

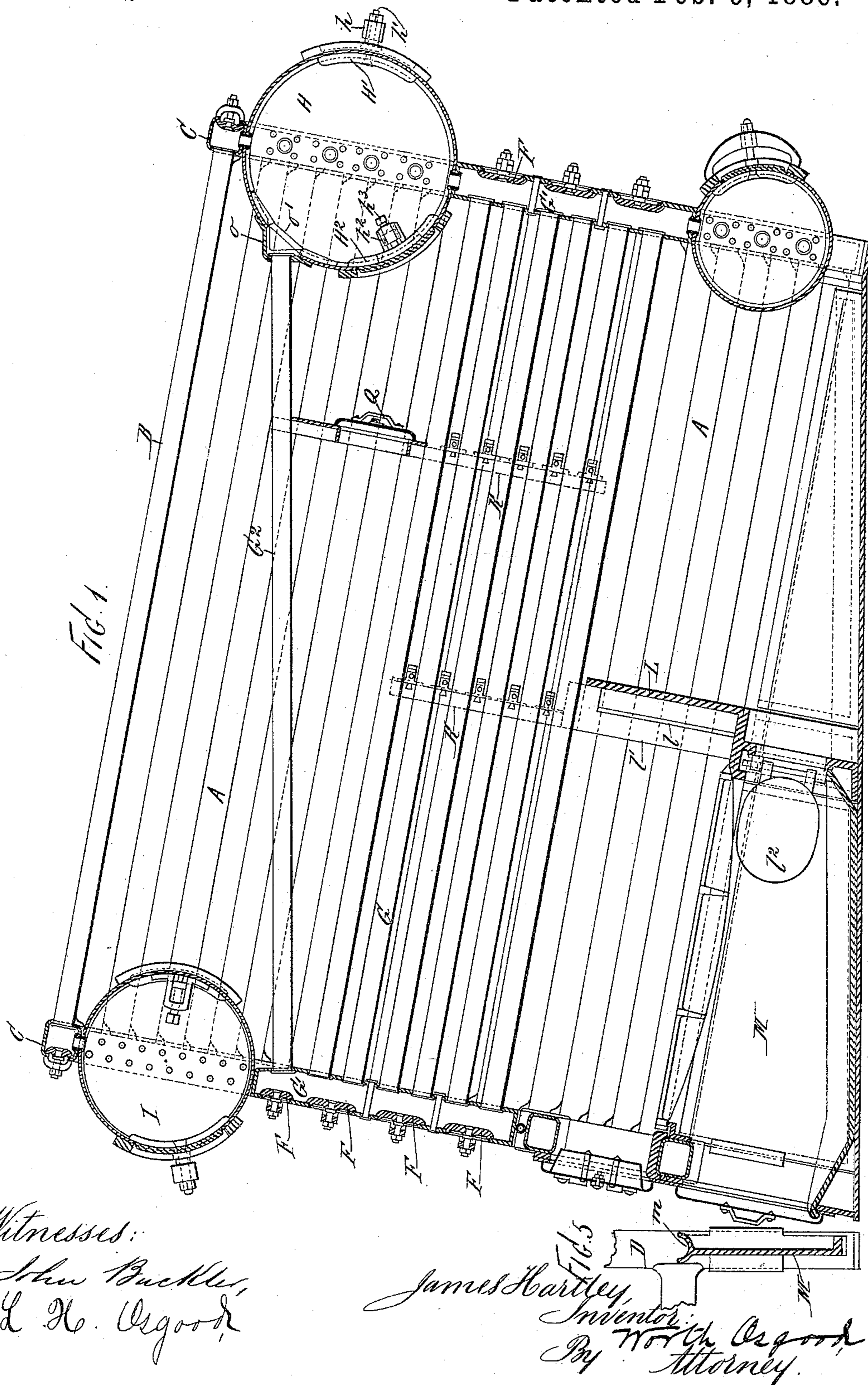
(No Model.)

4 Sheets—Sheet 1.

J. HARTLEY.
STEAM BOILER.

No. 335,697.

Patented Feb. 9, 1886.



Witnesses:
John Buckles,
L. H. Usgood

James Hartley,
Inventor.
By North Osgood,
Attorney.

(No Model.)

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FIG. 2.

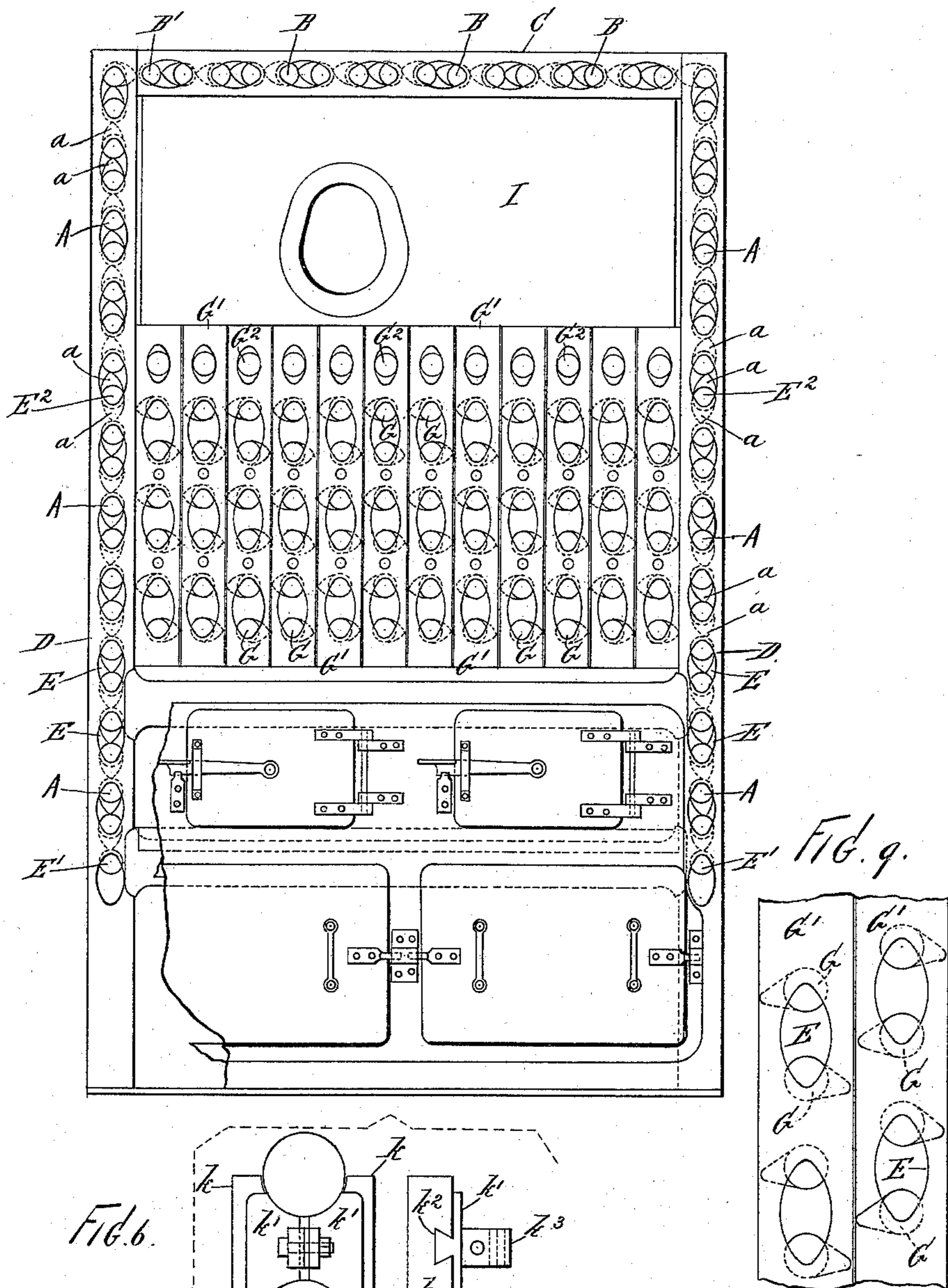
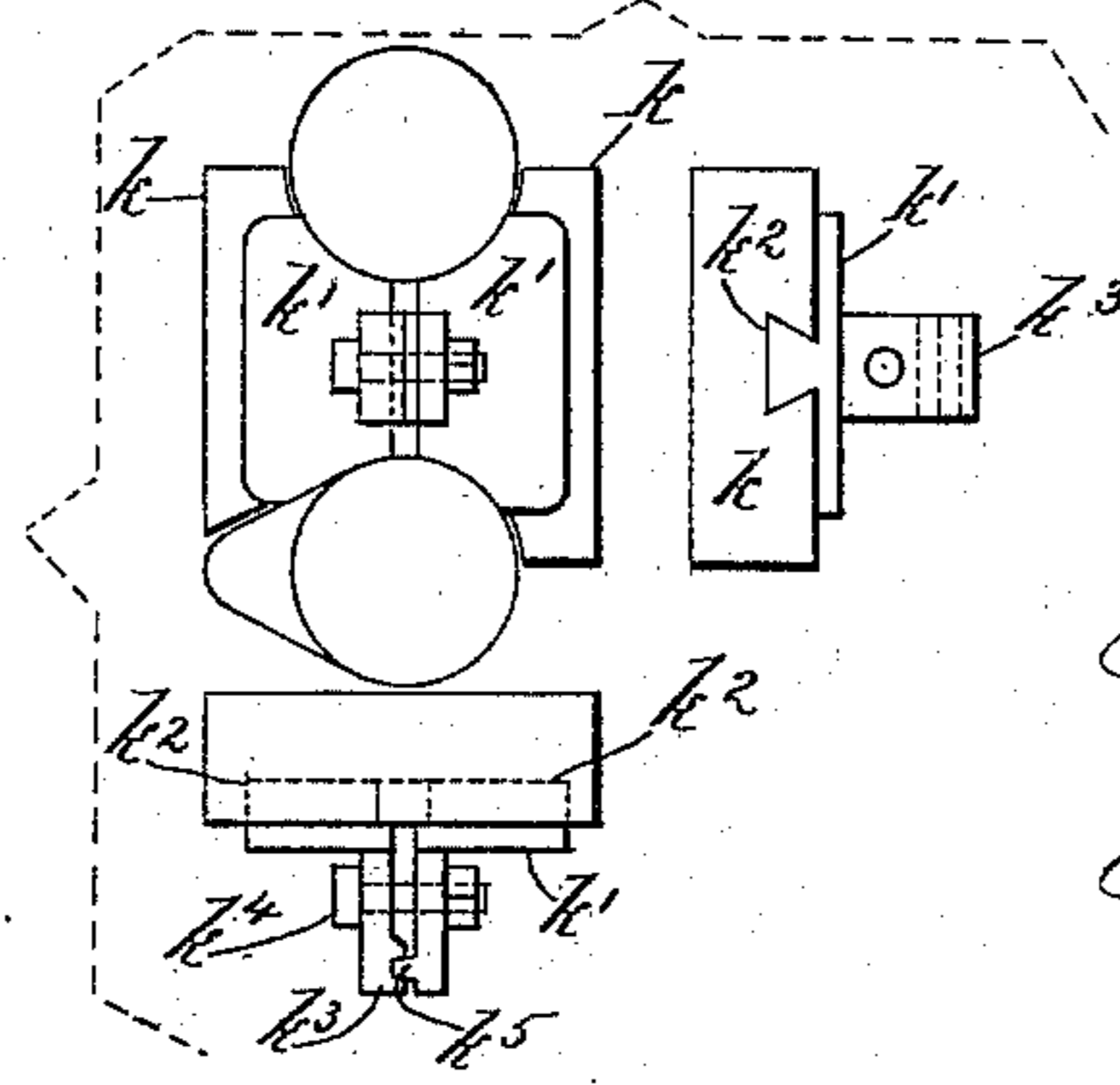


FIG. 9.

FIG. 6.



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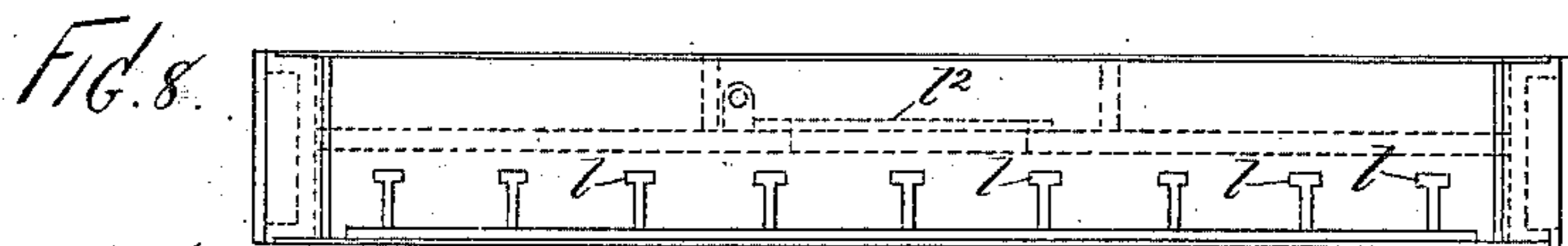
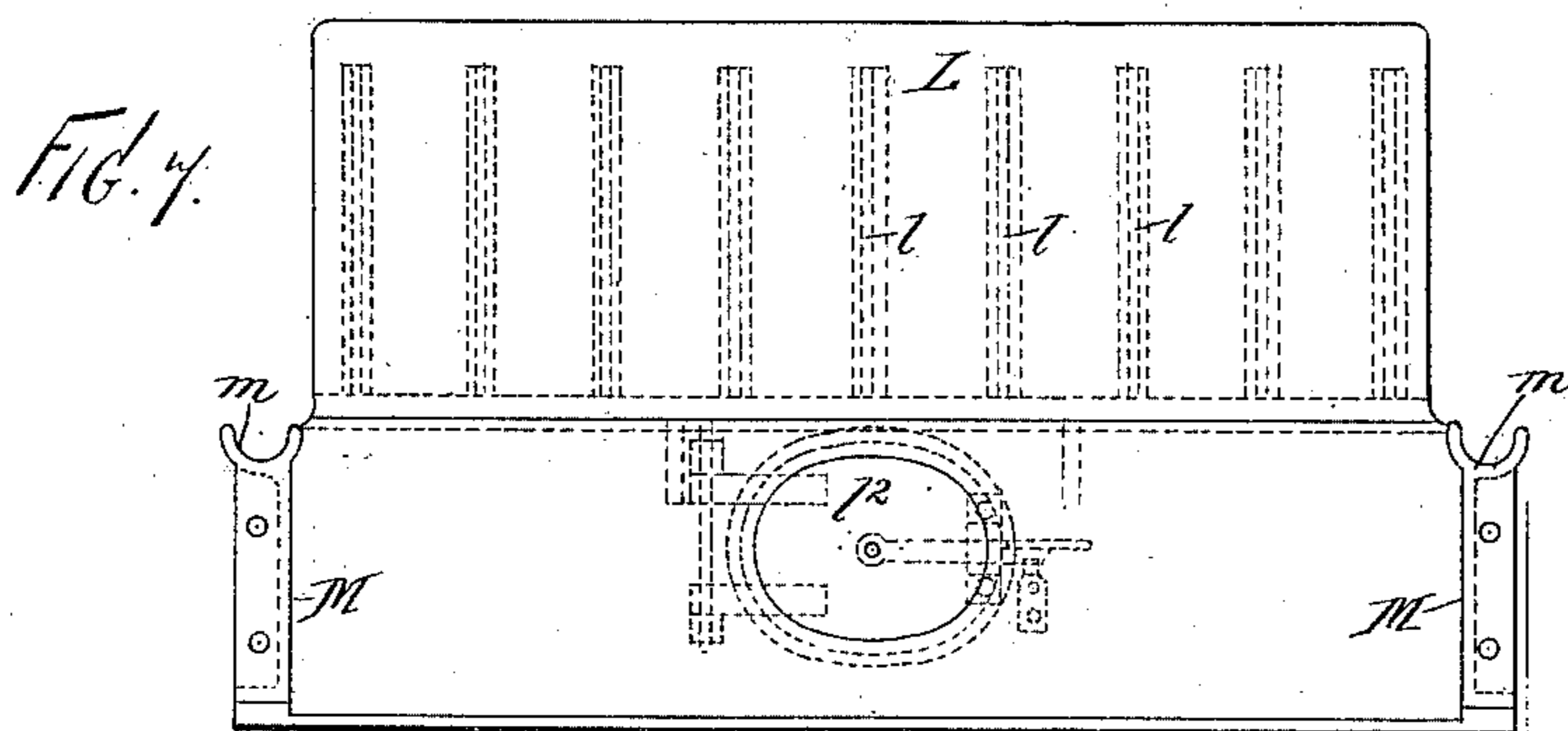
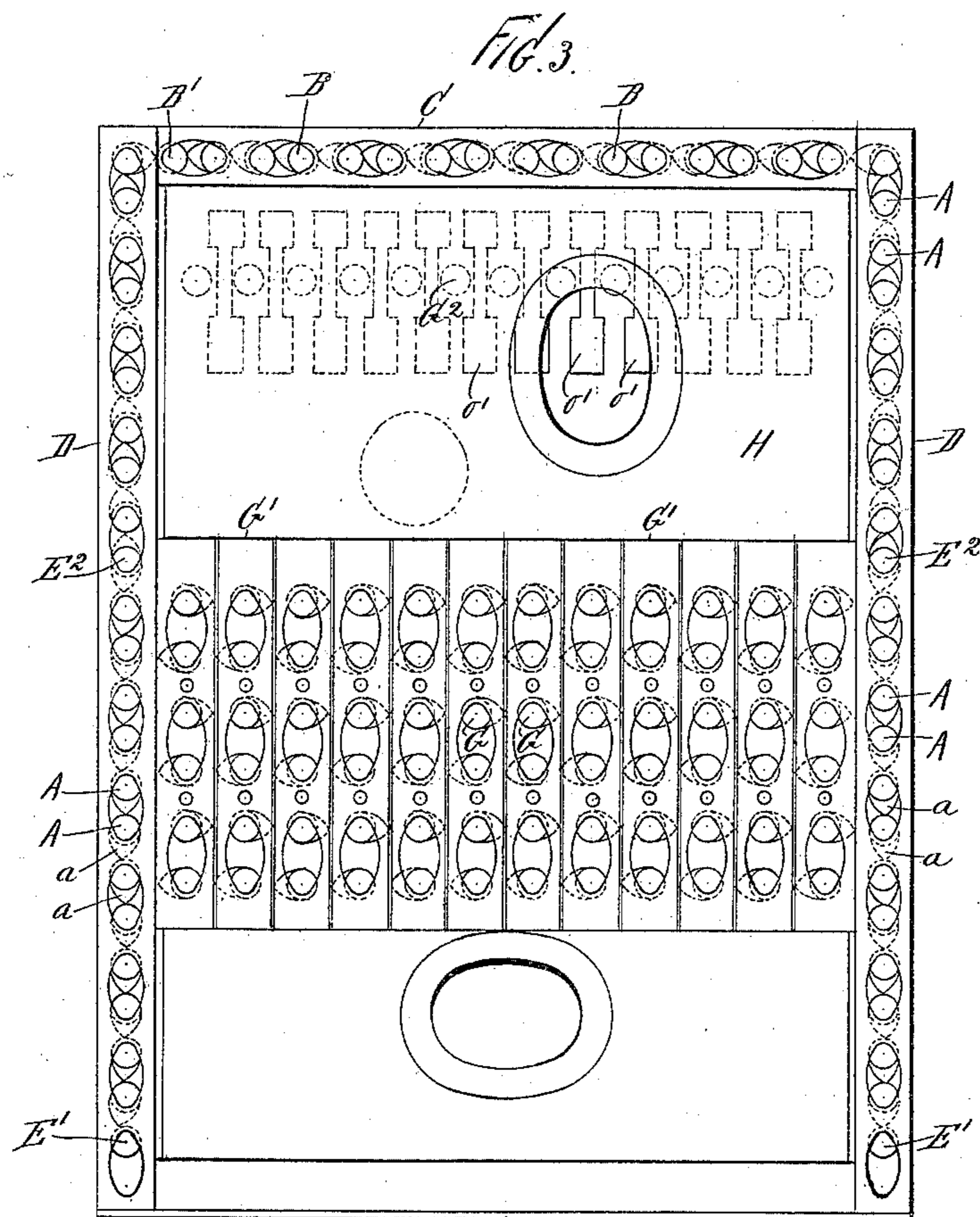
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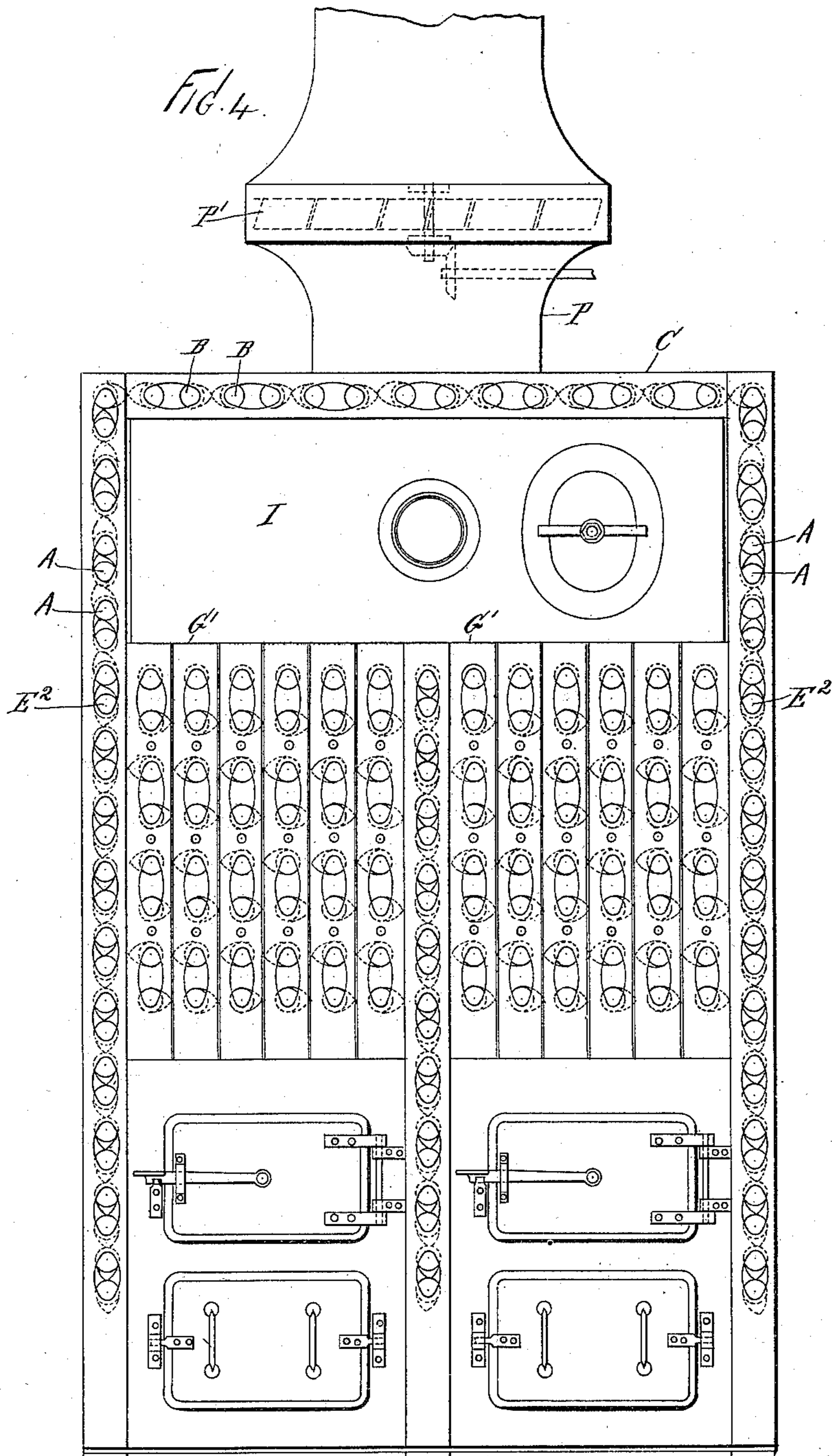
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UNITED STATES PATENT OFFICE,

JAMES HARTLEY, OF BROOKLYN, NEW YORK.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 335,697, dated February 9, 1886.

Application filed August 21, 1885. Serial No. 175,016. (No model.)

To all whom it may concern:

Be it known that I, JAMES HARTLEY, of Brooklyn, county of Kings, and State of New York, have invented certain new and useful
5 Improvements in Steam-Boilers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

10 My invention has relation to steam and analogous boilers, and chiefly to that class now ordinarily known as "sectional boilers;" but some of my improvements are applicable in boilers of any class, whether employing the
15 sectional part or not.

Among the objects of my invention are the arrangement of the tubes having offsets between the cylindrical ends in such manner as to equalize the fire-resisting capacity of all
20 without detracting from the steaming capacity of the boiler; to provide a simple, efficient, and convenient means of gaining access to the interior of the boiler from the exterior without dismounting any of the tubes or end boxes;
25 to provide simple and efficient means for forming and sustaining the fire-walls or other divisions within the sectional part of the boiler; to supply a cheap and durable form of bridge-wall at the end of the fire-box; to form the
30 side walls of the ash-pit with troughs or recesses for sustaining the lowermost of the side-tubes of the boiler and form sufficiently tight joints therewith; to provide a simple and durable means of connecting the tubes with
35 the water or other drum, and to so arrange and combine various parts of the boiler as to insure stability, cheapness, and facility of manufacture, and other advantages, as will hereinafter appear.

40 To accomplish all of this my improvements involve certain novel and useful arrangements or combinations of parts, peculiarities of construction and principles of operation, which will be herein first fully described, and then
45 pointed out in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 is a vertical longitudinal section and partial elevation of a steam-boiler constructed and arranged for operation in accordance with my invention, and
50 embodying my improvements. Fig. 2 is a

front end elevation, and Fig. 3 a rear end elevation, of the boiler shown in Fig. 1. Fig. 4 is a front end elevation of a boiler also embodying my improvements, showing the manner of
55 applying them in a double or multiple furnace boiler, and indicating one manner in which a draft-accelerator may be applied. Fig. 5 is a cross-section and partial elevation, showing the construction of the side plate of the ash-
60 pit, with the trough in which the lowermost of the side tubes are located. Fig. 6 represents in end elevation, side elevation, and plan view, the clamps employed for sustaining fire-brick or other refractory material in
65 position in connection with the tubes for forming fire-walls or other divisions in the sectional part of the boiler, all upon a scale enlarged beyond previous figures. Fig. 7 is an elevation, and Fig. 8 a top or plan view, showing
70 the construction of the bridge-wall below the sectional part of the boiler. Fig. 9 is an elevation upon a scale enlarged beyond that of previous figures, showing more plainly the form and arrangement of the tubes in the sec-
75 tional part of the boiler.

In all these figures like letters of reference, wherever they occur, indicate corresponding parts.

A A are the side tubes of the boiler, having
80 cylindrical ends by which they are secured in the corner boxes by expanding the ends, and provided with offsets between the cylindrical ends, as represented at *a a*, the said offsets being intended to bear against the adjacent
85 tube, and thereby form close vertical walls or sides of the boiler. The top or roof of the boiler is composed of similarly-formed tubes, (represented at B B,) the same being connected with horizontal end boxes, C C, similar in
90 form with the front and rear corner boxes, D D. The boxes are provided with man-holes, as E E, through which the ends of two tubes can be reached, the man-holes being intended to be closed by man-hole plates, like
95 those employed in the end boxes of the sectional part, and represented at F F. The wrought-iron tubes with cylindrical ends, having offsets between the ends secured in end boxes by expanding the ends of the tubes
100 within the boxes, have heretofore been described by me in previous applications for

Letters Patent; but in said applications the offsets upon the tubes forming the side walls of the boiler were all shown as turned up. I find that with this particular formation of tubes, if the offset be turned up and the tubes contain water, the offset constitutes a pocket within which steam is liable to be trapped, and when the tube is exposed to the fire, not being completely filled with water, the unfilled portion is liable to be burned out, or in any event to be much more rapidly destroyed by the action of the fire than the remaining portion. Therefore to equalize the heat-resisting capability of the tubes I mount all the tubes in the side walls which contain water, so that the offset shall be turned downwardly, and thus avoid all pockets within which steam may be trapped by the water. This arrangement is plainly shown in Figs. 2 and 3.

E' is the bottom tube of the series, and this may be cylindrical throughout its whole extent, if desired; or if provided with an offset the offset is turned down.

E^2 is a tube located at or about the water-line, and this has a double offset, so that it may touch the tube below, and also the tube above, so that the wall or side shall be unbroken. Above the tube E^2 the offsets are turned upward, as shown, the tubes being intended to contain steam only, and being in such position that they are not affected by the heat, as are the tubes below it. The offsets upon the corner tubes are turned inwardly, so as to touch the roof-tubes, and the roof-tubes are arranged in any suitable way. In the example shown one of the roof-tubes, B' , is cylindrical throughout. Upon the roof any light covering of non-conducting material may be employed. Within the sectional part of the boiler it is desirable also to prevent the lodgment of steam within the tubes, and to obviate as far as possible the accumulation of ashes and dust upon the tubes, as well as to arrange them in such manner that they may be easily and quickly cleaned of such accumulations.

G G are the tubes employed in the sectional part, each having an offset between the cylindrical ends. These tubes, instead of being staggered in pairs, as explained by me in a previous application for patent, are arranged so that the offsets in one horizontal row shall lie in one direction and in the next row in the opposite direction, as shown in Figs. 2 and 3; and in order to afford egress of steam from each tube without danger of any being trapped in the tube, I turn the offsets upon the tubes G so that they shall lie horizontally, as shown in Figs. 2 and 3, or preferably, for reasons to be hereinafter explained, as shown in Fig. 9, so that the apices of the offsets shall lie a little below the horizontal lines through the centers of the cylindrical ends. Each offset extends to about the margin of the vertical end box, G' , within which the tubes are secured. The heat or flame striking the under side of one tube is deflected to another in a

manner which will be readily understood, and which will be found effective in utilizing the heat. The tubes, being arranged as explained, have their upper surfaces inclined downwardly, so that ashes, &c., will tend to fall off rather than accumulate thereon, so that the exteriors of the tubes are to a certain extent self-cleaning. This desirable quality is of course best attained by turning the offsets, as indicated in Fig. 9. Between any two tubes ample space is afforded for the ashes to fall through, and yet not so great a space as to seriously interfere with the necessary deflection of the flame. When necessary to clean the exteriors of the tubes, the accumulations thereon can be easily brushed or blown or washed down between the spaces between the tubes.

It will be observed that the curvature of the upper or highest part of the tube coincides with the upper or highest part of the cylindrical ends, and thus egress of steam from the tubes takes place, the same as if the tubes were cylindrical throughout, and there is no danger that steam will be trapped in the tubes.

G^2 are cylindrical tubes connecting the front end boxes of the sectional part with the water-drum H at the rear. Over these tubes, or any part thereof, fire-clay or other refractory material may be placed to prevent the passage of flame.

To gain access to the interior of the boiler, the water-drum H is supplied with two man-hole plates, one, H' , secured in place upon the interior of the drum by the usual bridge, h , and bolt h' , and another, H^2 , also located upon the interior of the drum, but having the bridge h^2 and holding-screw h^3 arranged upon the interior instead of upon the exterior. The interior of the drum is reached through the man-hole covered by the plate H' , and the interior of the boiler is reached through the man-hole covered by the plate H^2 , which can be detached and replaced from the interior of the drum. The steam-drum I is likewise furnished with two man-holes, one secured by a bolt accessible from the exterior and the other by a screw accessible from the interior of the drum, as plainly shown. Through the steam-drum access is had to that part of the boiler above the tubes G^2 , and through the water-drum access is had to that part below G^2 . This arrangement enables me to reach the interior of the boiler without dismantling any part of the walls thereof, and without detracting from the security of the boiler.

Fire-walls or divisions are erected at any suitable points within the boiler, as at K K , for the purpose of directing the flame and the products of combustion so as to insure the economical use of the heat. These may be arranged in a variety of ways. The particular construction of these walls is most plainly indicated in Fig. 6. At k are fire-bricks, or pieces or blocks of refractory material, which are designed to be applied upon the tubes to

form the fire-walls or divisions. To secure these bricks or blocks in place, they are each supplied with a metallic piece, k' , connected in any suitable manner with the brick, preferably by dovetails k^2 . Upon each plate is a tang, k^3 , perforated to receive a bolt, k^4 . A projection, k^5 , upon one tang enters a corresponding recess in the opposite tang, which insures a proper location of the two tangs with respect to each other; but this projection may be omitted. The bricks are formed so as to fit the curvature of the tubes, one tube in Fig. 6 being shown as provided with the offset and the other being cylindrical to indicate that the bricks may be applied to tubes of any contour. The bricks are properly located upon the sides of the tubes and locked in place by use of the bolts k^4 . By a series of these bricks the division-walls are built up at any point within the boiler, and thus the walls are made up of small sections, any one of which may be detached and repaired as may be required. By this construction the fire-walls are easily formed and the whole sustained securely in the proper position. At the end of the fire-box, and below the sectional part of the boiler, is the bridge-wall L. This is made up of a heavy cast-iron piece extending from the base of the boiler to the proper height and provided with a series of T-shaped flanges or ribs, l , which serve to sustain the fire-bricks l' , or other refractory material against which the flame impinges. These bricks or the material may be removed and renewed whenever required. In the part of the bridge-wall below the grate-surface is an aperture closed by a door, l^2 , through which access to the part of the boiler in rear of the bridge-wall may be gained. This wall is easily and cheaply formed, and durable and serviceable for the purposes intended.

M M are the side walls of the ash-pit. These may be made of cast or wrought metal. They are each provided with a trough or recess, m , for receiving the lowermost tube of the series of side tubes. The curvature of the trough corresponds with the curvature of the tube, so that the side wall of the structure shall be sufficiently tight and close throughout.

The tubes G^2 , which connect the front end boxes of the sectional part with the water-drum at the rear, are inclined upwardly toward the drum, as shown in Fig. 1. To connect these tubes with the drum, I supply the drum with an offset, o , of which the face toward the tubes G^2 is arranged perpendicular to the longitudinal axes of said tubes, and this face is perforated to receive the ends of the tubes, and the tubes are secured thereto by expanding the ends within the offset.

The opening in the shell of the drum which communicates with the interior of the offset would weaken the drum if not suitably stayed. I therefore supply the drum with a number of interior stays (represented at o'), which are riveted to the shell of the drum. These are so arranged as to permit access to the ends of

the tubes G^2 between the stays, as indicated in Fig. 3, and at the same time permit the necessary circulation of water and steam. This construction enables me to connect the tubes with the drum by plain and simple joints and to preserve the requisite stability of the drum.

In Fig. 4 the boiler is shown as provided with two fire-compartments, one on each side of a vertical central wall, made up of tubes having offsets between their ends, the same as the side walls. In like manner any number of fire-compartments can be formed in one boiler-structure. The uptake P can be located at any desired point over the boiler, the roof being suitably formed. Within the uptake any fan or draft-accelerator, as P' , may be located.

In Fig. 4 the roof-tubes are shown turned so that they touch each other in pairs, leaving an open space between each pair, and this arrangement indicates one manner in which openings may be provided for the escape of smoke and products of combustion through the roof or other horizontal divisions, the closed parts of the divisions being intended to be formed by a layer of fire-brick or other refractory material.

The boiler being constructed and arranged substantially as above explained, is easily and cheaply constructed, and the parts readily accessible for cleaning and repairs. Steam is taken from the steam-drum I by any suitable connections. Q is a door or stopper in the rear fire-wall.

Having now fully described my invention, what I claim as new herein, and desire to secure by Letters Patent, is—

1. In a boiler of the character herein described, having tubes provided with offsets between their cylindrical ends for forming side walls or barriers, the tubes which contain water being arranged, as explained, with the offset turned down below the upper part of the cylindrical portion of the tube, so as to obviate trapping of steam within the offset, the tube having the double offset and the remaining tubes having their offsets turned up, all combined substantially as and for the purposes set forth.

2. In a boiler of the character herein described, having side walls and top and interior sectional part, the tubes of the sectional part having offsets between their cylindrical ends, said tubes being secured in the separate vertical end boxes, and being arranged, as explained, so that the offsets shall lie below the upper portion of the cylindrical part of the bodies of the tubes, substantially as and for the purposes set forth.

3. In a steam-boiler, the combination, with the water-drum provided with two man-holes, of the two man-hole plates and the securing devices, the securing device for one plate being located outside of the drum, and that for the other plate located inside of the drum, for the purposes and objects set forth.

4. In a steam-boiler, the combination, with the steam-drum provided with two man-holes, of the two man-hole plates and the securing devices, the securing device for one plate being located outside of the drum, and that for the other plate located inside of the drum, for the purposes and objects set forth.

5. In a sectional boiler, the combination, with the tubes, of the sectional part of the fire-walls or divisions formed of separate blocks or pieces locked in place upon the tubes by means of bolts and plates secured to the blocks or pieces, substantially as shown and described.

6. In a steam-boiler of which the side walls are made up of a series of tubes, the walls of the ash-pit provided with troughs to receive the lowermost tubes of the boiler-walls and form joints therewith, substantially as and for the purposes set forth.

7. In a steam-boiler, a drum provided with

an offset for receiving the ends of the inclined pipes communicating with said drum, and the interior stay-pieces combined with said drum, substantially as and for the purposes set forth. 25

8. In a sectional boiler, the tubes of the sectional part having offsets and cylindrical ends, said tubes being arranged, substantially as shown, so that clearing-space shall be afforded between consecutive tubes, and so that the apices of the offsets upon the tubes shall lie in or below the horizontal lines through the centers of the cylindrical ends, for the objects explained. 30

In testimony that I claim the foregoing I have hereunto set my hand in the presence of two witnesses. 35

JAMES HARTLEY.

Witnesses:

WILLIAM H. SHAW,
HENRY FRANKE.