

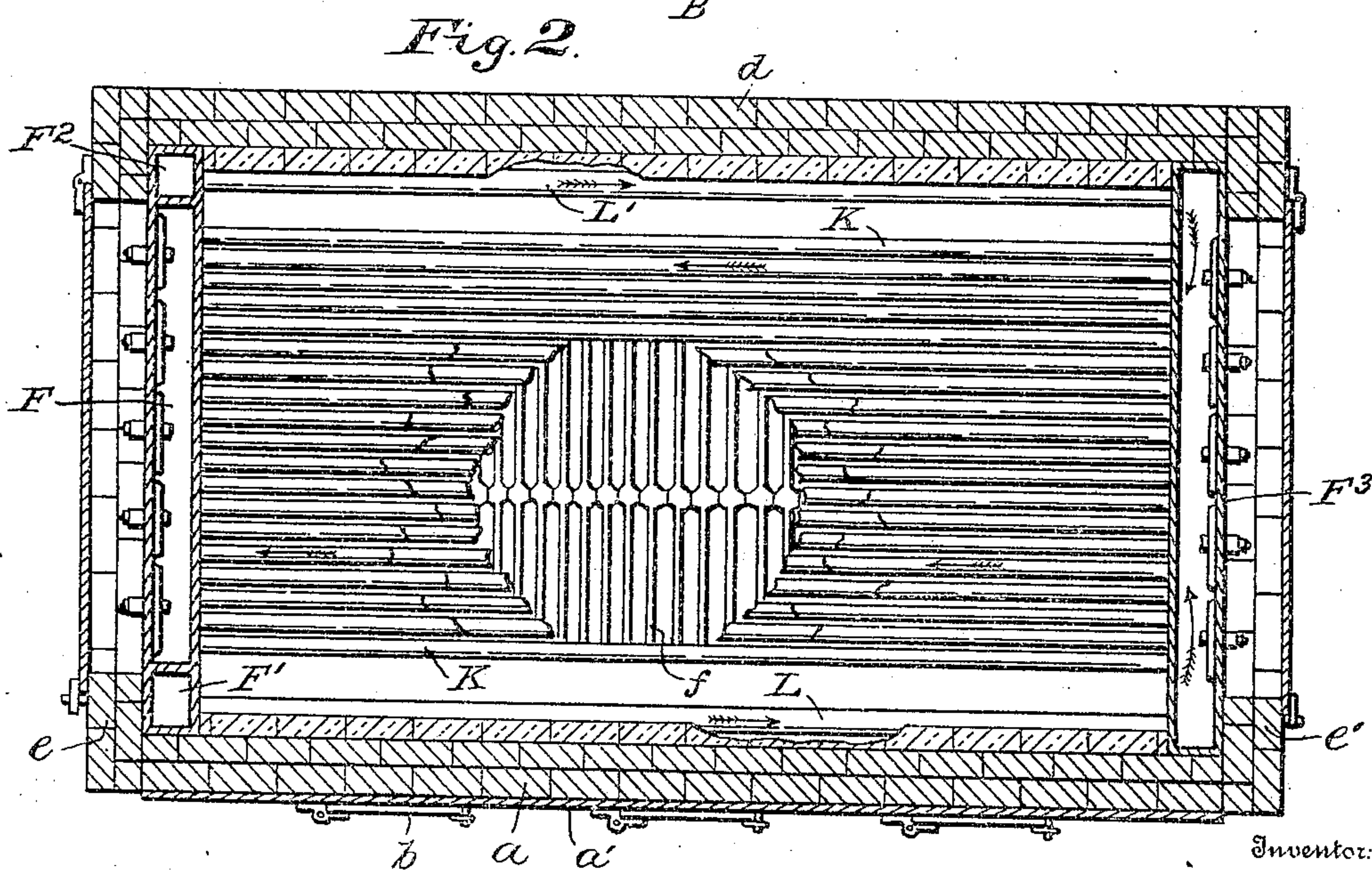
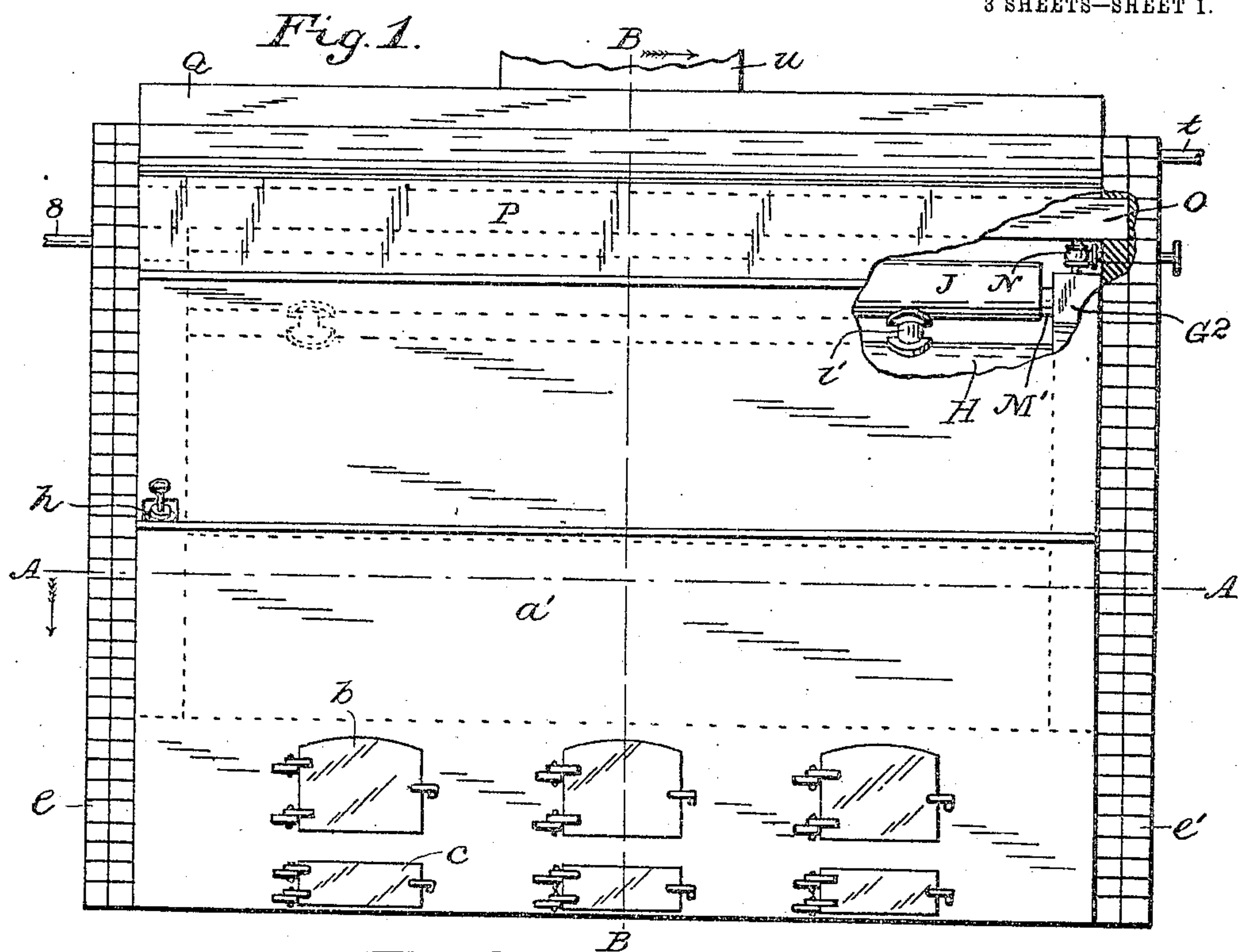
No. 835,597.

PATENTED NOV. 13, 1906.

I. H. BOYER.
STEAM PRODUCER.

APPLICATION FILED JAN. 12, 1906.

3 SHEETS—SHEET 1.



Witnesses:

Wm. Thompson
Stella Snider.

Isaac H. Boyer,
By

E. J. Silvius.

Attorney.

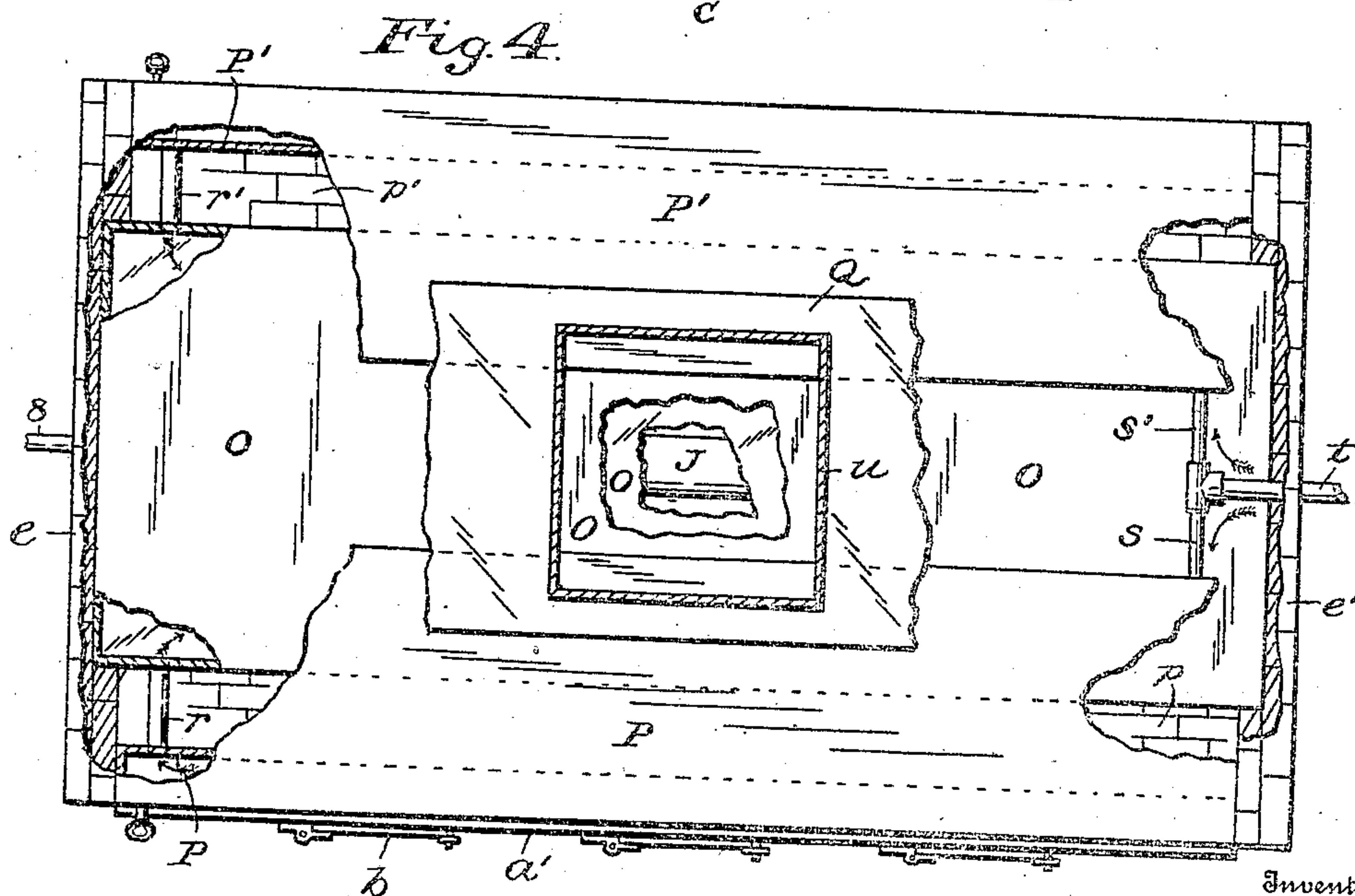
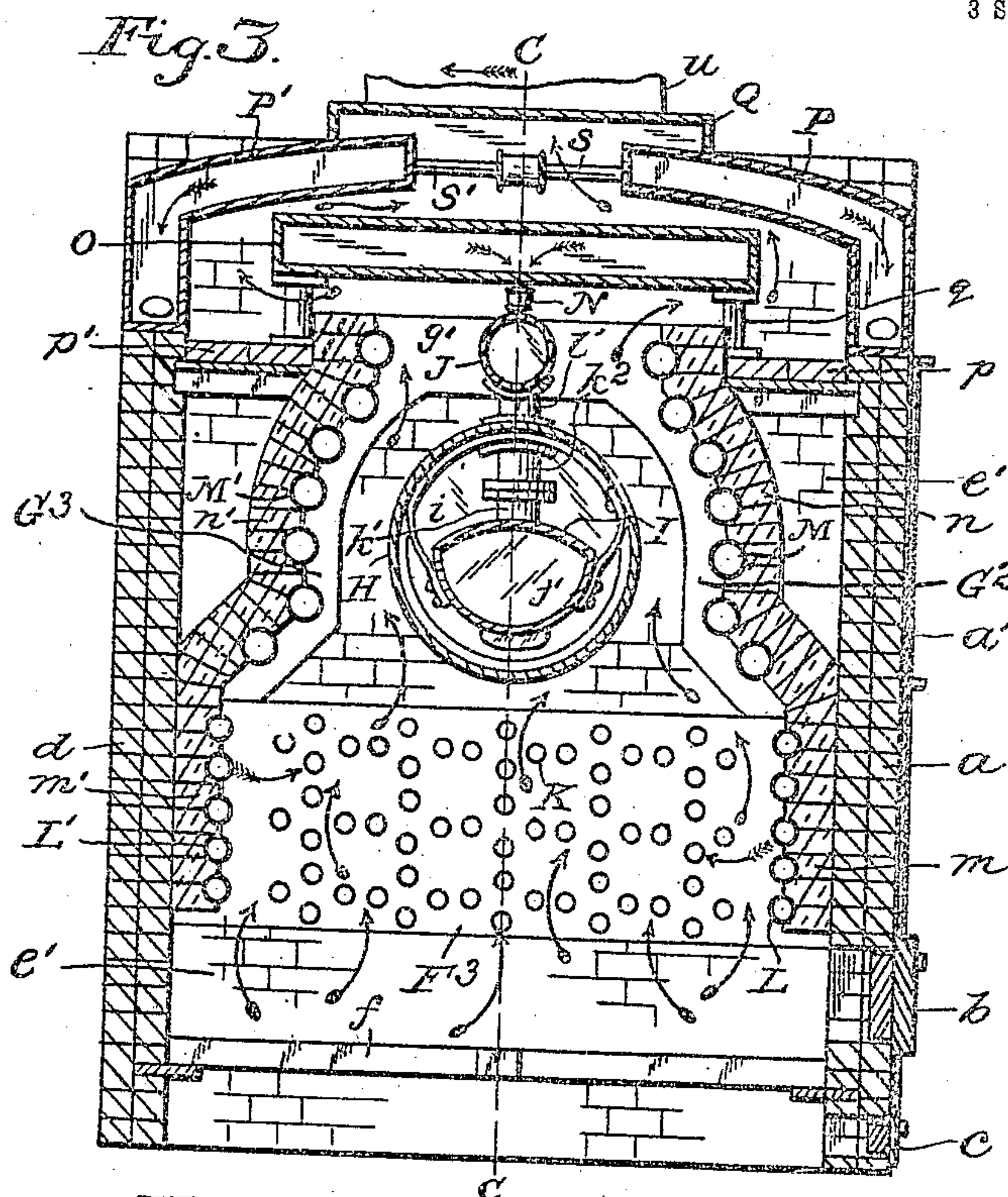
No. 835,597.

PATENTED NOV. 13, 1906.

I. H. BOYER.
STEAM PRODUCER.

APPLICATION FILED JAN. 12, 1906.

3 SHEETS—SHEET 2.



Witnesses:

Wm. Thompson
Stella Snider.

Isaac H. Boyer,
By

C. J. Silvius,
Attorney.

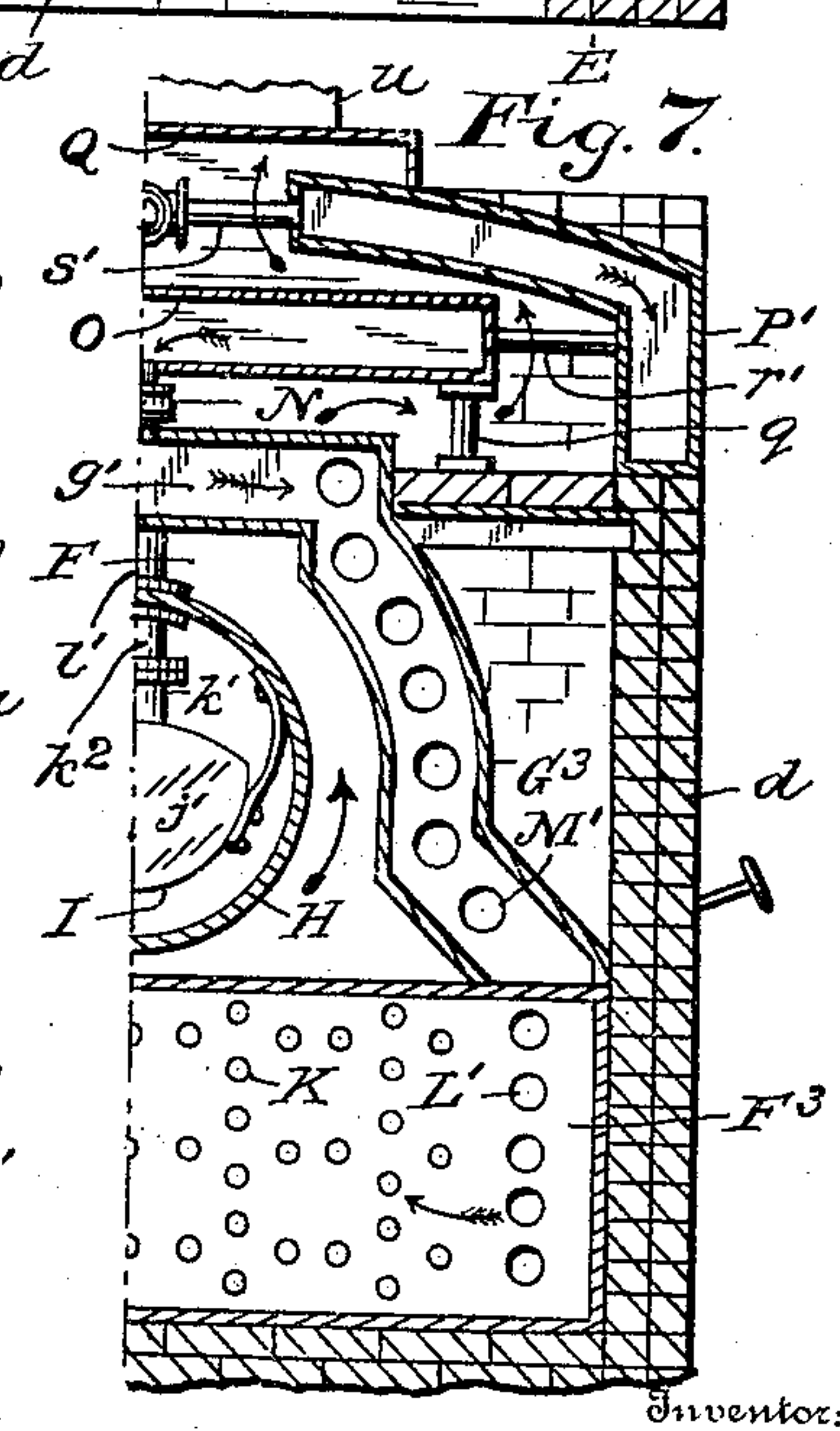
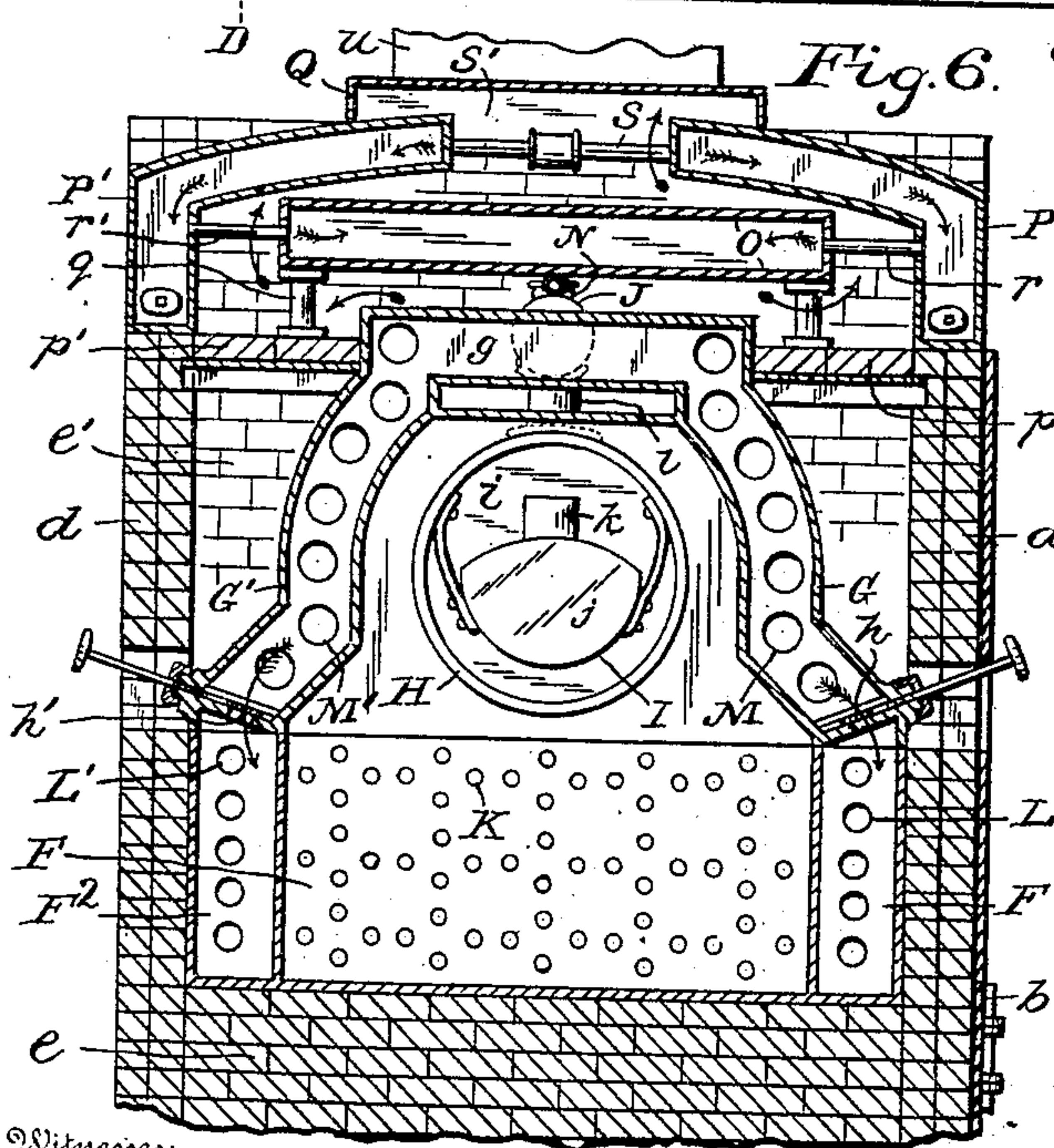
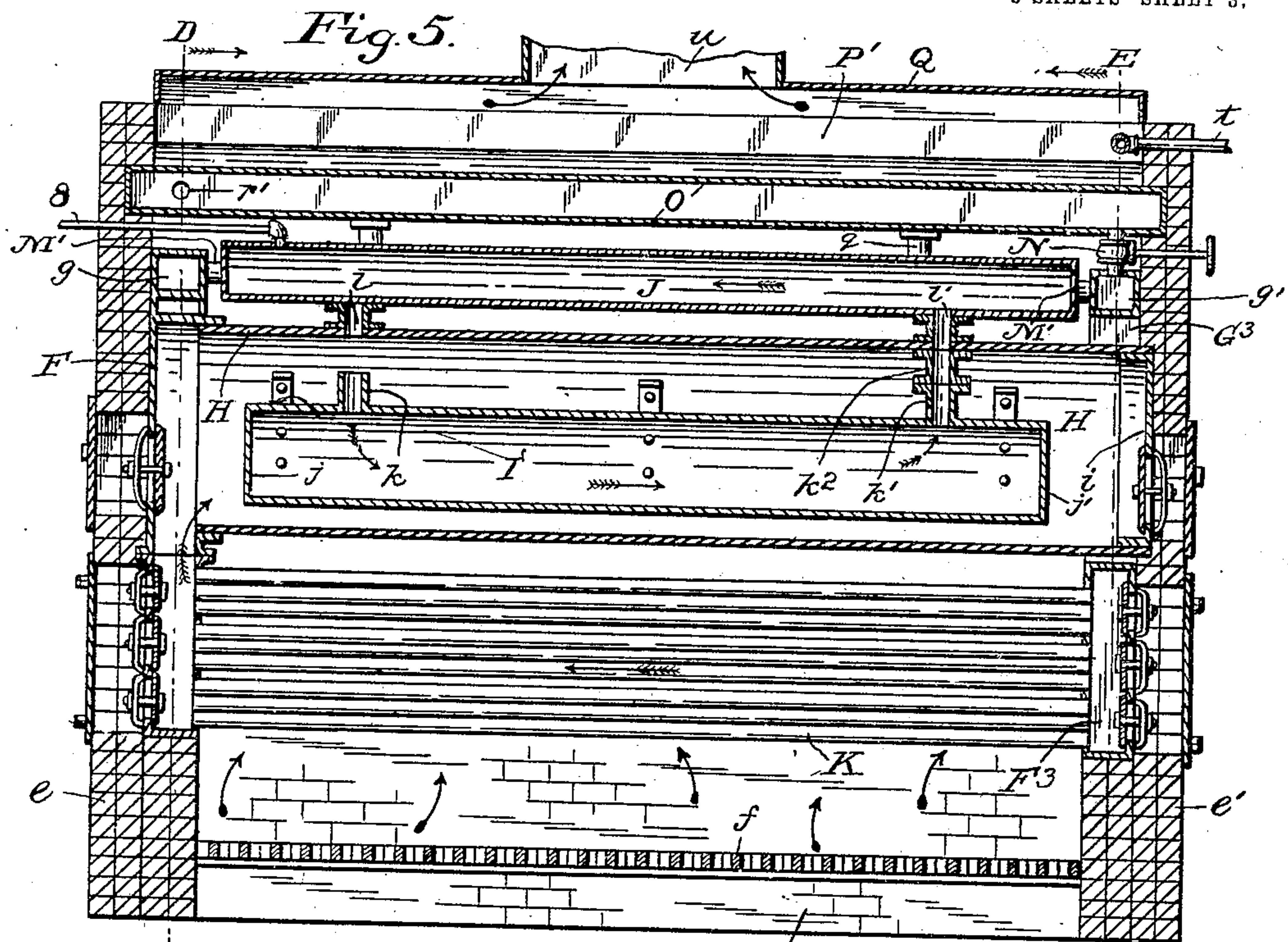
No. 835,597.

PATENTED NOV. 13, 1906.

I. H. BOYER.
STEAM PRODUCER.

APPLICATION FILED JAN. 12, 1906.

3 SHEETS—SHEET 3.



Witnesses:

Wm. Thompson
Stella Snider.

Inventor:
Isaac H. Boyer,
By
E. J. Silvius,
Attorney.

UNITED STATES PATENT OFFICE.

ISAAC H. BOYER, OF MUNCIE, INDIANA.

STEAM-PRODUCER.

No. 835,597.

Specification of Letters Patent.

Patented Nov. 13, 1906.

Application filed January 12, 1906. Serial No. 295,711.

To all whom it may concern:

Be it known that I, ISAAC H. BOYER, a citizen of the United States, residing at Muncie, in the county of Delaware and State of Indiana, have invented new and useful Improvements in Steam-Producers; and I do declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to apparatus whereby steam may be produced from water by the consumption of fuel, the invention having reference particularly to various features and the relative arrangement thereof in the construction of the apparatus.

Objects of the invention are to provide an improved compact construction generally in steam-producers, particularly in the evaporators or boilers thereof, and to provide improved facilities in steam-producers for heating the feed-water for making steam conveniently to a high degree during its progress to the evaporator or boiler where it is to be converted into steam by means of previously utilized heat from the furnace of the apparatus without requiring the consumption of any fuel in excess of what may be required for raising the water to the boiling-point after having already been heated to a high degree.

Another object of the invention being to provide an advantageous construction and arrangement of superheater, all to the end that steam may be produced of dry quality and with the minimum amount of fuel consumed, while at the same time in a measure lessening the loss and nuisance arising from smoke escaping from the furnace.

The above-mentioned and other objects are attained in the present invention, which consists of a steam-producer having certain novel features of construction in respect to the furnace, the evaporator and its appurtenances, the primary heating apparatus, and the superheater thereof; and the invention consists, further, in the parts and the combinations and arrangements of parts, as hereinafter particularly described, and referred to in the appended claims.

Referring to the drawings, Figure 1 is a front elevation of the improved steam-producer, external portions of which are broken away to disclose internal parts; Fig. 2, a horizontal sectional view on the line A A in Fig. 1, parts being broken away to disclose parts

in lower planes; Fig. 3, a transverse sectional view on the line B B in Fig. 1; Fig. 4, a top plan view in which parts are broken away exposing internal parts; Fig. 5, a longitudinal vertical sectional view, as on the line C C in Fig. 3; Fig. 6, a transverse sectional view, as on the line D D in Fig. 5, the lower portion being broken away; and Fig. 7, a fragmentary half-section, as on the line E E in Fig. 5.

Similar reference characters in the different figures of the drawings designate corresponding elements or features.

In construction the apparatus comprises a front wall *a*, having an ornamental front *a'* and a suitable number of furnace-doors *b* and ash-pit doors *c*, there being suitable openings in the wall at the doors, a rear wall *d*, and side walls *e* and *e'*, the four walls forming a furnace structure in which are suitable grates *f*. The walls are sufficiently high to inclose the principal elements of the apparatus, and firebrick linings are used where needed. Also suitable doorways and doors are provided, where found desirable, for gaining access to parts inclosed by the walls.

A main water-head *F* is arranged at the side wall *e* somewhat higher than the grates *f* and extends upwardly a considerable distance for purposes which will further appear. A narrow water-head *F'* is arranged between a lower end of the water-head *F* and the front wall *a*, and a narrow water-head *F''* is arranged between the other lower end of the water-head *F* and the rear wall *d*. The three water-heads together extend approximately from the front wall *a* to the rear wall *d*, and the water-heads may be suitably attached one to another structurally. A main water-head *F'''* is arranged at the opposite side wall *e'* and extends approximately from the front wall *a* to the rear wall *d*, being equal in length to the water-heads *F*, *F'*, and *F''* together and as deep vertically as the water-heads *F'* or *F''*. A pair of narrow curved water-heads *G* and *G'* are connected together by a water-head *g*, and they together extend over or straddle the upper part of the water-head *F* and may be suitably attached thereto structurally, the lower ends of the water-heads *G* and *G'* being connected and in communication with the upper ends of the water-heads *F'* and *F''*, respectively, there being regulating-valves *h* and *h'* arranged, respectively, between the water-heads *G* and *F'* and the water-heads *G'* and *F''* by which communications may be closed when desired. A pair of

curved narrow water-heads G^2 and G^3 are connected together by a water-head g' and together are similar to the water-heads G , G' , and g , but the water-heads G^2 and G^3 are closed at their lower ends and are supported upon the water-head F^3 , and may, if desired, be formed as structural parts thereof.

A tubular evaporator H has one end thereof attached to the inner wall of the upper portion of the water-head F , being in communication therewith, and its end is arranged between the water-heads G and G' , the other end of the evaporator having a head i closing the end, which is supported by the side wall e' between the water-heads G^2 and G^3 , the evaporator therefore extending longitudinally parallel to the front and rear walls a and d and midway between them and directly above the grate area.

A steam-drum I , combining in its functions a receptacle or passage for steam and also a water divider, is suitably supported in the evaporator, so as to be shifted therein in order to remove scales or deposits, and the drum is preferably formed as a tube slightly flattened at its upper side, the lower side being semicircular and curved concentrically to the under side of the tubular evaporator H , so that a relatively shallow body only of water may be held on the bottom of the evaporator. The ends of the drum are closed by heads j and j' and a suitable number of stand-pipes k k' extend upwardly from the top of the drum, affording steam-passages between the drum and the upper portion of the evaporator, the stand-pipes preventing water, at the usual level in the evaporator, from entering the drum; but if the drum be made circular or so as to approach near to the top of the evaporator apertures only may be provided in the top of the drum without the stand-pipes.

A superheater J , formed, preferably, as a drum, in which steam may be subjected to the drying and heating effects of the furnace-heat is arranged above the evaporator on a saddle l and connected therewith by a saddle-pipe l' , which provide support for the superheater and communication with the steam-drum directly above the stand-pipe k' by means of a removable pipe k^2 . An outlet-pipe 8 is connected to the superheater for conducting steam therefrom.

A series of primary heating-tubes K are connected to the water-head F^3 , and also to the lower part of the water-head F , thus extending horizontally through the furnace somewhat above the grates thereof and below the plane of the bottom of the evaporator H . The tubes afford ducts for the passage of water from the water-head F^3 to the water-head F , from the upper part of which the water may enter the evaporator. A series of primary heating-tubes L are connected to the water-head F' and also to the water-

head F^3 , and a series of similar tubes L' are connected to the water-head F^3 and also to the water-head F^2 , the tubes L and L' affording ducts for the passage of water from the water-heads F' and F^2 , respectively, to the water-head F^3 .

A series of heating-tubes M are connected to the water-heads G and G^2 , and a series of like tubes M' are connected to the water-heads G' and G^3 , the tubes providing ducts for water from the water-heads G^2 and G^3 to the water-heads G and G' , the water-head g affording free circulation and equality of pressure in the two series of tubes, and the water may be fed into the water-head g' through a regulating-valve N from any suitable source. Fire-brick linings m m' n n' afford means for reflecting heat to the sides of the heating-tubes that are near the front and rear walls of the furnace.

The above-described construction may in some cases be provided with a draft-flue and chimney and will alone give good results but in order to obtain the value of the heat to the fullest extent additional primary heating apparatus is provided and preferably employed in construction, comprising a shallow closed tank O , that is mounted above the superheater J on the side walls e and e' and partially supported by bridge-walls p and p' and posts q thereon, the tank having connection with the regulating-valve N . The tank is broader than the opening that is provided between the tops of the linings n and n' . Two arch-tanks P and P' are mounted on the front and rear walls a and d , respectively, and extend upwardly to suitable heights and inwardly one toward the other above the tank O , there being spaces provided for draft-passages, the ends of the arch-tanks being supported by the side walls e and e' . A hood Q is arranged upon the tops of the arch-tanks and provided with a chimney connection u . At the opposite end of the tank O to that which is connected with the valve N a duct r is connected to the tank and to an end of the tank P , and a duct r' is connected also to the tank O and to an end of the tank P' for the delivery of water to the tank O , from which the water may be fed through the valve N . The opposite ends of the tanks P and P' are connected by branch pipes s and s' of a feed-pipe t , that may be supplied with water from any suitable source, as from a pump or injector. The ducts r and r' are arranged somewhat higher than the bottoms of the tanks P and P' , so that the tanks serve to collect sediment from the water, and thus prevent excessive deposits in the evaporator and primary heating-tubes and in the water-heads, and the sediment may be readily removed through suitable wash-out holes.

From the foregoing description of construction it will be apparent that the primary heating-tubes L and L' form parts of

facings of the front and rear walls of the furnace and that the tubes M and M' form parts of the upper walls of the furnace and the heat-passages at the front and rear of the evaporator being thus conveniently and advantageously arranged to be exposed to the direct effects of the furnace heat without detracting from the value of the heat that is to be generated, essentially, for application to the evaporation or conversion of the water in the evaporator into steam.

The herein-described type of steam-producer is well adapted to limited ground-space and, with suitable wall-braces, for use in water craft.

It will be understood that the outer surfaces of the superheater J and the upper portion of the shell of the evaporator H may be suitably protected against being overheated by the flames from the furnace and that a safety-valve and a water-gage and steam-gage will be provided, as is customary. Also that suitable stay-bolts and braces are to be provided where required. If desired, the connecting-pipe k^2 may be removed.

In practical use the feed-water is to be supplied through the inlet-pipe t , and when the water flows through the course heretofore indicated and rises in the evaporator H to a suitable height—as, for instance, so as to fill the shallow space under the steam-drum therein—the flow of water should be stopped by the valves h and h' , and thereafter the proper water-level should be maintained in the evaporator by manipulation of the valves, and the valve N may be used as occasion may require for either stopping or regulating the flow of feed-water. A fire being started in the furnace the flames and heat will rise between the tubes K throughout their lengths from the water-head F to the water-head F³, raising the temperature of the water therein nearly to the boiling-point, so that the hot water after entering the narrow space between the drum I and the bottom of the evaporator-shell will be rapidly raised to the boiling-point and converted into steam, which will rise and fill the superheater J by the way of the drum I through the pipes k and k' , through the pipe k of which the steam may also escape from the drum if its temperature becomes greater than that of the steam at the sides and above the drum, the drum serving to dry the steam before it rises to the superheater through the pipes k' , k^2 , and l' . The different arrows indicate the courses of the water circulation and the draft from the furnace to the chimney, and it will be observed that the waste heat will begin to heat the feed-water in the tanks P and P', and the temperature of the water will increase in the tank O and, further, in the primary heating-tubes, the hotter water above the valves h and h' of course rising at first until the whole volume above the valves becomes equal in

temperature and serving to rapidly heat the incoming feed-water, so that the water will already have a high temperature when fed through the lower regulating-valves h and h' , all effected by heat that must be produced and cannot be entirely absorbed by the water in the evaporator, the linings n and n' necessarily receiving and reflecting some of the waste heat, forming, as they do, the necessary walls of the heat-passages.

It will be observed that the lower portions of the walls n and n' and the water-heads G, G', G², and G³ are sloping, so as to deflect the heat toward the bottom of the evaporator H, and the walls and water-heads are curved at their upper portions, so as to deflect the heat toward the superheater as the heat approaches the tank O to pass around the sides thereof through the opening between the top parts of the tanks P and P' into the hood Q.

Having thus described the invention, what is claimed as new is—

1. A steam-producer including a furnace having a front wall, a rear wall, a pair of main water-heads forming parts of opposing side walls, a pair of relatively narrow water-heads at opposite ends of one of the main water-heads and having heating-tubes connected thereto and also to the opposite main water-head and extending along the front and rear walls, an evaporator connected to the main water-head that is between the narrow water-heads, and heating-tubes connected to both of the main water-heads.

2. A steam-producer including a furnace having a front wall and a rear wall, a pair of main water-heads of unequal height and horizontal length forming parts of end walls, a pair of relatively narrow water-heads at opposite ends of the horizontally-shorter one of the pair of main water-heads, a series of heating-tubes connected to the pair of main water-heads, heating-tubes connected to the relatively narrow water-heads and also to the horizontally-longer one of the main water-heads, inlet-valves connected to the tops of the narrow water-heads, an evaporator connected to the taller one of the main water-heads, and opposing curved walls extending from the front and rear walls toward and partially over the evaporator and terminating above the plane of the top of the evaporator.

3. A steam-producer including a front wall and a rear wall, a pair of main water-heads of unequal height and horizontal length forming parts of end walls, a pair of relatively narrow water-heads at opposite ends of the horizontally-shorter one of the main water-heads, a series of heating-tubes connected to the pair of main water-heads, heating-tubes connected to the relatively narrow water-heads and also to the horizontally-longer one of the main water-heads, an evaporator connected to the taller one of the main water-

heads, inlet-valves connected to the tops of the narrow water-heads, walls opposite to the evaporator and therewith forming heat-passages to the top from the bottom thereof, a water-divider in the evaporator, a superheater connected with the evaporator and having connection with the water-divider, and a chimney connection in communication with the heat-passages.

4. A steam-producer including a furnace, an evaporator mounted above the furnace with heat-passages extending from the furnace at opposite sides of the evaporator and above the top thereof, a superheater having communication at one end thereof with the evaporator, a steam-outlet pipe connected to the superheater, a steam-drum supported in the evaporator and having communication therewith near the communication between the superheater and the evaporator, and a duct connecting the steam-drum with the superheater and extending through the wall of the evaporator, the evaporator having a water-supply passage communicating therewith, and there being a draft-duct in communication with the heat-passages.

5. A steam-producer including a furnace having heating-tubes against the inner faces thereof, water-heads connected to the heating-tubes, an evaporator mounted above the furnace with heat-passages extending from the furnace at opposite sides of the evaporator and above the top thereof, the passages having walls provided on the inner faces thereof with heating-tubes, separate water-heads connected to the heating-tubes of the walls of the heat-passages and also having communication with the first-mentioned water-heads, a primary heating-tank mounted above the evaporator and extending over the heat-passages forming the top of a flue, a water-inlet connected to the tank, a duct extending from the tank to the water-heads, a duct extending from the water-heads to the evaporator, and a draft-passage extending from the heat-passages under the tank.

6. A steam-producer including a furnace, an evaporator mounted above the furnace with heat-passages extending from the furnace at opposite sides of the evaporator and above the top thereof, a superheater connected operatively with the evaporator, a steam-outlet pipe connected to the superheater, a primary heating-tank mounted above the superheater and extending over the heat-passages forming the top of a flue, a draft-passage continuing from the heat-passages, a water-inlet connected to the tank, a duct extending from the tank to the evaporator, and a valve in the duct.

7. A steam-producer including front and rear furnace-walls, a pair of main water-heads forming parts of end walls of the fur-

nace, an evaporator connected to one of the water-heads in communication therewith, two pairs of connected upright curved water-heads extending above the plane of the top of the evaporator at opposite ends thereof and having heating-tubes connected therewith, walls between the pairs of curved water-heads, an inlet-pipe connected with one of the pair of curved water-heads, and a water-duct communicating with the other one of the pair of curved water-heads and also with one of the main water-heads and provided with a regulating-valve.

8. A steam-producer including a furnace, an evaporator mounted above the furnace with heat-passages extending from the furnace at opposite sides of the evaporator and above the top thereof, a superheater connected operatively with the evaporator, a steam-outlet connected to the superheater, a primary heating-tank mounted above the superheater and extending over the heat-passages forming the top of a flue, a pair of arch-tanks at opposite sides of the primary heating-tank and extending partially over the top thereof with flues between the primary heating-tank and the arch-tanks, inlet-pipes connected to the arch-tanks, ducts between the arch-tanks and the primary heating-tank, and a duct between the primary heating-tank and the evaporator provided with a regulating-valve.

9. A steam-producer including a furnace comprising front and rear furnace-walls, a pair of main water-heads at opposite sides of the furnace of unequal height and horizontal length, the taller one being horizontally the shorter one of the pair, a pair of relatively narrow water-heads at the ends of the shorter one of the pair of main water-heads, a series of heating-tubes connected to the pair of main water-heads, a series of heating-tubes connected to one of the narrow water-heads and also to the longer one of the main water-heads, a series of heating-tubes connected to the other one of the narrow water-heads and also to the longer one of the main water-heads, a pair of connected upright curved water-heads straddling the taller one of the main water-heads and connected with the pair of narrow water-heads and provided with regulating-valves, a pair of connected upright curved water-heads mounted upon the longer one of the pair of main water-heads, heating-tubes connected with both pairs of upright curved water-heads, and an evaporator connected to the taller one of the main water-heads.

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

ISAAC H. BOYER.

Witnesses:

WM. C. THOMPSON,
E. T. SILVIUS.