

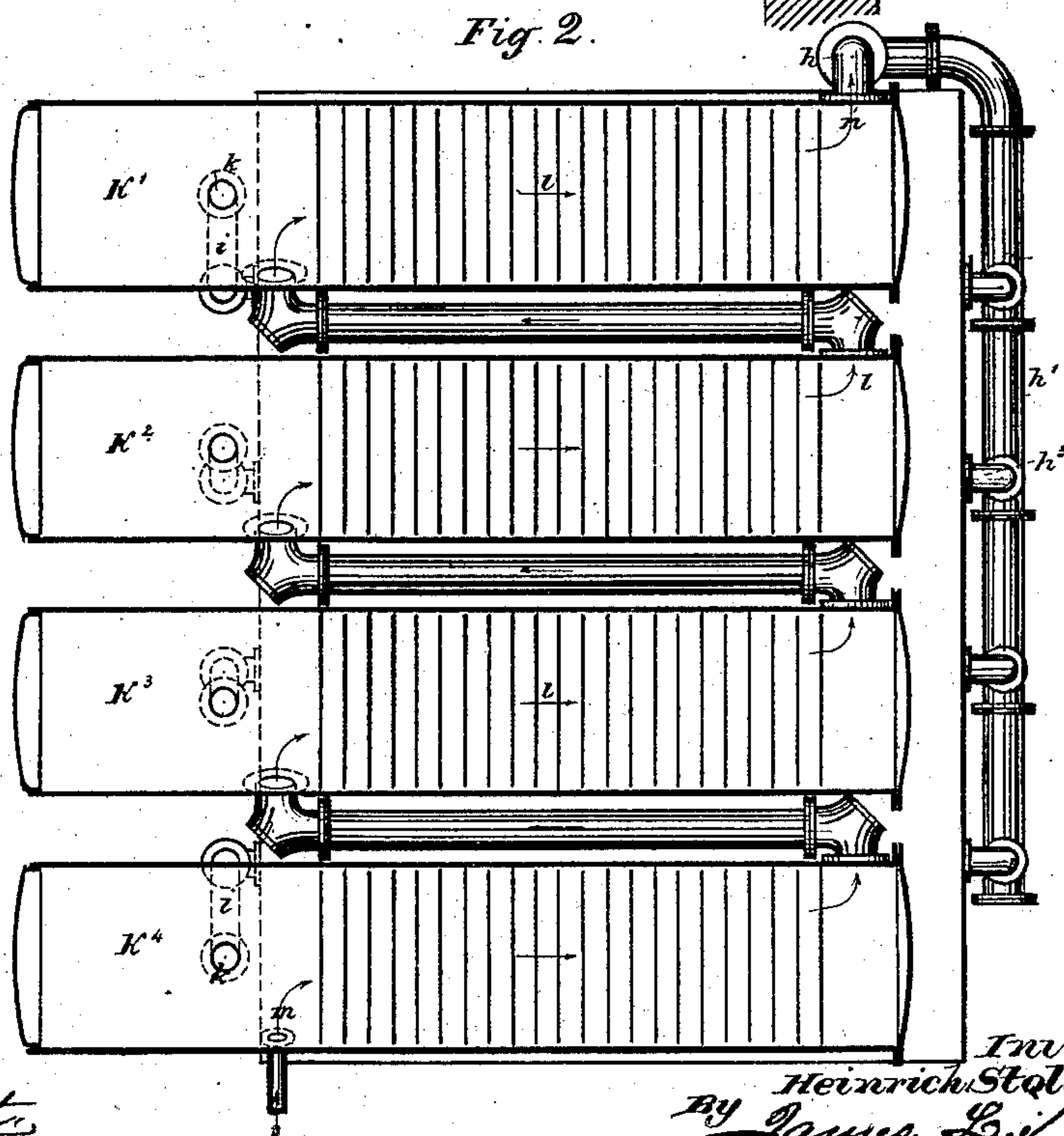
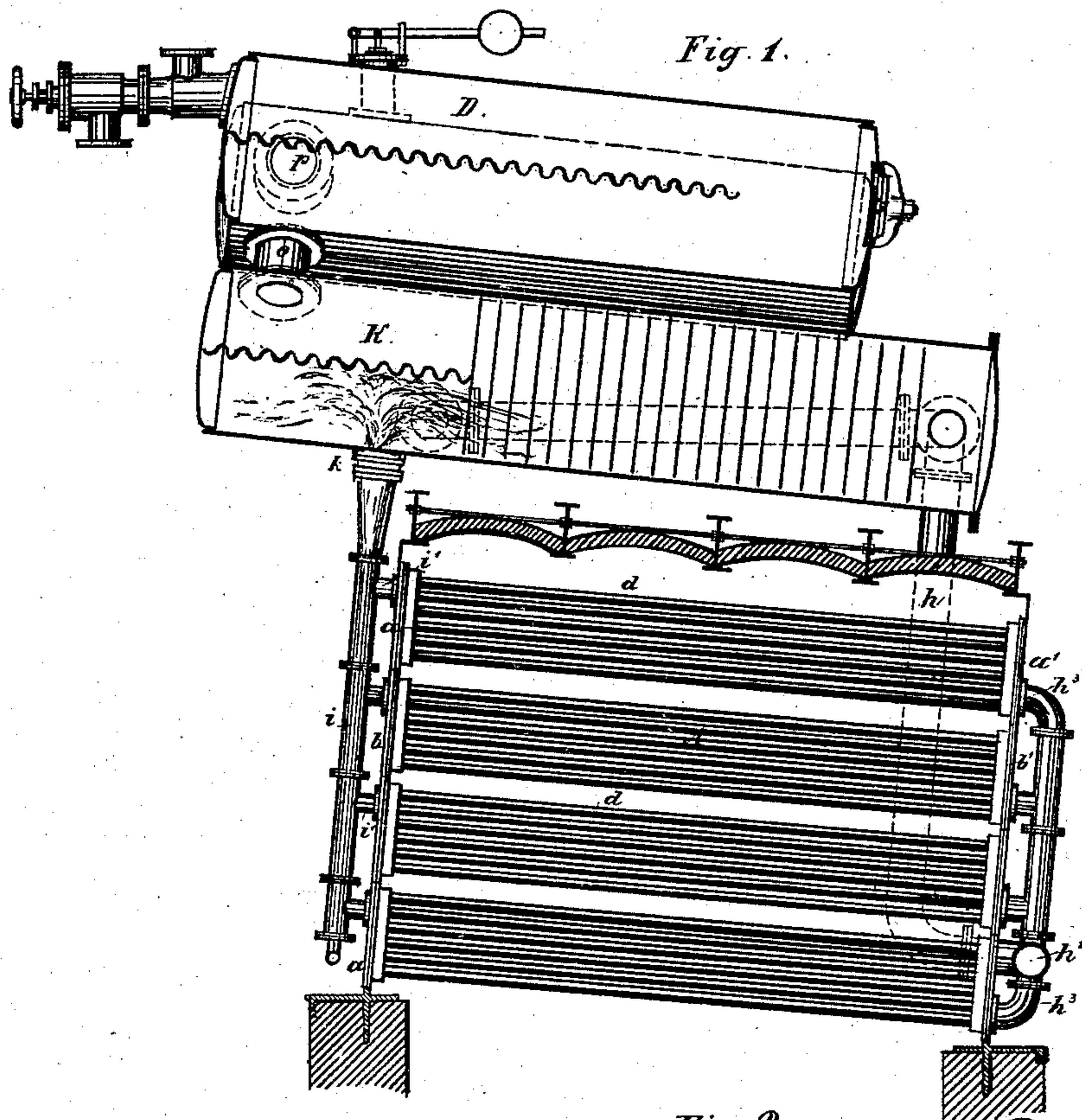
(No Model.)

3 Sheets—Sheet 1.

H. STOLLWERCK.  
STEAM BOILER.

No. 286,864.

Patented Oct. 16, 1883.



Witnesses,

J. A. Rutherford

Robert Everett

Inventor,  
Heinrich Stollwerck,  
By James L. Norris, atty.

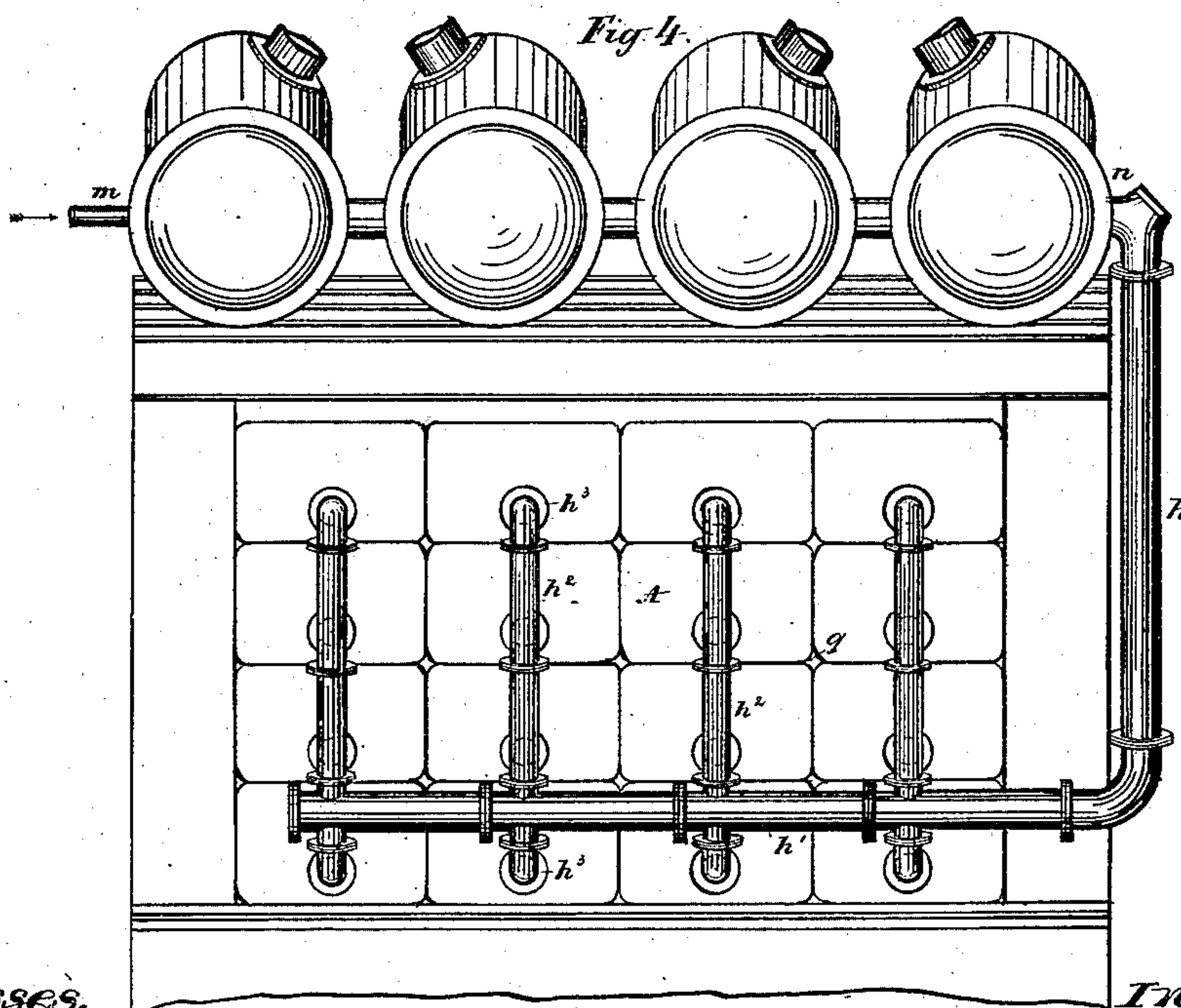
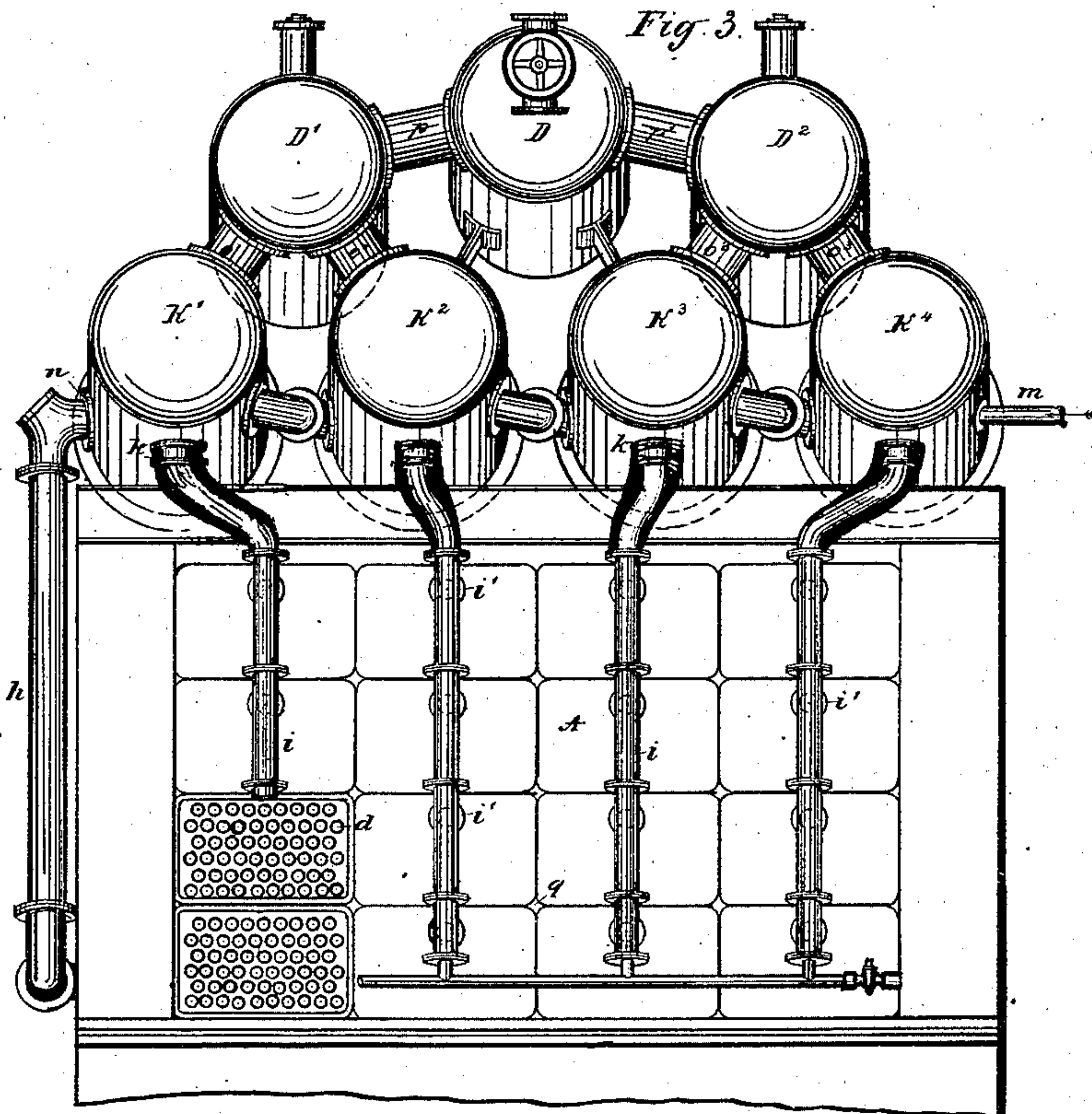
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Fig. 5.

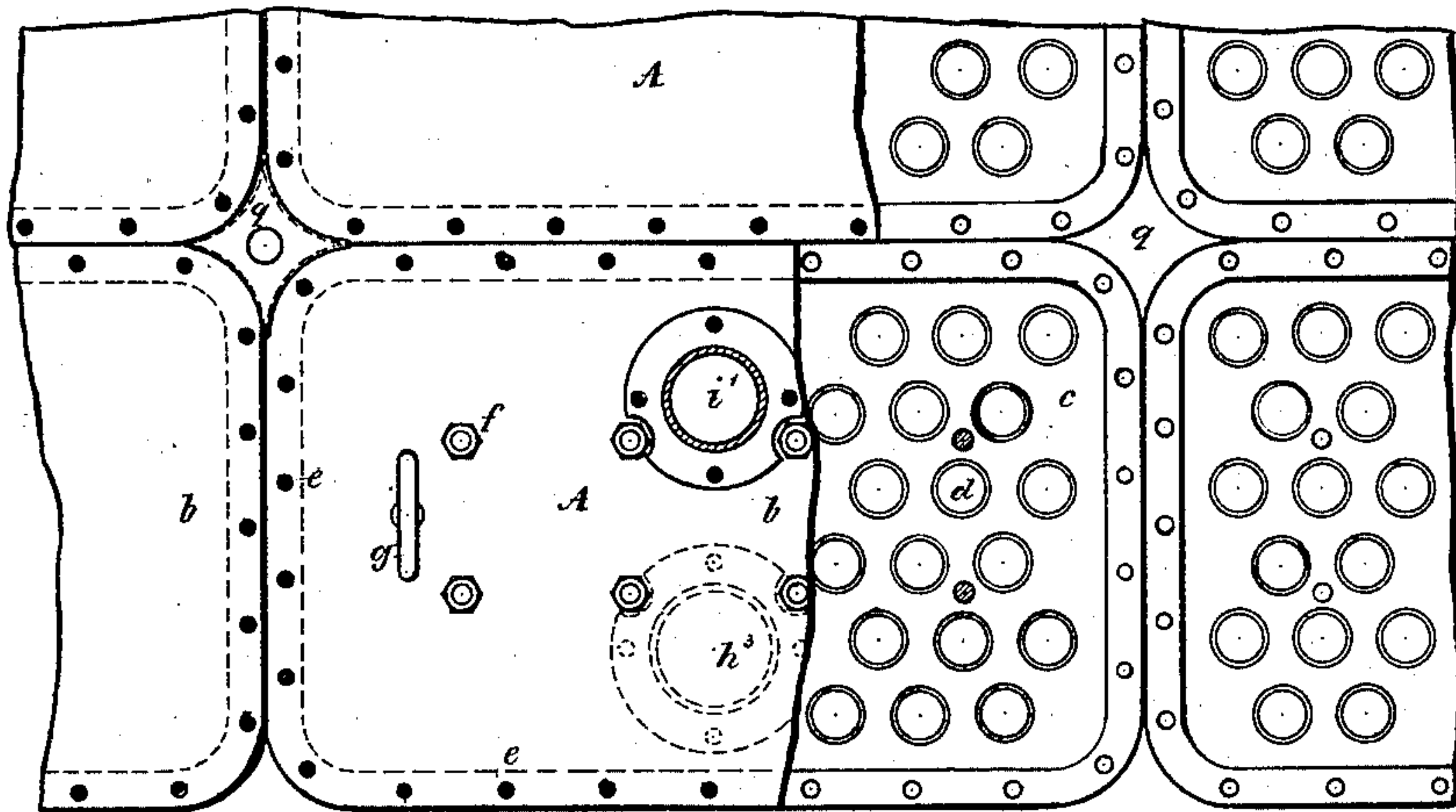
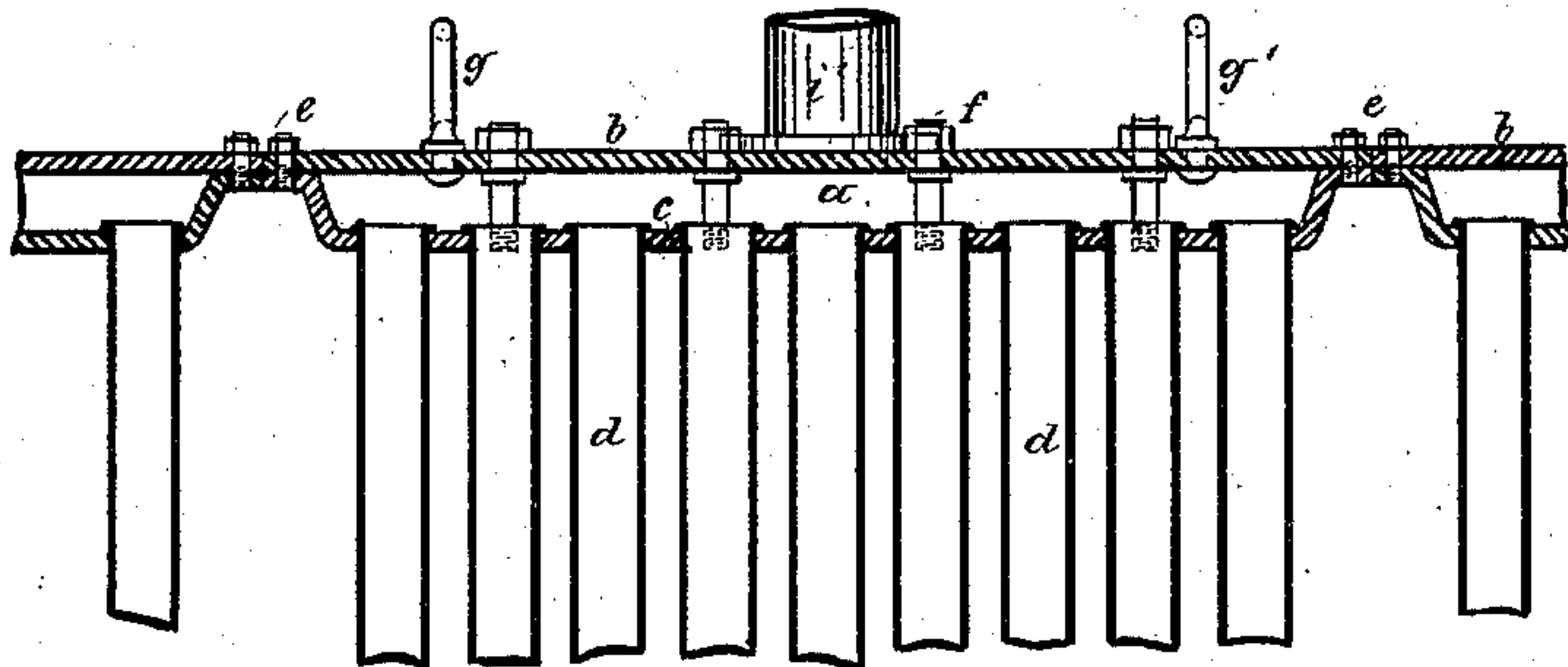


Fig. 6.



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# UNITED STATES PATENT OFFICE.

HEINRICH-STOLLWERCK, OF COLOGNE-ON-THE-RHINE, PRUSSIA, GERMANY,  
ASSIGNOR TO GEBR. STOLLWERCK, OF SAME PLACE.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 286,864, dated October 16, 1883.

Application filed May 1, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, HEINRICH STOLLWERCK, of the city of Cologne-on-the-Rhine, in the Kingdom of Prussia and German Empire, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

This invention relates to steam-boilers, the same being preferably composed of a number of tubular boilers or compartments arranged and connected in such a manner as practically to form one single steam-boiler.

The object of my said invention is to produce at a comparatively low cost a boiler for generating steam, preferably for engines of great capacity, or for other purposes, said boiler at the same time occupying comparatively but little space, and requiring less fuel than any other boiler of the known constructions.

My said invention, therefore, consists in constructing a number of tubular boilers or compartments consisting of two chambers firmly closed at their outer ends by means of detachable covers, and communicating with each other by a number of tubes tightly fitted into the inner or adjacent walls of the said two chambers, and in arranging these said tubular boilers or compartments in sets above or alongside of each other, or both, and connecting the front ends of the different compartments with the rear ends of the latter by means of a system of pipes in such a manner as practically to form one single large boiler, in the said connecting-pipes of which, as well as in the tubes of each of the compartments composing the same, a constant circulation of steam and water is maintained.

My improved boiler is particularly adapted for use with an apparatus for freeing its feed-water from incrustation before entering the said boiler. In order, therefore, to enable others skilled in the art to better understand the nature of my invention, I will now proceed to describe the same in combination with such apparatus, though the boiler may also be used without such apparatus, or in combination with any other similar device for supplying feed-water freed of its incrustation be-

fore entering the tubes of the said compartments.

In the accompanying drawings, forming part of my specification, Figure 1 is a vertical longitudinal section of my improved boiler; Fig. 2, a horizontal section of the boilers or depositing-chambers mounted above and connected with the boiler, the said depositing-chambers forming part of the device for freeing the feed-water from incrustation, as patented to me by Patent of the United States No. 272,347, which device is here shown in connection with my improved steam-boiler. Fig. 3 is a front view of my improved boiler, partly in section, and shows the system of pipes connecting the front chambers of the compartments. Fig. 4 is an end view of the same, and shows the system of pipes connecting the rear chambers of the compartments. Fig. 5 is an end view, partly in section, of some of the compartments composing my improved boiler. Fig. 6 is a transverse vertical section through the said compartments, Fig. 5.

Reference being had to the accompanying drawings, my improved steam-boiler consists of one, or, preferably, of a number of smaller boilers or compartments, A, arranged alongside of or above each other, or both, preferably in such a manner as to form vertical sets. Each of the said compartments consists of two chambers, *a a'*, firmly closed by means of covers *b b'*, and communicating with each other by means of the open water-tubes *d*, tightly fitted in and connecting the perforated inner walls, *c c'*, of the water-chambers *a* and *a'* of each compartment. The covers *b b'* are provided with handles *g g'*, to allow of an easy removal of the same, and in order to add to their strength have stay-bolts *f*. The said compartments, each forming a small boiler for itself, and arranged in vertical sets alongside of each other, are each provided with a short pipe, *h<sup>3</sup>*, connecting the same by means of the intermediate system of pipes, *h' h<sup>2</sup>*, with the feed-water and circulation pipe *h*, and entering the rear water-chamber, *a'*, of each compartment at its lower end, while the short discharge-pipes *i'*, attached to the upper part of each of the front chambers, *a*, connect the



compartments of each vertical set with a mutual discharge-pipe, *i*, for each set. The said pipes *i* are preferably constructed wider at the top than below, and the upper elbows of the said pipes should be of larger diameter than the pipes, so as to offer as little friction as possible to the ascending mixture of water and steam. These discharge-pipes *i* communicate with the steam-reservoirs from which the steam is taken for use, and their continuation at the same time discharges into the feed-water and circulation pipe *h*. In the construction illustrated in the drawings, wherein the boiler is shown as connected with the said device for freeing feed-water from incrustation, the discharge-pipes *i* are not connected directly with the steam-reservoirs and the circulation-pipe *h*, but are first made to enter the depositing-chambers  $K' K^2$ , &c., so as to meet the fresh feed-water entering the said depositing-chambers through the pipe *m*, and by causing a circulation of the said feed-water in the apparatus, in the manner to be more fully described below, to assist in freeing the same from incrustation. In this case the connection with the steam-reservoirs is established by means of the short pipes  $o o' o^2 o^3$ , leading from the depositing-chambers  $K' K^2$  and  $K^3 K^4$  to the steam-reservoirs  $D' D^2$ , while all steam-reservoirs communicate with each other through the short pipes *p p'*, leading from  $D'$  and  $D^2$  to the steam-reservoir *D*, whence the steam is ultimately taken in a practically dry state, to be used for whatever purpose it may be intended for. The connection of the discharge-pipes *i* with the circulation and feed-water pipe *h* is likewise not a direct one in this instance, but is made at the depositing-chamber  $K^4$ , by which means the feed-water, carried along by the circulating mixture of steam and water issuing from the short pipe *k*, is first made to pass through all the intervening depositing-chambers before discharging into the pipe *h*.

It is evident that in connecting the above-described or any other apparatus with my improved boiler the number of steam-reservoirs employed may be varied to any desired extent, this depending on the number of sets of compartments composing my improved steam-boiler, or on the character of the intermediate apparatus connected with the same.

In the drawings my improved steam-boiler is shown as being composed of four vertical sets of boiler-compartments; but I wish it distinctly understood that I do not confine myself to this number, and that the same may be varied to any desired extent without deviating from the nature of my invention. Instead of connecting each vertical set of boiler-compartments directly with the steam-reservoirs, or with the depositing-chambers of the apparatus, here shown as connected with my improved steam-boiler by means of the pipes *i*, the latter may also be made first to enter some transversely-arranged pipe or chamber which

communicates with the several steam-reservoirs or with the several depositing-chambers by means of short pipes. Such arrangement will preferably be chosen when the number of vertical sets of boiler-compartments differs from the number of depositing-chambers. The corners of the several compartments being rounded off, openings *g* are formed at the points where the corners of four compartments meet. These openings serve for cleaning the tubes of ashes and soot, such cleaning being effected by introducing a jet of steam, or a scraper, or brush, &c., into the said openings.

Having thus described my improved steam-boiler, I will now proceed to describe its operation.

The water in the water-chambers *a a'* and tubes *d*, forming the compartments *A* of my improved steam-boiler, being heated, steam is generated in the same, said steam and the water in the compartments ascending in the tubes of the several compartments. The steam, carrying particles of water along with it, then ascends through the pipes *i i*, entering the same from each of the several compartments through the discharge-pipes *i' i'*, and is by them conveyed either directly to the steam-reservoirs, or, preferably, as shown in the drawings, into the several depositing-chambers  $K' K^2 K^3 K^4$ . After having served its purpose in the intermediate apparatus, in the manner to be hereinafter described with regard to the particular apparatus shown in this instance, the steam ascends into the steam-reservoirs  $D' D^2$ , and ultimately enters the reservoir *D* through the pipes *p p'*. Coming in contact with a number of plates of corrugated sheet metal arranged in the several reservoirs, it is freed from its water by condensation, and is collected in the reservoirs, and ultimately taken from the reservoir *D*, to be used as may be desired. The water which is carried along by the steam coming from the boiler and ascending through the pipes *i* is ultimately discharged from the latter either directly into the pipe *h*, or, in case of the apparatus having the depositing-chambers  $K' K^2 K^3 K^4$  being employed in combination with my invention, as shown in this instance, it first enters the depositing-chamber  $K^4$ , together with the steam, and thereupon passing, and at the same time carrying along with it the fresh feed-water entering through the pipe *m*, preferably in a highly-heated state, into the next depositing-chamber,  $K^3$ , is here met by the circulating mixture of steam and water issuing from the next short pipe, *k*, and again carried along into the next depositing-chamber,  $K^2$ , where the same operation is repeated until the entire mixture of circulation and purified feed-water is ultimately discharged into the feed-water and circulation pipe *h* from the last depositing-chamber,  $K'$ , at *n*, to be again conveyed into the one or more compartments *A* composing the boiler proper, and to be again circulated through the several compartments, pipes, and intermediate



apparatus in the manner as hereinbefore stated. It will be seen from the above that a continuous circulation is thus obtained through the entire system of compartments, pipes, &c., composing the said improved boiler.

The advantages derived from my improved tubular steam-boiler hereinbefore described will be readily understood to be as follows:

First. In employing the construction as above described I am enabled to generate steam for engines of any size (from twenty to one thousand horse-power) by means of one single boiler, the said boiler being non-explosive, since the smallest diameter may be employed for the tubes, which alone form the heating-surface. The quantity of water used is very small, and as the latter is intended to be free from incrustation, repairs may be considered hardly ever to be required.

Second. The water-surface at the water-level is a very large one for tubular boilers, and the space for the steam may be chosen as large as desired, and adapted to the requirements of any stationary working system.

Third. A saving in space and masonry-work is obtained as of 1: 10 to 15 as compared with Cornwall boilers having the same heating-surface.

Fourth. The first outlay for procuring the said boiler is considerably less than with any other boilers of any known construction.

Fifth. By means of the construction as shown, a more thorough utilization of the heating-gases is obtained, resulting in great saving of fuel and cost of labor.

Having thus described my improved tubular steam-boiler, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the boiler-com-

partments A, constructed as herein described, of the steam and water eduction pipes *i*, made wider at the top, and connected to the hollow heads *a* at one end, and the return-pipe *h*, connecting with the heads *a* at the opposite end, all arranged substantially as specified.

2. The combination of a series of boiler-compartments, A, arranged substantially as shown, having steam and water discharge pipes at one end, connected to the hollow heads *a*, and feed-water and circulation-water return-pipes at their other ends, with the depositing-chambers K K', &c., provided with corrugated plates, and arranged to successively receive the feed-water, as specified.

3. The combination of a series of tubular compartments, A, having steam and water discharge pipes *i*, made wider at top, and connected at one end to the hollow heads *a*, and feed-water and circulation-water return-pipes *h* at their other ends, with the depositing-chambers K K', &c., and steam-reservoirs D D', &c., all connected and arranged substantially as described.

4. The combination of a series of tubular compartments, A, steam and water discharge pipes *i*, made wider at top, and connected to hollow heads *a*, and the feed-water and circulation-water return-pipes *h*, with the depositing-chambers K K', &c., provided with corrugated plates, all arranged substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HEINRICH STOLLWERCK.

Witnesses:

SAMUEL SPACKMAN,  
TH. PEITMANN.