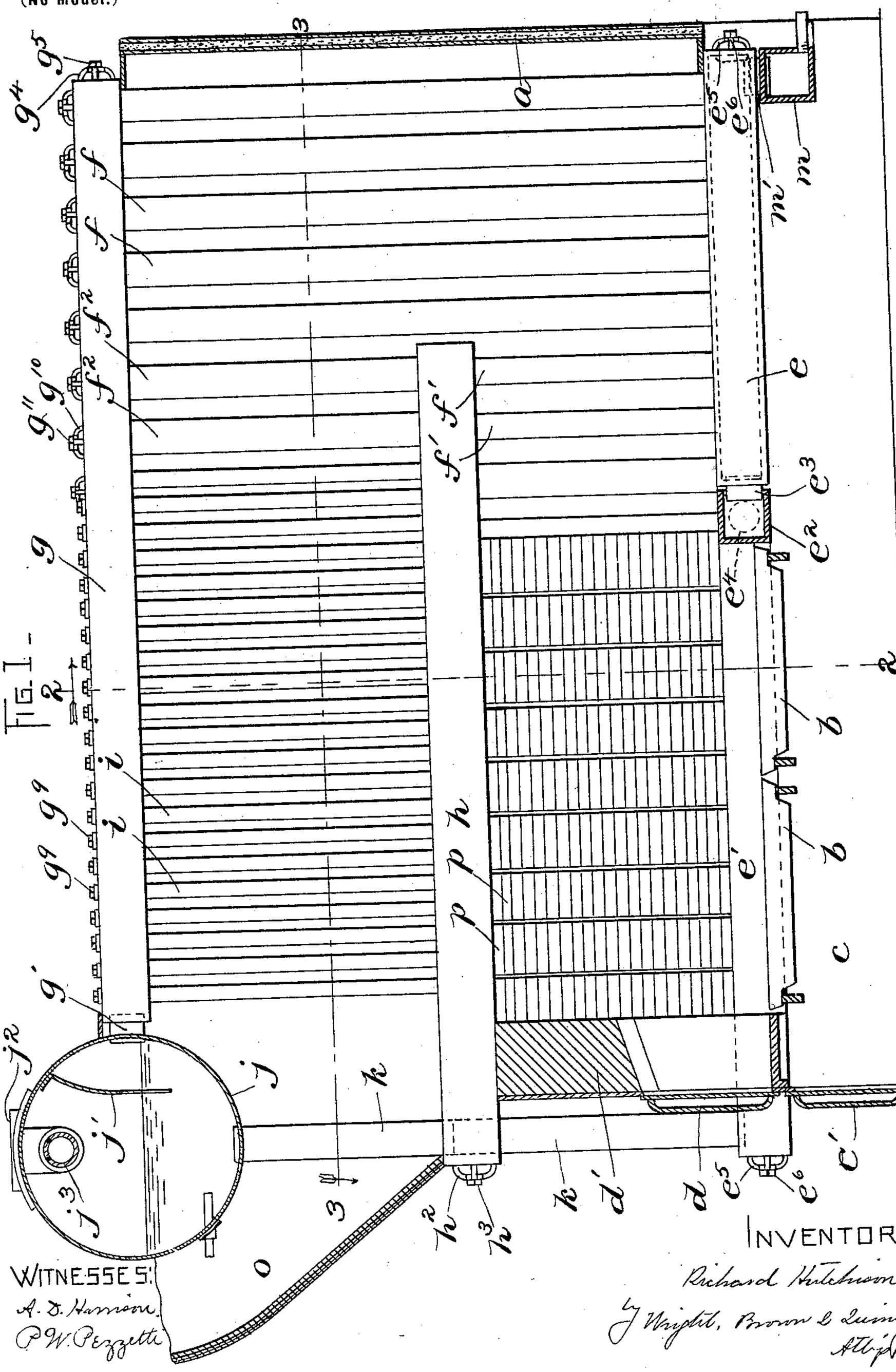
No. 614,206. Patented Nov. 15, 1898.

R. HUTCHISON.

STEAM BOILER.

(Application filed May 13, 1898.)

(No Model.) 5 Sheets—Sheet 1.



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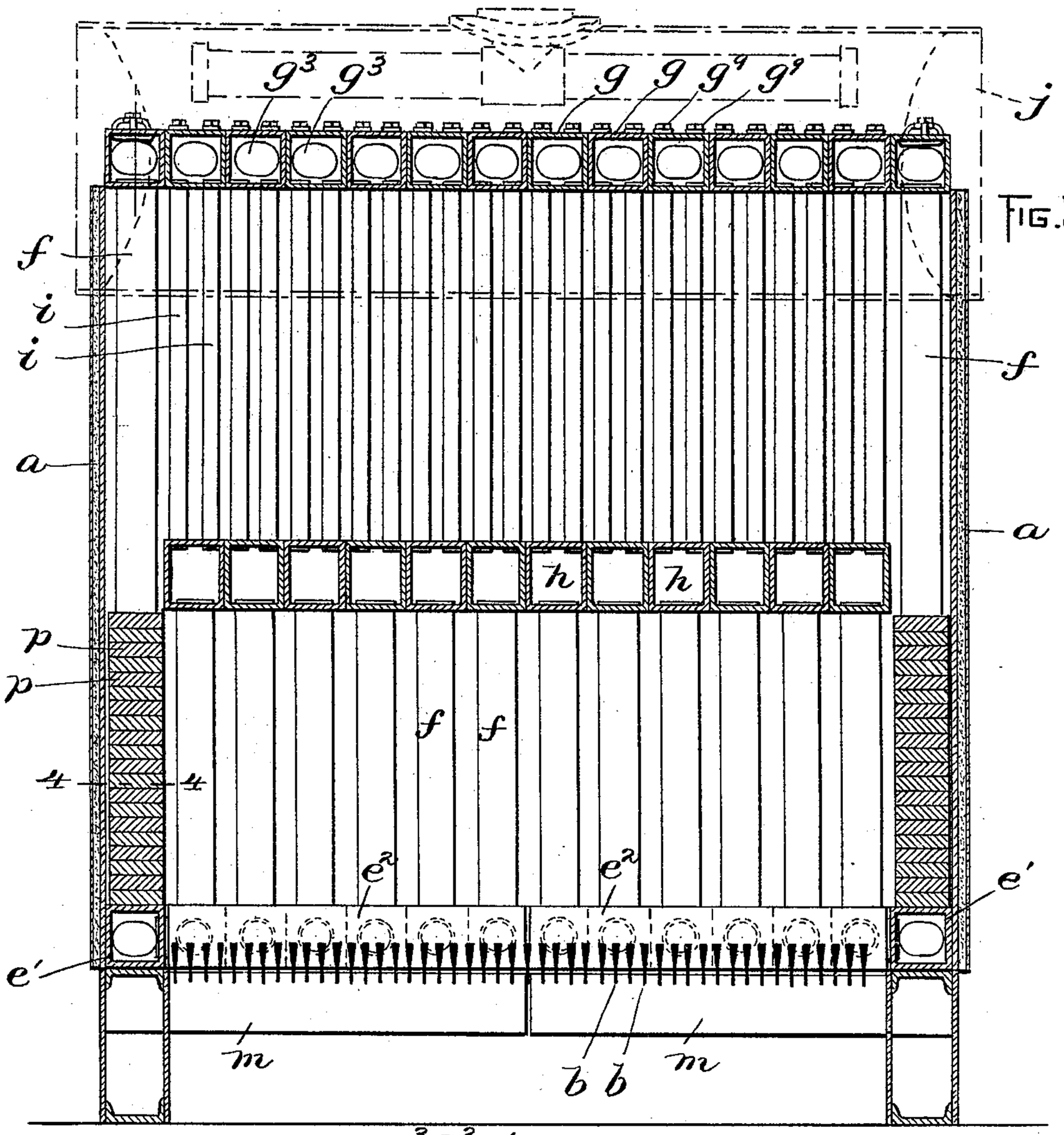

FIG. 2.

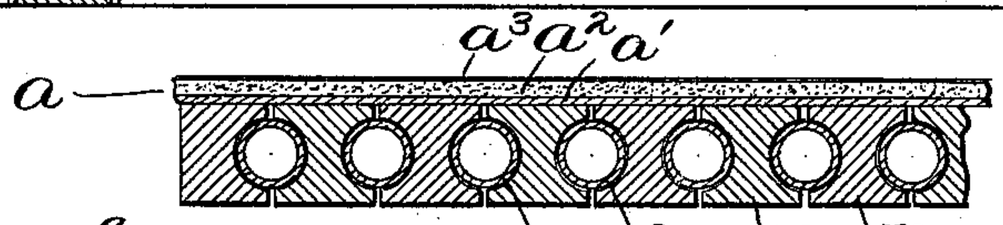

FIG. 4.

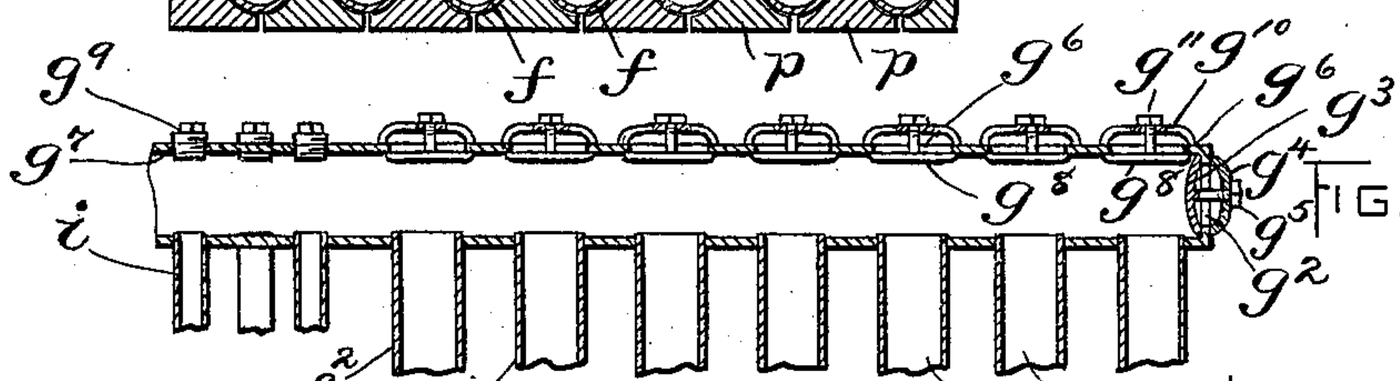

FIG. 6.

FIG. 5.

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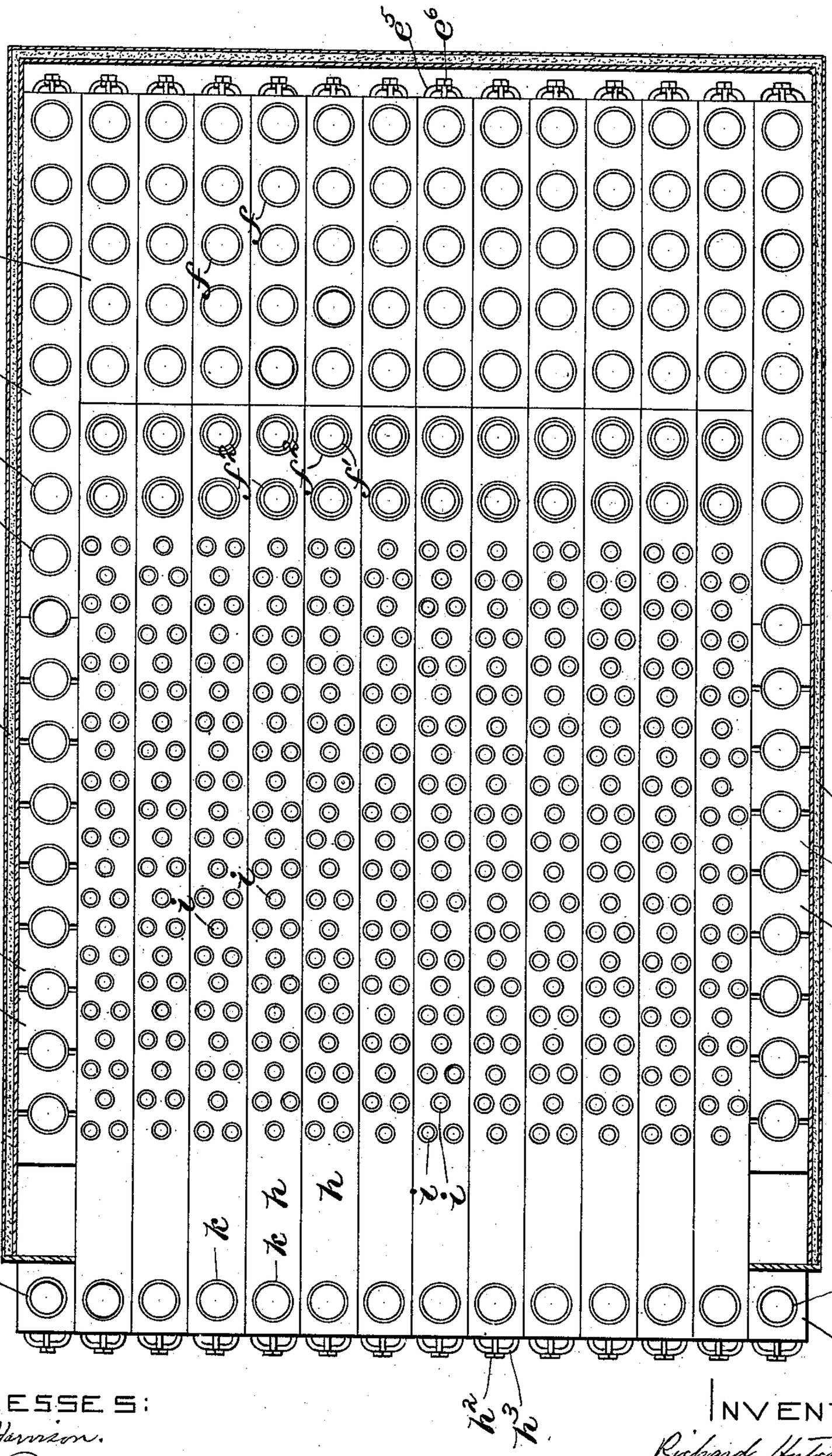

Fig. 3.

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(Application filed May 13, 1898.)

(No Model.)

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FIG. 7.

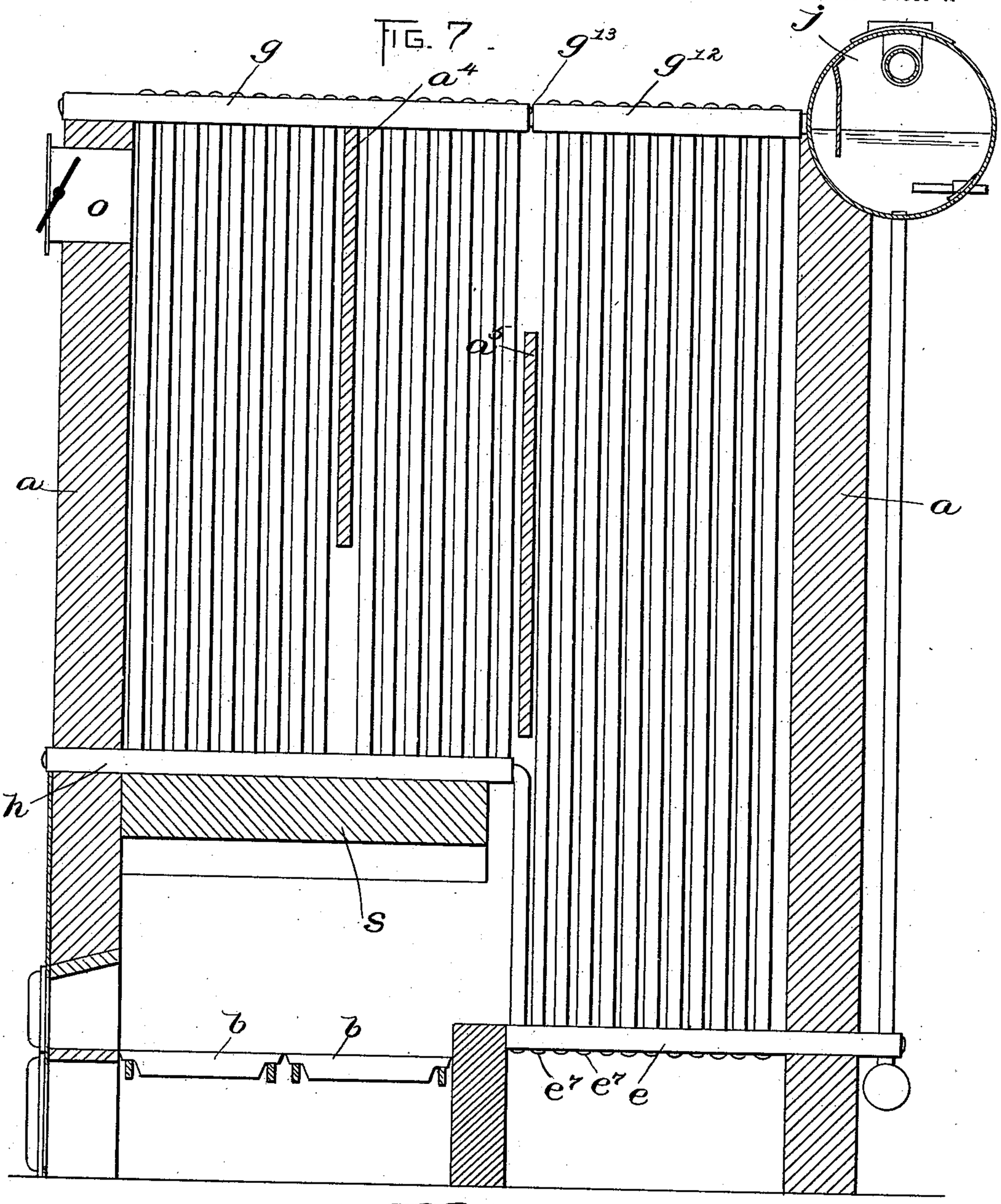
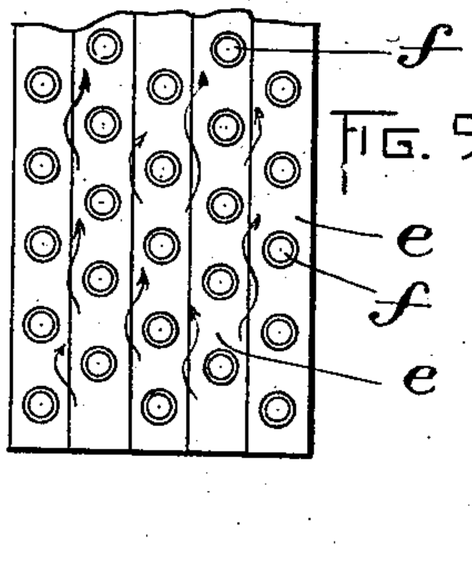


FIG. 9.



WITNESSES:

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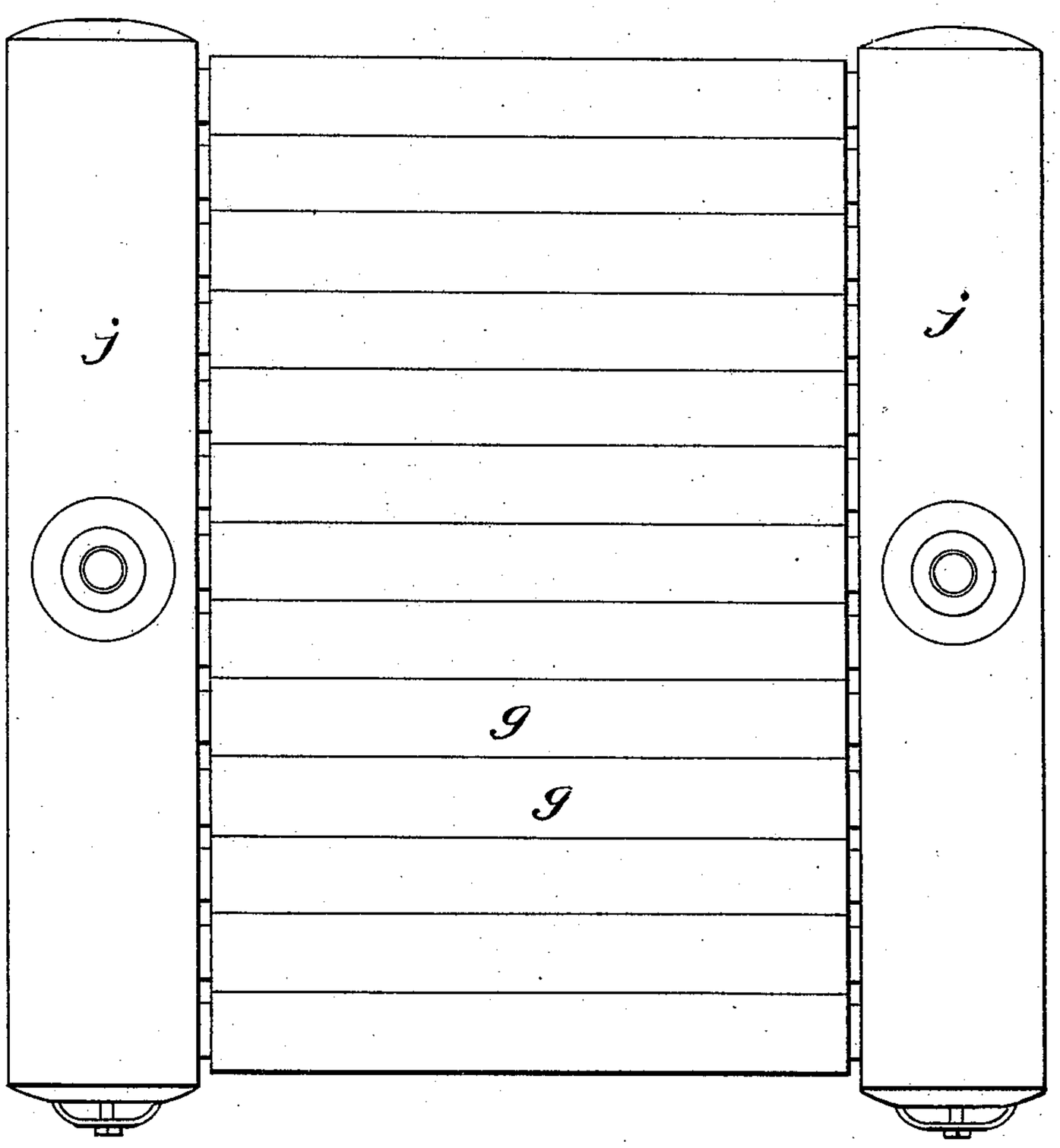

FIG. 8.

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UNITED STATES PATENT OFFICE.

RICHARD HUTCHISON, OF SOMERVILLE, MASSACHUSETTS.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 614,206, dated November 15, 1898.

Application filed May 13, 1898. Serial No. 680,575. (No model.)

To all whom it may concern:

Be it known that I, RICHARD HUTCHISON, of Somerville, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

This invention relates to sectional water-tube boilers; and it has for its object to provide a boiler which may be easily repaired and cleaned, as well as one of inexpensive and compact construction.

The invention consists in the improvements which I shall now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a longitudinal sectional view of a boiler constructed in accordance with my invention. Fig. 2 represents a section on line 2 2 of Fig. 1. Fig. 3 represents a section on line 3 3 of Fig. 1. Fig. 4 represents a section on line 4 4 of Fig. 2. Fig. 5 represents a detail perspective view showing the construction of the side of the furnace. Fig. 6 represents a detail sectional view of one of the top series of manifolds employed in my boiler. Fig. 7 represents a view similar to Fig. 1, showing another embodiment of my invention. Fig. 8 represents a top plan view showing still another embodiment. Fig. 9 represents a sectional view showing a method of arranging the tubes.

The same reference characters indicate the same parts in all the figures.

In carrying out my invention I construct the heating-surface of the boiler of a series of manifolds and a series of upright tubes, certain of the manifolds employed being, if desired, arranged to form a baffle, which deflects the products of combustion in their passage from the furnace.

Referring for the present to Figs. 1 to 6, inclusive, of the drawings, a represents the outer inclosing casing of the boiler, which may be of any preferred construction. The sides of the casing may be built up, as shown in Fig. 4, in which a' may represent an inner layer of material, such as asbestos, a^2 a layer of magnesia placed outside of the said inner layer, and a^3 a thin wall of sheet-iron outside of the layers a' a^2.

b b represent the bars composing the grate.

c represents the ash-pit, c' the ash-pit door, and d the fire-door, which latter covers an opening formed in a front wall d'.

e e represent a series of square boxes or manifolds placed side by side in the rear of the grate and extending in a longitudinal direction. Two longer manifolds e' e' are placed along the side of the boiler at the base thereof and are connected with the front ends of the manifolds e through two transversely-extending manifolds or boxes e^2, which are jointed into the manifolds e and e' by means of nipples e^3 e^4. These latter manifolds e^2 do not quite meet each other in the middle of the boiler, the object of this construction being to allow for expansion and contraction due to heat. They are raised above the level of the grate-bars and serve as an edge for the grate to prevent injury of the rear tubes by means of the fire-tools. At the rear ends of the manifolds e and jointed to the same by means of nipples m' m' are two mud-drums m m, placed end to end in the same manner as the manifolds e^2 e^2. The manifolds e and the manifolds e' are preferably formed with hand-holes in their ends for the purpose of cleaning the manifolds or obtaining access to the tubes, said hand-holes being covered by hand-hole plates secured in place by means of clamps or bridges e^5 and bolts e^6.

h h represent a second or intermediate set of manifolds or square boxes set in contact, side by side, and extending longitudinally from the front of the boiler toward the rear thereof, the said manifolds in the present instance being located directly above the grate and forming the top of the furnace. The rear ends of these manifolds are connected with the manifolds e by means of upright tubes f' f'.

g g represent a third series of square boxes or manifolds arranged side by side longitudinally of the boiler and forming the top thereof. These manifolds are connected with the manifolds e and e' at the base of the boiler by means of a series of upright tubes f f and with the intermediate set of manifolds h by means of a series of tubes i i and f^2 f^2. The long tubes f f at the rear and sides of the boiler are here shown as of a larger size than the short front tubes i i, and either or both sets of tubes may be staggered in the mani-

folds in order to break up and deflect the hot gases. In the tops of the manifolds g, over each of the tubes, are formed apertures g^6 g^7, which are of a size to permit the removal and insertion of the tubes and also to allow them to be cleaned. The larger apertures g^6 in the present instance are shown as covered by inside hand-hole plates g^8, secured in place by means of clamps or bridges g^{10} and bolts g^{11}, and the smaller apertures g^7 are shown as being screw-threaded and closed by screw-plugs g^9. In the rear end of each of the manifolds g is formed an oblong aperture g^2, through which the hand-hole plates g^8 g^8 may be inserted and removed. The aperture or hand-hole g^2 is covered by an inside hand-hole plate g^3, held in place by a clamp g^4 and bolt g^5.

In order to permit the ready insertion and removal of the tubes f' f', connecting the manifolds h and e, I prefer to make said tubes of a diameter considerably less than that of the tubes f^2 f^2, connecting the rear ends of the manifolds h with the to pmanifolds g, and locate the former tubes directly in line with the latter tubes, so that the tubes f' may at any time be passed directly through the tubes f^2. It is also possible, however, to provide for the insertion and removal of these lower tubes f' in a convenient manner by making them only slightly smaller than the tubes f^2, and then after removing one or more of the latter tubes pass the corresponding tube or tubes f' through the apertures in the manifolds thus exposed. The preferred manner in which I affix all of the tubes in my improved boiler is to screw their lower ends into the manifolds and expand their upper ends; but both ends of the tubes could, if desired, be expanded into their apertures.

j is a steam and water drum connected to the front ends of the top manifolds g by means of nipples g' and communicating with the manifolds h and e' by means of downtake-tubes k k'. Inside of the drum in front of the openings for the manifolds g is a baffle-plate j'.

j^2 is a steam and safety valve opening in the top of the boiler, and j^3 is a dry pipe connected with said opening.

o is an uptake located in the present instance in front of the steam and water drum i and designed to conduct the products of combustion from the tubed space into a flue or stack.

To arrange for cleaning scale and sediment from the intermediate manifolds h and to permit access to the ends of the tubes, I provide the front ends of the manifolds with hand-holes, which are covered with inside hand-hole plates secured in place by means of clamps h^2 and bolts h^3.

Figs. 4 and 5 represent in detail a construction suitable for the sides of the furnace. p p represent a series of fire-bricks of peculiar shape arranged along the sides of the fire-chamber and built up to a sufficient height to protect the side tubes f f from direct contact with the fire. These bricks are of a thickness slightly less than the spaces between the adjacent tubes and are superposed in vertical columns with closely-adjoining edges. Each brick is shaped somewhat like a letter H, in which the end recesses are semicircular, so as to fit around the tubes. The manner of insertion or removal of a brick is illustrated in Fig. 5, the brick being first inserted edgewise between the tubes and then turned over, so as to lie flat upon the brick below the adjoining columns of bricks, forming a practically continuous wall, which is held in place by the engagement of the bricks with the tubes. To replace a single brick in any part of the wall, it is merely necessary to lift up those bricks above it a sufficient distance and allow the said brick to be turned on edge and withdrawn and a new brick substituted. This construction may also, if desired, be applied to the roof of the furnace.

It will be seen from the description of the construction and arrangement of the manifolds and tubes that the gases and other products of combustion from the fire-chamber will be deflected around the rear end of the baffle formed by the intermediate manifolds h h among the rear tubes of the boiler and will then be conducted in a lateral path among the front tubes and out into the uptake. The boiler is provided, as will be seen, with an upper chamber or pass for the gases and a lower chamber or pass which constitutes the fire-chamber, the two being connected by a vertical passage. Such a construction is particularly well suited for marine purposes, because a high-roofed and capacious furnace is obtained, giving a large combustion-chamber with a very low center of gravity in the boiler. The space occupied by the boiler, compared with the heating-surface obtained, is very small. The boiler is easily repaired, since access is obtainable to each individual tube, and in case of defect the defective tube or tubes are the only ones which need to be removed. If one or more of the manifolds burn out or are otherwise injured, the defective one or ones can be easily and quickly replaced. A definite and strong circulation is obtained through the straight tubes and manifolds and scale or sediment when deposited can be easily removed.

When two or more boilers of this description are to be placed in batteries or nests side by side, it is desirable to extend the manifolds from front to rear, as shown, in order to give convenient access to their ends; but when a boiler is to stand singly, with sufficient room at the sides to conduct cleaning and repairing operations, the manifolds might stand diagonally or transversely, as shown, with respect to the top series of manifolds in Fig. 8, in which latter case two steam and water drums j j are shown, one extending along each side of the boiler.

The position of the steam drum or drums which may be employed is subject to variation, according to design and to conditions, such as the size and shape of the space to be occupied by the boiler. In Fig. 7 I have shown a modification of my invention, in which the drum is located at the back of the boiler. The said figure illustrates my invention as embodied in an upright boiler suitable for use on land. In this construction the front and rear tubes *f f* and *i i* are elongated, the boiler is inclosed by a brick casing *a*, and baffles a^4 a^5 are provided to deflect the products of combustion, one extending down from the top of the boiler toward the intermediate manifolds *h* and the other extending up from the rear ends of said manifolds toward the top of the boiler. A flue *o* is provided near the top of the front wall of the casing as an outlet for the products of combustion. In connection with this form of boiler I have shown some variations in structure, such as the addition of a brick arch *s* beneath the intermediate manifolds *h* to form the top of the furnace and the division of the manifolds at the top of the boiler into a front set *g'*, corresponding to the intermediate manifolds *h*, and a rear set g^{12}, corresponding to the lower manifolds *e*, the members of the two sets being connected by nipples g^{13}. In an emergency where a defect occurs in a manifold that manifold and the tubes connected therewith can be entirely removed, the exposed apertures in the other manifolds stopped by plugs, and the boiler put in use again without greatly decreasing its efficiency. In Fig. 7 the lower manifolds are represented as provided with hand-holes on their under sides, located beneath each of the tubes *f f* and covered by plates which are held in place by suitable clamping devices e^7 e^7. This construction is equally applicable to the manifolds *e*. (Shown in Fig. 1.) In the upright form of boiler (shown in Fig. 7) the intermediate manifolds *h* do not act directly as a baffle, although the general arrangement of the tubes and manifolds forming the heating-surface of the boiler is the same as that of the boiler shown in Figs. 1 to 4.

An arrangement of tubes for the purpose of deflecting the hot gases is illustrated in detail in Fig. 9. A single row of tubes *f f* is here shown in each of a series of boxes or manifolds *e*, arranged so that the tubes in one row come opposite the spaces in the adjoining row. Thus, although unobstructed longitudinal spaces are left between the different rows of tubes, it will readily appear that the streams of gases will tend to swing from side to side and take sinuous paths between the tubes, as indicated by the undulating lines, the result being that the gases impinge on practically all sides of the tubes. This effect is not obtained when the tubes are placed opposite to each other in adjacent rows.

It will be understood that various modifications relating to such structural details as the cross-sectional shape of the manifolds, the position of the uptake, &c., may be made without departing from the spirit of my invention.

Having thus described my invention and indicated the manner of constructing and using the same, although without having attempted to set forth all the forms in which it may be embodied or all the modes of its use, I declare that what I claim is—

1. In a sectional water-tube boiler, a grate, an upper series of manifolds forming the top of the boiler, a lower series of manifolds arranged at the base of the boiler, back of the grate, a back series of tubes connecting the upper and lower manifolds, an intermediate series of manifolds arranged above the grate and terminating forward of the said back tubes, the latter manifolds being arranged in contact, side by side, and collectively constituting a baffle, a front series of tubes connecting the intermediate and upper manifolds, and an outlet for the products of combustion.

2. In a sectional water-tube boiler, a lower series of manifolds arranged at the base of the boiler, an upper series of manifolds arranged at the top of the boiler, an intermediate series of manifolds, a back series of relatively long upright tubes connecting the upper and lower manifolds, a front series of relatively short upright tubes connecting the upper and intermediate manifolds, and means in the top sides of the upper manifolds for permitting the removal, insertion, and cleaning of the tubes of both series.

3. A sectional water-tube boiler comprising a grate, a lower series of manifolds arranged at the base of the boiler and formed with apertures in their ends, means for closing said apertures, an upper series of manifolds arranged at the top of the boiler and formed with apertures in their ends, means for closing said apertures, a steam-drum connected with the said upper manifolds, a downtake leading from said drum, an intermediate series of manifolds formed with apertures in their ends, means for closing said apertures, a series of upright tubes connecting the upper and lower manifolds, a second series of upright tubes connecting the upper and intermediate manifolds, the upper manifolds being formed with apertures above the several tubes, permitting the removal, insertion, and cleaning thereof, and means for closing said apertures.

4. A sectional water-tube boiler comprising a grate, a lower series of manifolds arranged at the base of the boiler, back of the grate, an upper series of manifolds arranged at the top of the boiler, an intermediate series of manifolds set in contact, side by side, and constituting a baffle, a series of upright tubes connecting the upper and lower manifolds, a second series of upright tubes connecting the

upper and intermediate manifolds, and a third series of upright tubes connecting the lower and intermediate manifolds.

5. In a water-tube boiler, a grate, and a plurality of independent manifolds arranged end to end across the end thereof, for the purpose specified.

6. In a water-tube boiler, two transverse manifolds, and a series of tubes connecting the same, one of said manifolds having opposite the tubes provisions for access thereto, and the other manifold having an imperforate wall opposite the tubes.

In testimony whereof I have affixed my signature in presence of two witnesses.

RICHARD HUTCHISON.

Witnesses:
R. M. PIERSON,
C. F. BROWN.