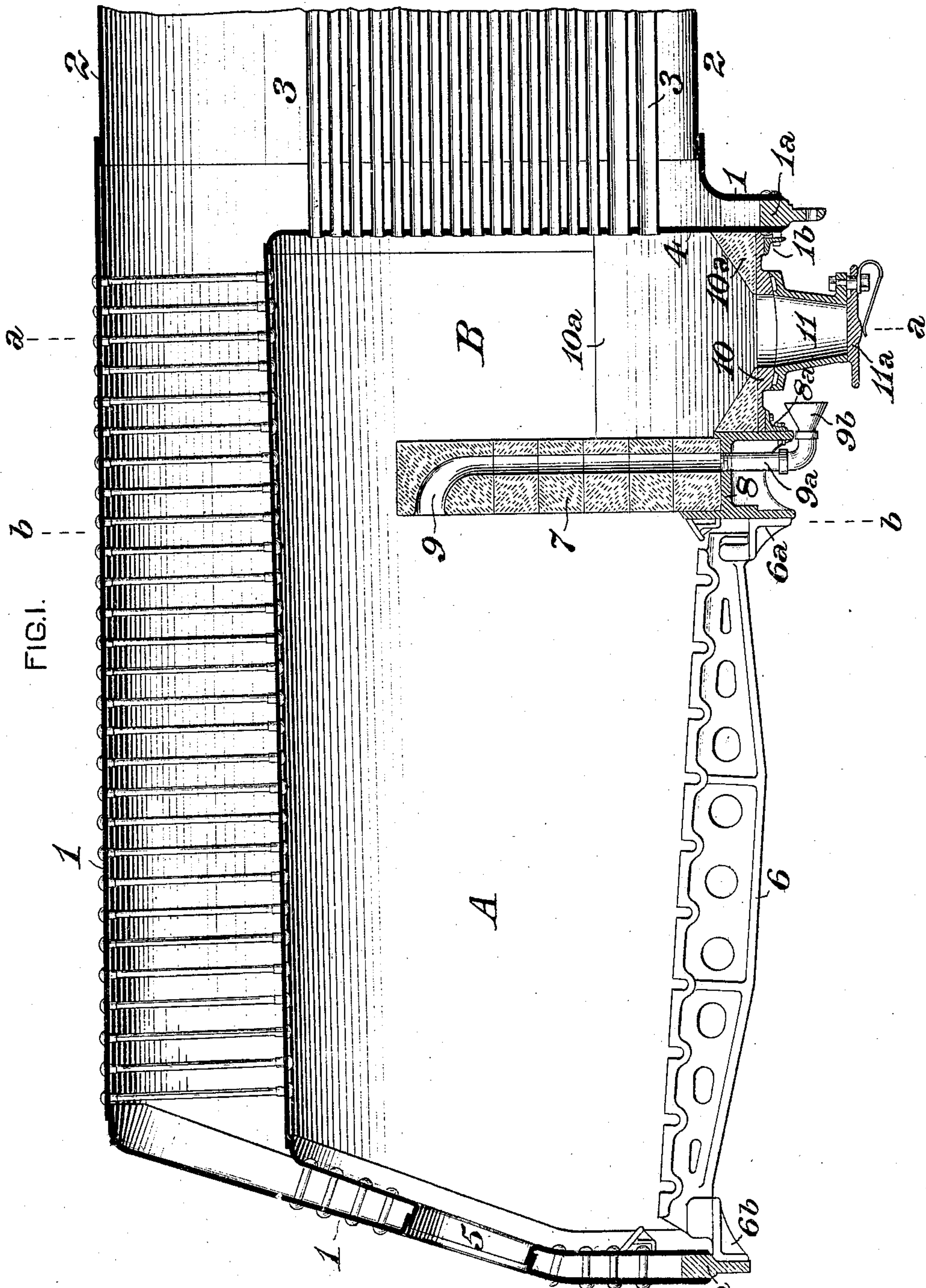


F. F. GAINES.  
LOCOMOTIVE BOILER FURNACE.  
APPLICATION FILED APR. 10, 1909.

934,157.

Patented Sept. 14, 1909.

2 SHEETS—SHEET 1.



WITNESSES

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FIG. 3.

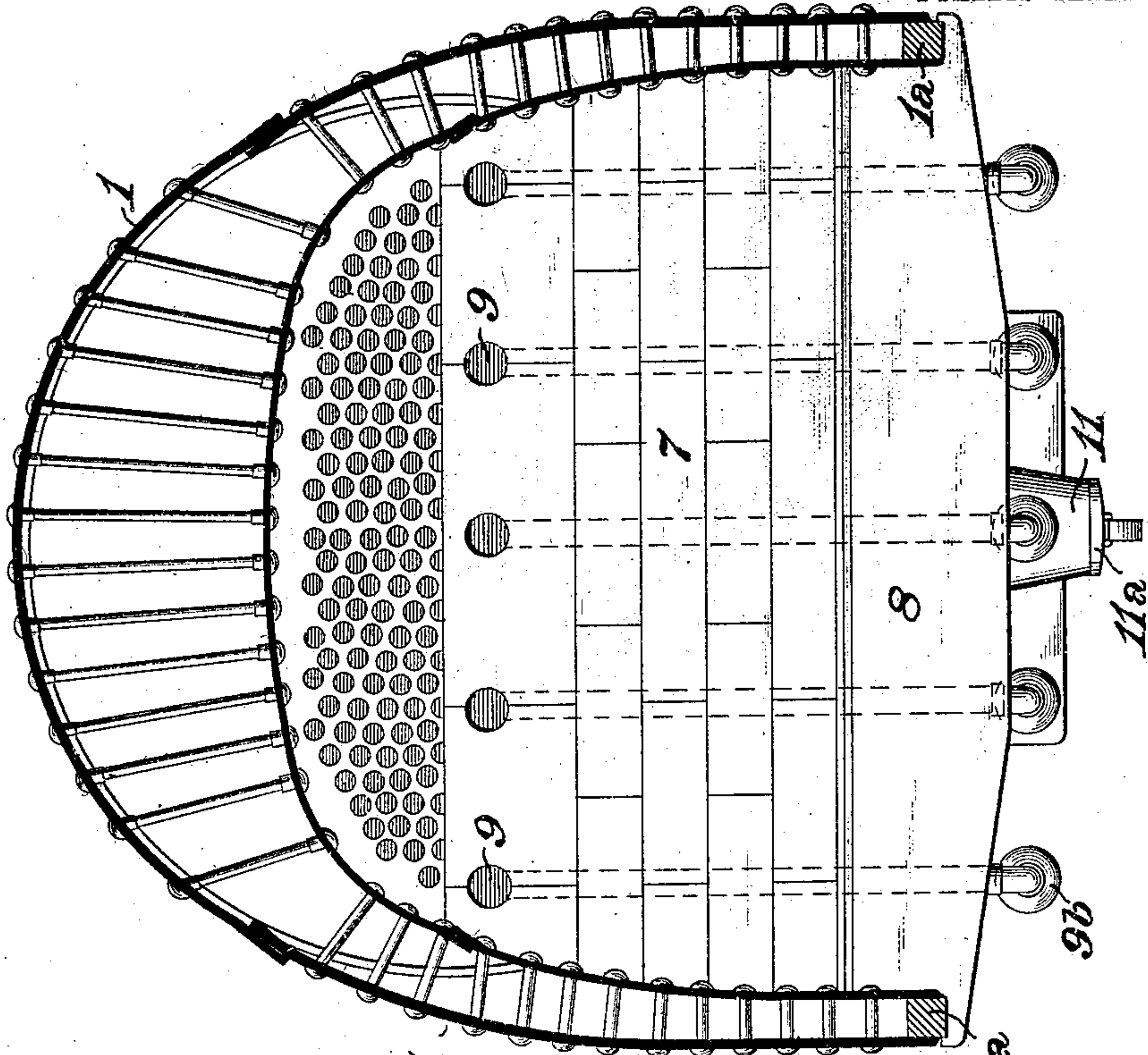
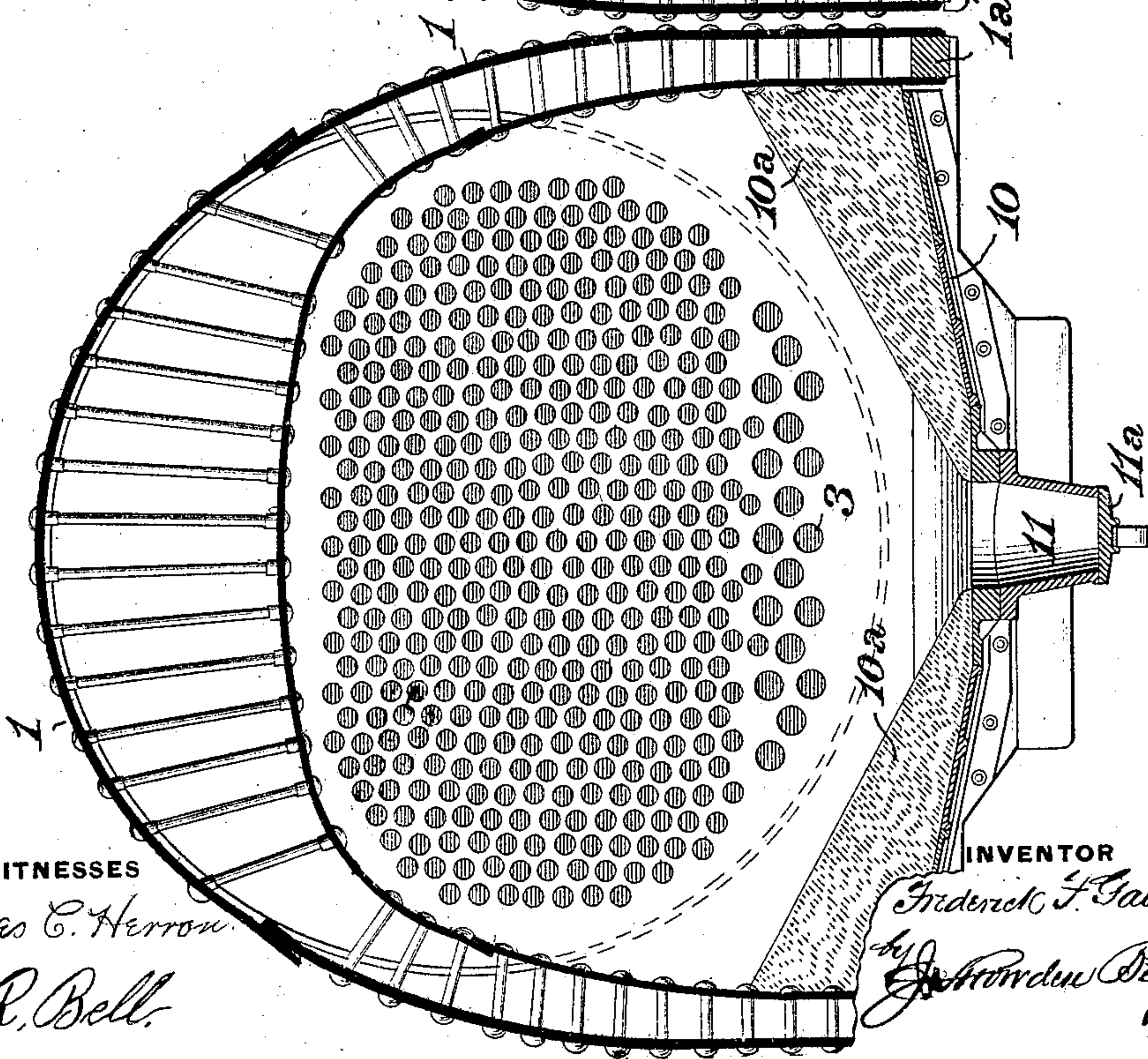


FIG. 2.



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# UNITED STATES PATENT OFFICE.

FREDERICK F. GAINES, OF SAVANNAH, GEORGIA.

## LOCOMOTIVE-BOILER FURNACE.

934,157.

Specification of Letters Patent. Patented Sept. 14, 1909.

Application filed April 10, 1909. Serial No. 489,064.

*To all whom it may concern:*

Be it known that I, FREDERICK F. GAINES, of Savannah, in the county of Chatham and State of Georgia, have invented a certain new and useful Improvement in Locomotive-Boiler Furnaces, of which improvement the following is a specification.

The object of my invention is to provide means, of ready and comparatively inexpensive application either in new constructions or in existing locomotive boilers, whereby the recognized advantages of a combustion chamber interposed between the grate and the flues, in the particulars of economy of fuel and increase in the life of flues, may be made available at a materially less cost than where a combustion chamber located within the waist of the boiler is employed, as in ordinary practice, and a substantial reduction in the evolution of smoke from the stack be also attained.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings: Figure 1 is a vertical longitudinal central section through the firebox and the adjoining portion of the waist of a locomotive boiler, illustrating an application of my invention, and; Figs. 2 and 3, vertical transverse sections through the firebox, on the lines *a a* and *b b*, respectively, of Fig. 1.

My invention is herein exemplified as applied in a locomotive boiler which is, in other respects, of a construction known and approved in present practice, having a wide firebox, 1, connected to a waist, 2, through which a plurality of flues, 3, extend from a flue sheet, 4, to a smoke box (not shown) at the forward end of the waist. The rear water wall of the firebox is provided with one or more firing openings, 5, controlled by suitable doors, in the usual manner, and a set of grate bars, 6, of any preferred construction, is supported adjacent to the bottom of the firebox, below which grate bars an ash pan is to be located, as in locomotive boilers of the various standard forms.

In the practice of my invention, I provide a vertical bridge wall, 7, of firebrick or other suitable refractory material, which extends entirely across the inside of the firebox, between the flue sheet, 4, and the rear water wall of the firebox, its top being ordinarily at a distance below the crown sheet equal to about one third the distance from the crown sheet to the bottom row of tubes,

and its bottom adjacent to the bottom of the firebox. The primary function of the bridge wall, 7, is to divide the space inside the firebox into a fire chamber, A, extending from the rear side of the bridge wall to the rear of the firebox, and a combustion chamber, B, extending from the front side of the bridge wall to the flue sheet, 4. Inasmuch as the proportions of relative volume of the fire chamber and combustion chamber will be governed by several conditions, such as the character of fuel used and the amount of grate area deemed most effective and desirable for the particular fuel used and the character of service of the locomotive, the specific longitudinal location of the bridge wall in the firebox is not an essential of my invention, and must be determined by the discretion of the constructor familiar with locomotive work. Generally speaking, the fire chamber should be of substantially greater volume than the combustion chamber, and, as an example of proportions found satisfactory in practice, there may be cited a length of 97 inches for the fire chamber and 27½ inches for the combustion chamber. It will, however, be obvious to those skilled in the art, that my invention is not limited to these or any other fixed proportionate lengths of the chambers.

The bridge wall is supported on a transverse bearer, 8, of substantially inverted U section, which is secured, at its ends, by bolts or other suitable connections, to the side portions of the mud ring, 1<sup>a</sup>, of the firebox, and has its side flanges projected upwardly above its web, so as to provide a seat for the lowest course of brick of the bridge wall and prevent its longitudinal displacement. Bearers 6<sup>a</sup>, secured to the rear side of the bridge wall bearer, support the forward ends of the grate bars, 6, and the rear ends of said bars are supported on bearers, 6<sup>b</sup>, secured to the rear transverse portion of the mud ring, 1<sup>a</sup>.

A plurality of vertical air passages, 9, is formed in the bridge wall, 7, each of said passages terminating, at its upper end, in an enlarged or flaring discharge opening on the rear side of the bridge wall, near its top. Air supply pipes, 9<sup>a</sup>, which are secured in the bearer, 8, and form exterior continuations of the air passages, extend forwardly, by return bends, and are provided, at their forward ends, with flaring or funnel shaped mouth pieces, 9<sup>b</sup>. The currents of air which enter the air passages, in the forward move-



ment of the locomotive, are heated therein, in their passage through the highly heated bridge wall, and, when discharged from the upper ends thereof, commingle with the  
 5 gases of combustion, as the latter pass upwardly from the fuel on the grate, and promote their more effectual combustion as they pass through the combustion chamber, B, correspondingly preventing the evolution of  
 10 smoke. Where this construction is used on passenger engines, and it is essential or desirable to reduce the evolution of smoke to a minimum, steam jets may be provided in connection with the air openings, so as to  
 15 furnish a sufficient volume of air, when the engine is standing still, to complete combustion and eliminate smoke.

Objection has been found in practice with combustion chambers formed in the waist of  
 20 the boiler, in the particulars of the inevitable accumulation of a greater or less quantity of cinders therein, and the difficulty experienced in removing them. If an opening is made for this purpose in the lower wall of the  
 25 combustion chamber, liability to leakage, and burning out of the rivets securing the joint ring, is experienced. In order to enable any accumulation of cinders to be readily removed from the combustion chamber when-  
 30 ever desired, without involving the use of any members jointed to a water space, I close the lower end of the combustion chamber, B, by a bottom plate, 10, which is downwardly inclined from the sides to the middle of the  
 35 combustion chamber, and is secured to and supported by angle irons, 1<sup>b</sup>, and 8<sup>a</sup>, bolted to the front portion of the mud ring, 1<sup>a</sup>, and to the front flange of the bearer, 8, respectively. A discharge hopper, 11, closed by a  
 40 movable slide or door, 11<sup>a</sup>, is secured to the bottom plate, 10, below and around a central opening therein, and the bottom plate is protected from the heat of the cinders by a  
 45 floor, 10<sup>a</sup>, of firebrick or other refractory material, which is inclined, both laterally and longitudinally, toward the opening above the discharge hopper, so as to cause  
 50 cinders to drop into the latter, from which they may be easily and quickly removed, whenever desired, by opening the door or slide, 11<sup>a</sup>.

Among the advantages of my invention which will be apparent to those skilled in the construction and operation of locomotives,  
 55 are the provision of an effective combustion chamber, and the capacity of carrying a suitable depth of fire in a shallow firebox, without involving the cost of construction and maintenance of those located within the  
 60 waist of the boiler and above a bottom water space or wall, which latter necessitates a diminution of flue heating surface; the ability of application, at slight cost, to existing locomotive boilers, particularly where it may  
 65 be found that a larger grate area has been

provided than is necessary or economical under the conditions of fuel and service; the facility of removal of accumulations of cinders without requiring cooling down of the  
 70 engine and entrance of an operator behind the bridge, and without involving joints in water spaces; and the supply of a volume of heated air to consume the gases in their passage from the fire chamber to the combustion chamber.

I claim as my invention and desire to secure by Letters Patent:

1. The combination, with a locomotive boiler firebox having a flue sheet, of a separate and independent bearer extending across the  
 80 firebox, near the bottom thereof and between the forward end of the grate and the flue sheet, a mud ring, connections securing the ends of said bearer to the side portions of the mud ring, a bridge wall of refractory  
 85 material supported on said bearer, a bottom plate closing the space between the bridge wall and the flue sheet, a discharge hopper secured to the bottom plate below a central  
 90 discharge opening therein, and a movable plate or slide closing the discharge hopper.

2. The combination, with a locomotive boiler firebox having a flue sheet, of a separate and independent bearer extending across  
 95 the firebox, near the bottom thereof and between the forward end of the grate and the flue sheet, a mud ring, connections securing the ends of said bearer to the side portions of the mud ring, a bridge wall of refractory  
 100 material supported on said bearer, a bottom plate closing the space between the bridge wall and the flue sheet, a floor of refractory material covering said bottom plate and downwardly inclined toward a central  
 105 discharge opening therein, a discharge hopper secured to the bottom plate below said discharge opening, and a movable plate or slide closing the discharge hopper.

3. The combination, with a locomotive boiler firebox having a flue sheet, of a separate and independent bearer extending across  
 110 the firebox, near the bottom thereof and between the forward end of the grate and the flue sheet, a mud ring, connections securing the ends of said bearer to the side portions  
 115 of the mud ring, a bridge wall of refractory material supported on said bearer, a bottom plate closing the space between the bridge wall and the flue sheet, angle supports secured to the front and rear sides of said  
 120 bottom plate and to the front portion of the mud ring and to the bearer, respectively, a discharge hopper secured to the bottom plate below a central discharge opening therein, and a movable plate or slide closing the  
 125 discharge hopper.

4. The combination, with a locomotive boiler firebox having a flue sheet, of a separate and independent bearer extending across  
 130 the firebox, near the bottom thereof and be-



tween the forward end of the grate and the flue sheet, a mud ring, connections securing the ends of said bearer to the side portions of the mud ring, a bridge wall of refractory material supported on said bearer and containing a plurality of vertical air passages which open on its rear side near its top, downwardly and forwardly extending air supply pipes secured to the bearer, each communicating with one of the air passages and being open at its forward end, a bottom plate closing the space between the bridge wall and the flue sheet, a discharge hopper secured to the bottom plate below a central discharge opening therein, and a movable plate or slide closing the discharge hopper.

5. The combination, with a locomotive boiler firebox having a flue sheet, of a separate and independent bearer extending across the firebox, near the bottom thereof, a mud ring, connections securing the ends of said bearer to the side portions of the mud ring, grate bars extending between said bearer and the rear of the firebox and adapted to be supported on said bearer and on the rear portion of the mud ring, a bridge wall of refractory material supported on said bearer, a bottom plate closing the space between the bridge wall and the flue sheet, a discharge hopper secured to the bottom plate,

below a central discharge opening therein, and a movable plate or slide closing the discharge hopper.

6. The combination, with a locomotive boiler firebox having a flue sheet, of a separate and independent bearer extending across the firebox, near the bottom thereof, a mud ring, connections securing the ends of said bearer to the side portions of the mud ring, grate bars extending between said bearer and the rear of the firebox, a bridge wall of refractory material supported on said bearer and forming a division between a fire chamber space above the grate bars and a combustion chamber space between its forward side and the flue sheet, said bridge wall containing a plurality of air passages which open at their upper ends into the fire chamber space, and at their lower ends to the atmosphere, a bottom plate closing the bottom of the combustion chamber space, a discharge hopper secured to the bottom plate below a central discharge opening therein, and a movable plate or slide closing the discharge hopper.

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Witnesses:

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