No. 646,401. Patented Mar. 27, 1900.

W. H. HARRISON.

STEAM GENERATOR.

(Application filed Oct. 11, 1899.)

(No Model.) 2 Sheets—Sheet 1.

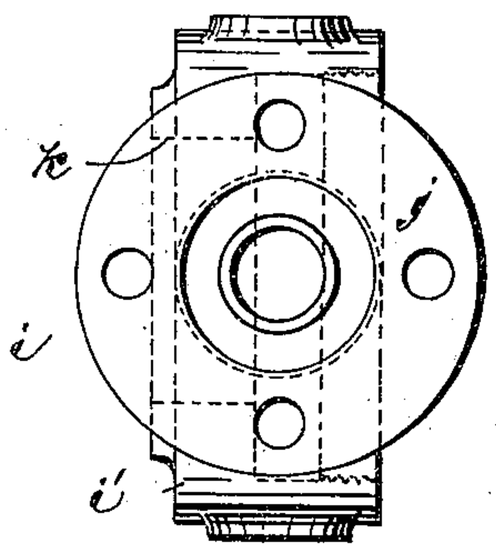

Fig. 2.

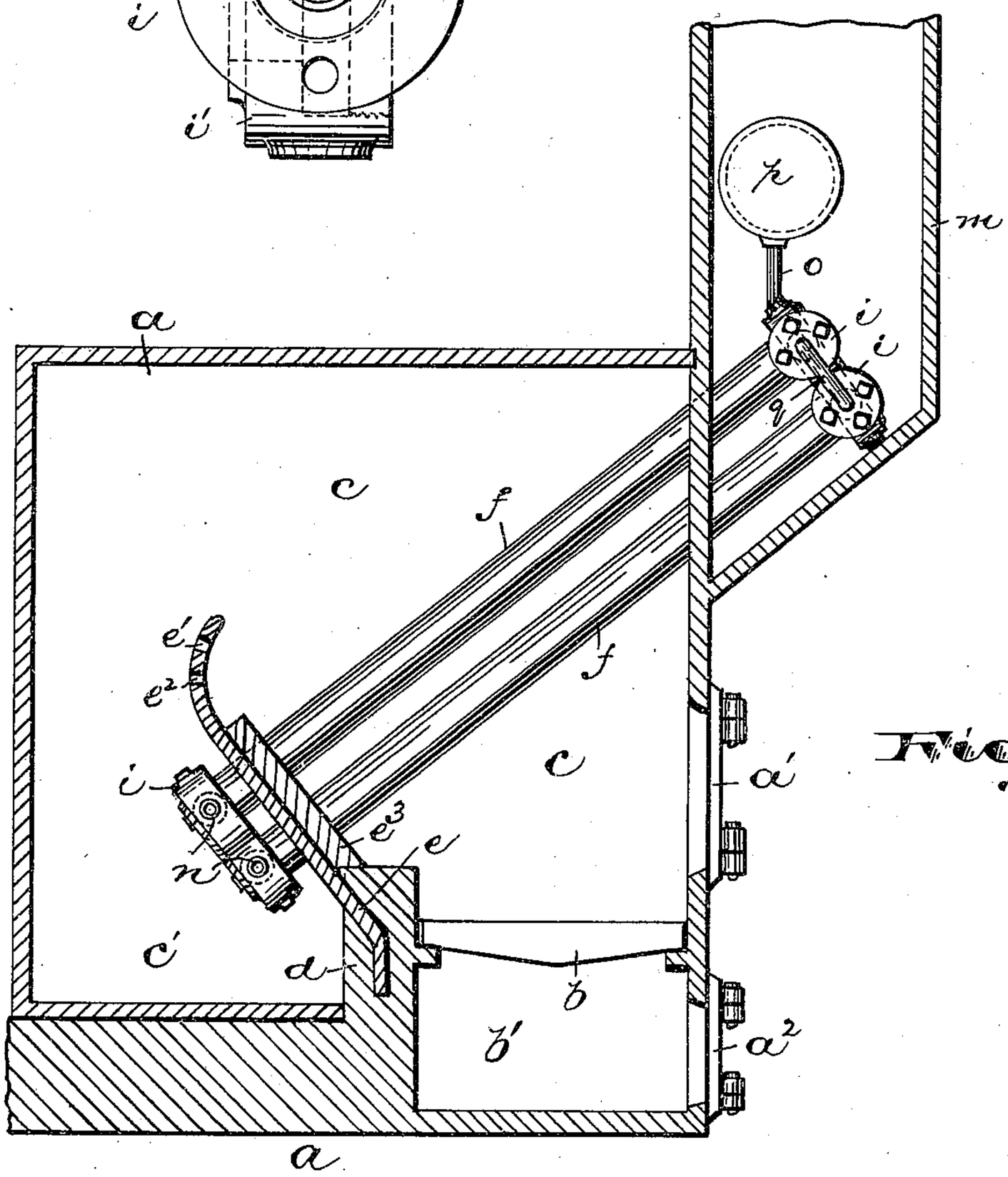

Fig. 1.

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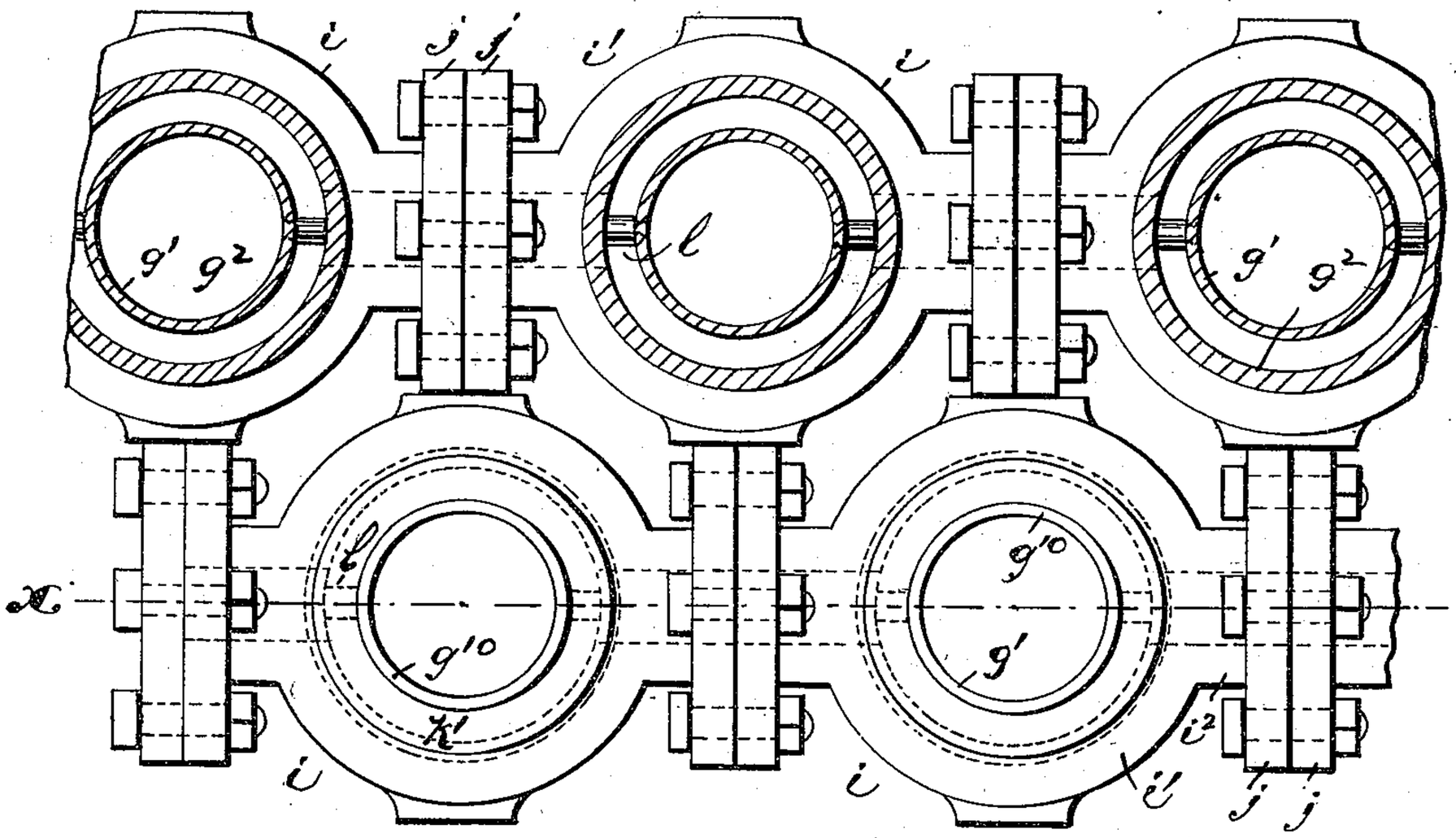

Fig. 3.

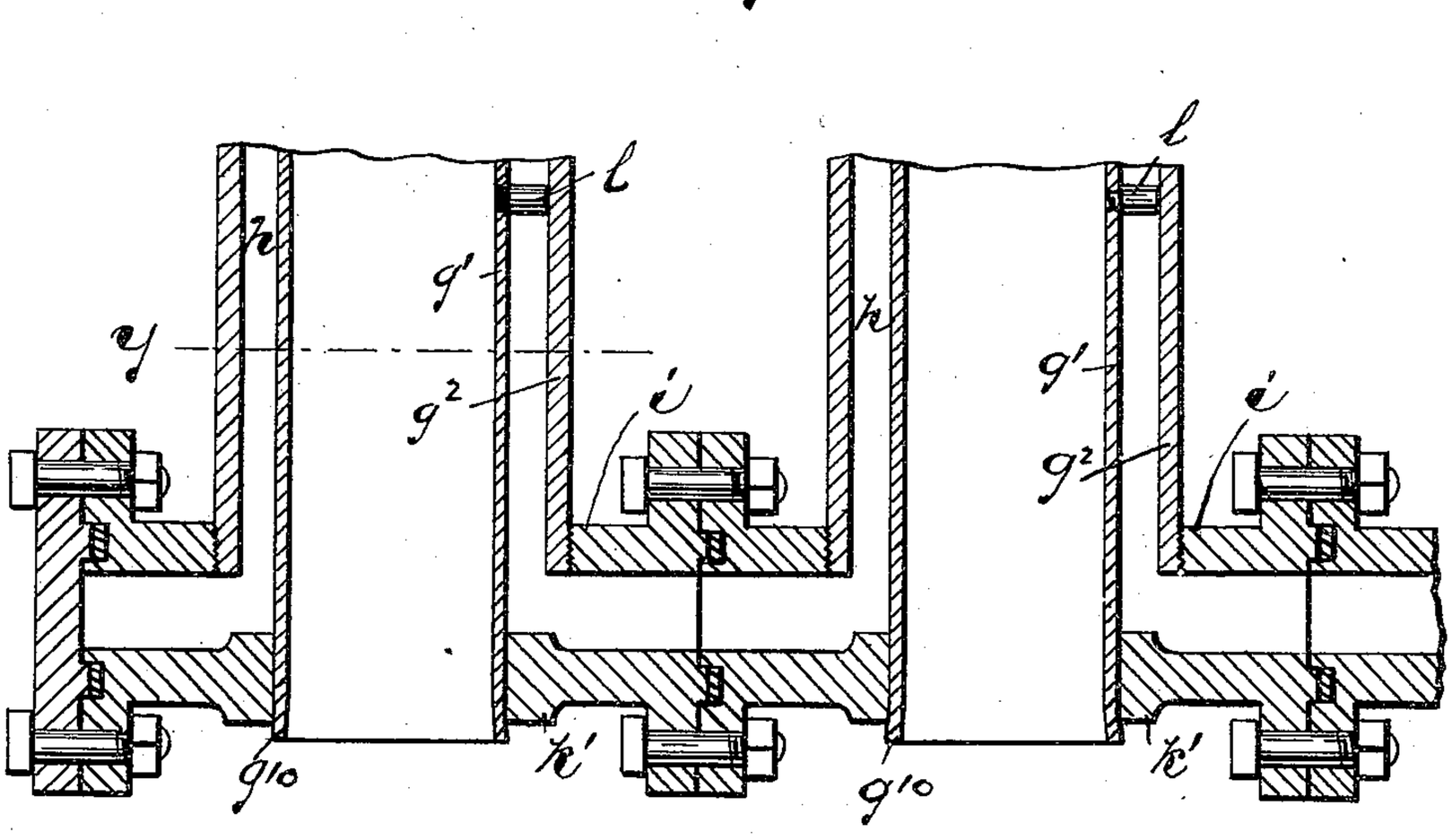

Fig. 4.

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UNITED STATES PATENT OFFICE.

WILLIAM H. HARRISON, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO CHARLES GILBERT FOWLER, OF SAME PLACE.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 646,401, dated March 27, 1900.

Application filed October 11, 1899. Serial No. 733,245. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM H. HARRISON, a citizen of the United States, residing at New York, borough of Manhattan, and State of New York, have invented certain new and useful Improvements in Steam-Generators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

The objects of this invention are to enable steam to be generated with a less expenditure of heat than heretofore, to provide means for generating steam very rapidly and to thus enable a high pressure to be quickly secured, to economize heat, so that a less amount is needed to produce steam, and thus reduce the cost of generation, to diminish the danger of explosions, and to secure other advantages and results, some of which may be referred to hereinafter in connection with the description of the working parts.

The invention consists in the improved steam-generator herein described and in the arrangements and combinations of parts of the same, all substantially as will be hereinafter set forth, and finally embraced in the clauses of the claim.

Referring to the accompanying drawings, in which like letters of reference indicate corresponding parts in each of the several views, Figure 1 is a side view showing a boiler of my improved construction in its preferred form. Fig. 2 is an end view of a certain shoe or connection hereinafter more fully described. Fig. 3 is an end view, partly in section, as on line y, Fig. 4, of a series of tubes forming a generator of my improved construction; and Fig. 4 is a longitudinal sectional view on line x, Fig. 3.

In said drawings, a indicates a furnace with doors a' a^2, and b a grate of any usual construction arranged therein. Said furnace provides a fire-chamber c above said grate b, which chamber also extends back of and somewhat below the level of the grate, as at c', a partition d supporting the grate and separating the ash-pit b' from the downward extension c' of the fire-chamber.

From the top of the partition d an inclined deflector e extends obliquely upward away from the grate b into the fire-chamber c. Said deflector is in direction of its length parallel to the grate and extends the entire width thereof from side to side of the furnace, so that the heat rising from the fire-bed must pass up on the front side of said deflector and over the same and down at the back, as will be hereinafter more fully described. The outer edge of the deflector is preferably curled or bent upward toward the fire-bed, as at e', and this curved portion of the deflector may also be perforated, as at e^2, to allow the passage of a portion of the current of hot air through the deflector instead of all passing out around the extremity thereof. The deflector e serves also as a support for the lower ends of the boiler-tubes f, said tubes being disposed in an inclined or oblique position over the fire-bed, with their lower ends projecting below the deflector e into the lower extension c' of the fire-chamber. The said tubes thus extend above the grate b at a suitable height to receive heat therefrom, being supported near one end by the deflector e, which is perforated to receive them, and at the other end, at a higher point, by the wall of the furnace, into which wall the tubes are built. The heat rising from the fire-bed thus plays around the lower parts of the tubes before passing over the deflector e. Said deflector may be provided at its side next to the fire-bed with a layer e^3 of non-conductive protecting material, such as fire-clay, asbestos, or the like. The tubes are of a peculiar construction, as more clearly shown in Figs. 3 and 4, and next to be described.

Several tubes are grouped together in parallel relation to one another, as is common in boilers, being arranged either in rows or in any other suitable manner. Each one of these tubes f is double or composed of a tube within a tube, the inner one g' being of smaller diameter than the outer g^2, so as to provide an annular water-space h between the two tubes. The inner tube g' is open at its opposite ends and serves as a hot-air flue, the heat

being intended to play around the outer tubes as it arises from the fire-bed and then after being bent downward over the deflector *e* to pass into and up through the inner tubes *g'* to the chimney. The heat thus acts on both surfaces of the water inclosed between the outer and inner tubes, and the comparatively-thin annular column is heated with great rapidity. The ends of the parallel tubes *g' g²* are united, and the annular water-spaces *h* connected by shoes or connecting-pieces *i*, each of which comprises a hollow body portion *i'*, provided with diametrically-opposite tubular ends *i²*, flanged, as at *j*, whereby an impervious joining may be made to the next adjacent shoe after the ordinary manner of connecting pipe-sections. Said ends *i²*, thus described, extend transversely with respect to the boiler-tubes when the parts are in proper relation, and the middle body portion of the shoe is enlarged into a circular or disk shape in a plane perpendicular to the tubes. Said hollow disk-like body is then apertured at the side adjacent to the tubes, so that the end of the outer tube *g²* may be tightly screwed or otherwise fitted into said aperture. The inner tube *g'* extends across the interior chamber of the shoe and is fitted into a perforation *k* at the farther side, the extremity of the tube being expanded outwardly against the shoe, as at *g¹⁰*, as is common to secure an impervious fit. Each double tube is provided at its end with one of these shoes *i*, and adjacent shoes are then connected together, so that communication is established between the annular water-chambers of the tubes, as will be understood.

It will be understood that the ends of the tubes *g' g²* may be inserted into the shoe *i* and a tight fit secured in any manner common to the art other than the way shown. For instance, rivets may be passed through the tube *g'* and the rib *k'* on the shoe, and a similar rib may be provided for the tube *g²*.

Stays *l* are provided in the annular water-chamber *h* at about the middle of the length of the tubes to hold said tubes more firmly in their relative positions.

The series of tubes *f* after passing through the wall of the furnace extend into the chimney *m*, which provides a draft to carry off the gases and products of combustion which escape from the upper ends of the tubes.

Inlet-pipes *n* for supplying water to the generator are provided at the lowest end of the collection of tubes in any suitable manner, and outlet-pipes *o*, at the top and in the chimney *m*, permit the escape of steam to a steam dome or chamber *p*. Suitable connecting-nipples *q* are employed to provide communication between the end shoes of upper and lower series of tubes.

It will be evident that instead of having the outer and inner tubes *g'* and *g²* axially coincident, as shown, I may under some conditions arrange them eccentrically with reference to one another, so that a greater body of water is obtained on the side next the fire than on the opposite side. Again, if desired, one or both of the outer and inner tubes may be made of irregular cross-sectional shape, instead of regularly cylindrical, so as to secure a greater extent of surface presented to the heat. Other variations and modifications may also be made without departing from the spirit and scope of the invention, and I do not wish to be understood as limiting myself by the positive descriptive terms employed excepting as the state of the art may require.

Having thus described the invention, what I claim as new is—

1. The combination with a furnace providing a heat-chamber, and a chimney providing an independent flue separated from said heat-chamber by a partition, of a series of inclined double tubes arranged in said furnace-chamber and extending at their upper ends through the said partition into the chimney-flue, said tubes each comprising an inner and an outer tube forming an annular water-space between and an open central passage, a steam-dome arranged in said chimney, means for connecting the annular water-spaces of said tubes to one another and to said steam-dome, and a fire-grate arranged in said furnace-chamber beneath the inclined tubes and a deflecting-plate, whereby the entire heated currents rising from the grate are compelled to pass upward among said double tubes and then bend downward and escape through the central passages of the tubes into the chimney, where they warm the said steam-dome in escaping, substantially as set forth.

2. The combination of the furnace *a*, having the grate *b*, the chimney *m*, separated from the furnace-chamber by a partition, a deflecting-plate *e*, at one side of said grate, a series of double tubes arranged in an inclined position over said grate and being supported near their lower ends in said deflecting-plate and near their upper ends in said partition between the furnace and chimney and extending beyond said partition into the chimney, said tubes each providing a closed annular water-chamber and an open central passage, means for connecting said annular water-chambers at the lower ends of the tubes and at the extreme upper ends within the chimney, a steam-dome within said chimney and connected to said water-chamber, and a grate beneath said tubes between their points of support, substantially as set forth.

3. The combination with a closed furnace, inclined double tubes having their lower portions within said furnace, said tubes each providing an annular water-space and an open central passage leading to the chimney, and a fire-grate arranged beneath said tubes, of a deflecting-plate *e*, inclined upwardly away from the side of said grate and supporting the lower ends of the inclined tubes, the cen-

tral passages of said tubes opening at the under side of said deflecting-plate, and said plate extending upward beyond the tubes and being adapted to cause the currents from the fire-bed to pass among the inclined tubes before escaping through the central passages of said tubes, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 20th day of September, 1899.

WILLIAM H. HARRISON.

Witnesses:

CHARLES H. PELL,

C. B. PITNEY.