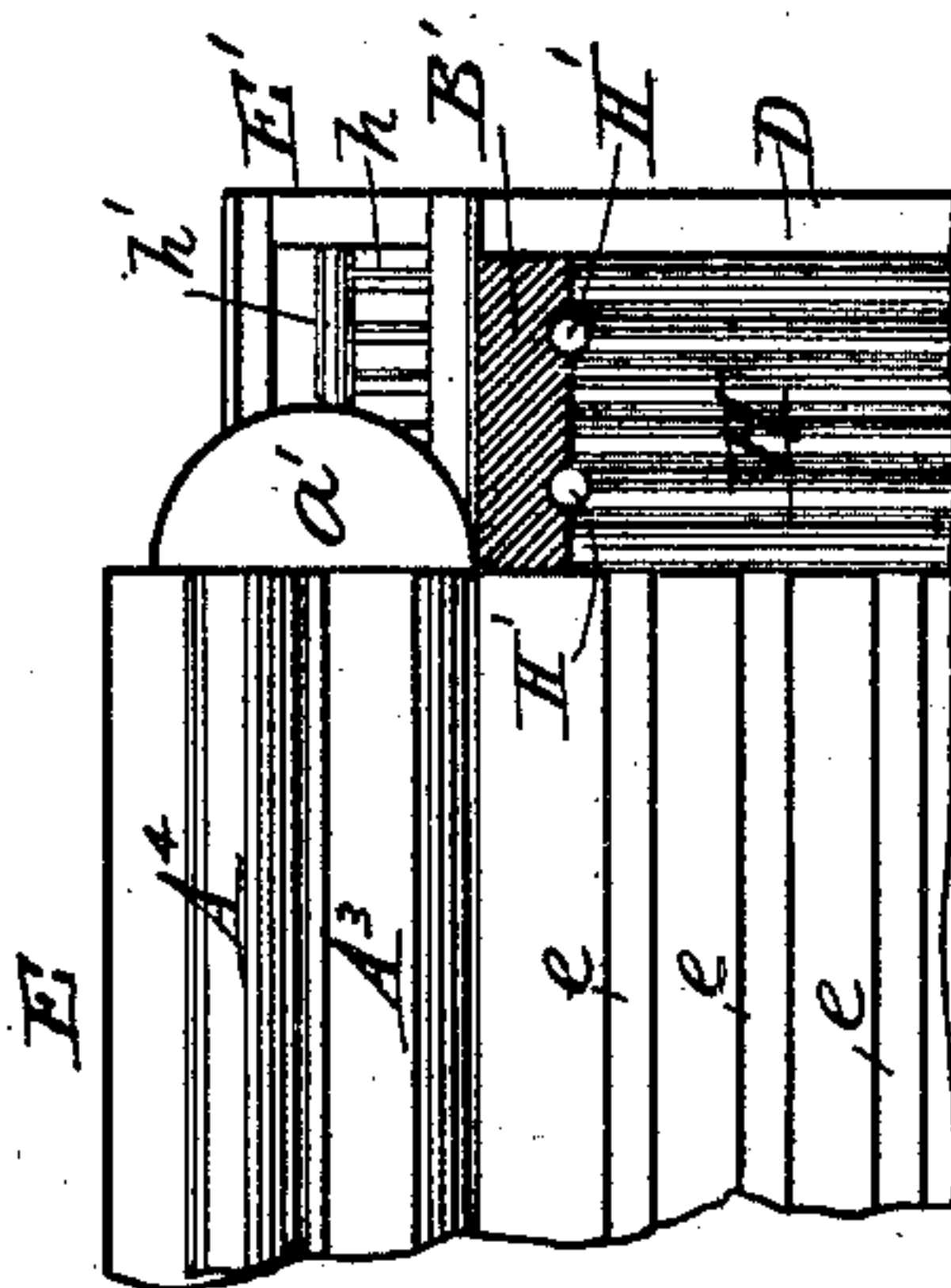
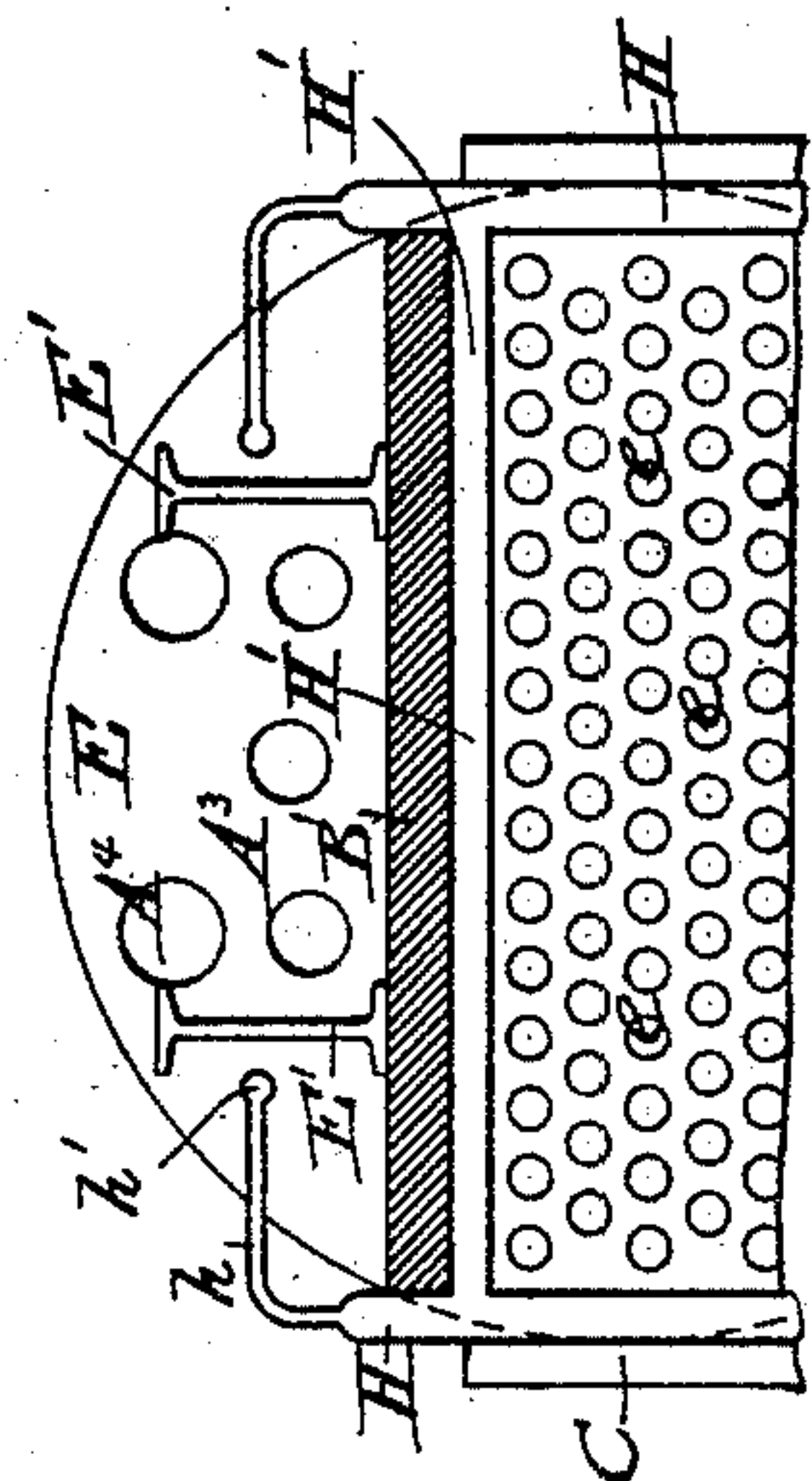


Fig. 7



Witnesses  
*Sidney P. Hollingsworth*  
*Baltus De Long.*

Inventor  
JOHN BAIRD  
by his attorneys  
*Baldwin, Davidson & Wright*



# UNITED STATES PATENT OFFICE.

JOHN BAIRD, OF NEW YORK, N. Y.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 458,818, dated September 1, 1891.

Application filed April 25, 1891. Serial No. 390,440. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN BAIRD, mechanical engineer, a citizen of the United States, residing at No. 324 Lexington avenue, New York city, county, and State, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

My invention more especially relates to marine and stationary steam-boilers of the class having their flues horizontal, or substantially so, and inclosed in suitable shells partially inclosed or surrounded by both substantially horizontal and upright water-tubes, as exemplified, for instance, in United States Letters Patent No. 415,135, granted to me November 12, 1889.

The objects of my invention are to secure a compact, simple, safe, and efficient steam-boiler of high steam-generating capacity, which ends I attain by certain novel organizations of instrumentalities hereinafter specified.

The accompanying drawings show my improvements embodied in apparatus consisting of a single large central shell and two small shells somewhat on the plan shown in my patent above mentioned. So much only of the apparatus is, however, shown as is required to illustrate the subject-matter claimed. Unless otherwise indicated, the parts are of usual approved construction.

The fire-door end of the boiler I term the "front," the opposite end the "rear." That side on the right hand of a person facing the fire-doors I term the "right," the opposite side the "left." Short unfeathered darts indicate the direction of view of the corresponding sections, solid feathered arrows the course of the hot gases, and dotted ones that of the water.

Figure 1 is a front elevation with the front hood-casing removed; Fig. 2, an elevation of the right-hand side of the boiler without jacketing; Fig. 3, a vertical cross-section on the line 3 3 of Figs. 2 and 6, looking backward; Fig. 4, a vertical central longitudinal section on the line 4 4 of Figs. 1 and 6, looking to the left; Fig. 5, a vertical cross-section through the back connection on the line 5 5 of Figs. 2 and 6, looking forward; Fig. 6, a plan view with portions broken away or omitted to show

the parts beneath. Fig. 7 is a cross-section through the upper portion of the back connection, similar to Fig. 5, showing modification of the method of supporting the fire-brick roof of the back connection; and Fig. 8, a vertical section, similar to Fig. 4, illustrating the same modification.

The products of combustion pass from the fire-box A through and around the various fire-tubes, flues, and water-tubes, by way of the back connection A', front hood or uptake A<sup>2</sup>, direct flues A<sup>3</sup>, and return-flues A<sup>4</sup> in the upper part of the boiler-shell, and thence up the chimney. The front head C and back head D are made of parallel plates, with a water-space between them, and are provided with the usual fire-doors and man-holes. A large cylindrical shell E, with flat ends, rests on the correspondingly-shaped front head and extends directly over the fire-box to the front end of the back connection, which is formed by a space left between the shell and back head.

B represents the brick-work of the back connection.

The rear end of the shell is mainly supported by semi-girders E', fastened to it and resting on the top of the back head. The lower two-thirds of the shell is filled with fire-tubes e, each alternate one of the upper row being omitted. The lower part of the shell communicates with the back head by a series of pipes e', five or six in number, crossing the back connection. A corresponding series of pipes e<sup>2</sup> connects the back head with the upper part of the boiler just below the water-line. The space between these pipes e<sup>2</sup> and the semi-girders E' is filled with fire-brick B', extending entirely across the back connection, thus forming a roof which tends to retain the heat therein. The upper part of the shell is traversed by direct flues A<sup>3</sup> and return-flues A<sup>4</sup>, which serve to conduct the heat back and forth through the boiler on each side of the longitudinal steam-pipe G, which is carried through the front hood (see Fig. 4) on its way to the engine, thus drying and heating the steam. This figure also shows a deflector a, projecting into the uptake above the fire-tubes, so as to deflect a portion of the heat through the flues A<sup>3</sup> A<sup>4</sup> and their connecting back hood a' to the



chimney, as above described. The normal water-line of the boiler is just above the level of the fire-tubes *e*.

The sides and top of that portion of the fire-box underlying the shell consist of a series of transverse arched water-tubes *F*, placed close together side by side, their lower ends being united to longitudinal horizontal side tubes *I*, which connect the front and back heads. These arched tubes and side tubes are connected by expansion-joints or jam-nuts *F'*, such as shown in my patent, No. 415,135, above mentioned. Arched tubes inclosing a fire-box are shown in United States Letters Patent respectively granted to me as No. 402,127, April 30, 1889, and No. 434,973, August 26, 1890. The arched tubes *F* are connected with the shell *E* by a series of short vertical tubes *f*, as in the patents above mentioned. The sides of the back connection are likewise composed of a series of parallel, upright, or slightly-inclined tubes *H*, arranged close together and extending up above the water-line of the boiler. These casing-tubes are connected at bottom with the side tubes *I* in a manner similar to the arched tubes *F*, above mentioned, and their upper ends are connected by small pipes *h* with pipes *h'*, leading into the steam-space of the boiler on each side. The casing-tubes rest upon the side tubes, and their connecting-pipes *h h'* enable them to expand and contract freely without danger of leakage.

Small shells *K* are arranged lengthwise of the fire-box beneath and on each side of the main shell. They are of the same length as the main shell *E* and are fitted with flues *k* to make a broader and more equable draft from the furnace and back connection to the front hood. A central water-pipe *k'* in these shells connects the front and back heads. The space between the arched tubes *F* and the main shell is filled with fire-brick or fire-clay *B<sup>2</sup>*, which also incloses the side shells *K*, thus protecting all the boiler-shells from the direct action of the flame.

In Figs. 7 and 8 the casing-tubes *H* are shown as connected by cross-tubes *H'*, which support the brick-work interposed between them and the semi-girders *E'*, instead of the longitudinal tubes *e<sup>2</sup>*, hereinbefore described.

Water-boxes *O* are shown as arranged on each side of the front of the fire-box, constituting, in fact, part of the casing of the front hood. These water-boxes are connected by a series of parallel horizontal water-circulating tubes *O'*, extending across the uptake in front of the fire-tubes *e*. Feed-water is supplied to these boxes by a pipe *o*, provided with a check-valve *o'*, the water-boxes being connected with the front and back heads by means of the longitudinal water-supply pipes *I*. This feed-water-heating apparatus constitutes part of the subject-matter of another application for United States Letters Patent, filed by me March 25, 1891, Serial No. 386,335, and is consequently not claimed herein.

The entire boiler, including its casing-tubes, is of course to be jacketed or protected whenever desirable to prevent loss of heat by radiation, and is also to be provided with the most improved appurtenances, such as safety-valves, water-valves, cocks, &c., for filling, emptying, or regulating the flow of air, steam, or water through the boiler.

The main shell, it will be observed, is in the form of a comparatively short flat-ended cylinder, of large diameter compared with its length, while the whole structure, including its casing, is substantially rectangular in cross-section, thus leaving little waste room. The larger portion of the main shell also lies within the fire-box, but being protected from the direct action of the flame, not only by the arched tubes, but also by the interposed fire-clay or brick-work, possesses all the advantages of a non-externally-fired boiler.

I claim herein as new and as of my own invention—

1. The combination, substantially as hereinbefore set forth, of a front head, a back head, a boiler-shell, longitudinal side tubes connecting the front and back heads, and a series of transverse arched water-tubes connecting the side tubes and main shell and constituting the top and sides of the fire-box.

2. The combination, substantially as hereinbefore set forth, of a front head, a back head, longitudinal side tubes connected to the front and back heads, transverse arched water-tubes connecting these side tubes and constituting the top and sides of the fire-box, a boiler-shell, fire-tubes traversing its water-space, direct and return flues traversing its steam-space, a back connection, and an uptake connected with the direct and return flues.

3. The combination, substantially as hereinbefore set forth, of a front head, a back head, longitudinal side tubes connecting them, transverse arched water-tubes connecting these side tubes and constituting the top and sides of a fire-box, a boiler-shell connected with these tubes, its fire-tubes, its back connection, and upright casing-tubes inclosing this back connection and connected at their lower ends with the longitudinal side tubes and at their upper ends with the steam-space of the boiler.

4. The combination, substantially as hereinbefore set forth, of a front head, a back head, longitudinal side tubes connecting them, transverse arched water-tubes connecting these side tubes and constituting the top and sides of a fire-box, a boiler-shell connected with these tubes, its back connection, and two series of longitudinal water-tubes crossing the upper and lower parts of the back connection and connecting the shell and back head.

5. The combination, substantially as hereinbefore set forth, of a boiler-shell, a series of transverse arched tubes connected with its water-space and forming the top and sides of the fire-box, side shells interposed be-



tween these tubes and the main shell, and fire-clay intermediate of said tubes and main shell and inclosing the side shells.

5 6. The combination, substantially as here-  
inbefore set forth, of a front head, a back  
head, longitudinal side tubes connecting them,  
transverse arched water-tubes connecting  
these side tubes and constituting the top and  
sides of the fire-box, a boiler-shell connected  
10 with these tubes, its back connection, upright  
casing-tubes inclosing it, and side shells in-  
terposed between the arched tubes and main  
shell and connected with the front and back  
heads.

15 7. The combination, substantially as here-  
inbefore set forth, of a front head, a back  
head, longitudinal side tubes connecting them,  
transverse arched tubes connecting these side  
tubes and constituting the top and sides of the  
20 fire-box, a boiler-shell connected with these  
tubes, its back connection, upright casing-  
tubes inclosing it connected at their lower

ends with the longitudinal side tubes and at  
their upper ends with the steam-space of the  
main shell, a front hood, water-boxes con- 25  
nected with the longitudinal side pipes, and  
feed-water-circulating tubes connecting these  
boxes across the uptake.

8. The combination, substantially as here-  
inbefore set forth, of a main shell, its fire- 30  
tubes below the water-line, a direct and re-  
turn flue in the steam-space of the boiler-  
shell, an uptake, a deflector which causes a  
portion of the hot gases to traverse these flues,  
and a steam-pipe extending between these 35  
flues through the steam-space of the boiler  
and through the uptake to dry and superheat  
the steam.

In testimony whereof I have hereunto sub-  
scribed my name.

JOHN BAIRD.

Witnesses:

A. J. BAIRD,  
ADDISON W. BAIRD.