No. 667,940. Patented Feb. 12, 1901.

D. G. GRANT.

STEAM BOILER.

(Application filed Sept. 11, 1900.)

(No Model.) 4 Sheets—Sheet 1.

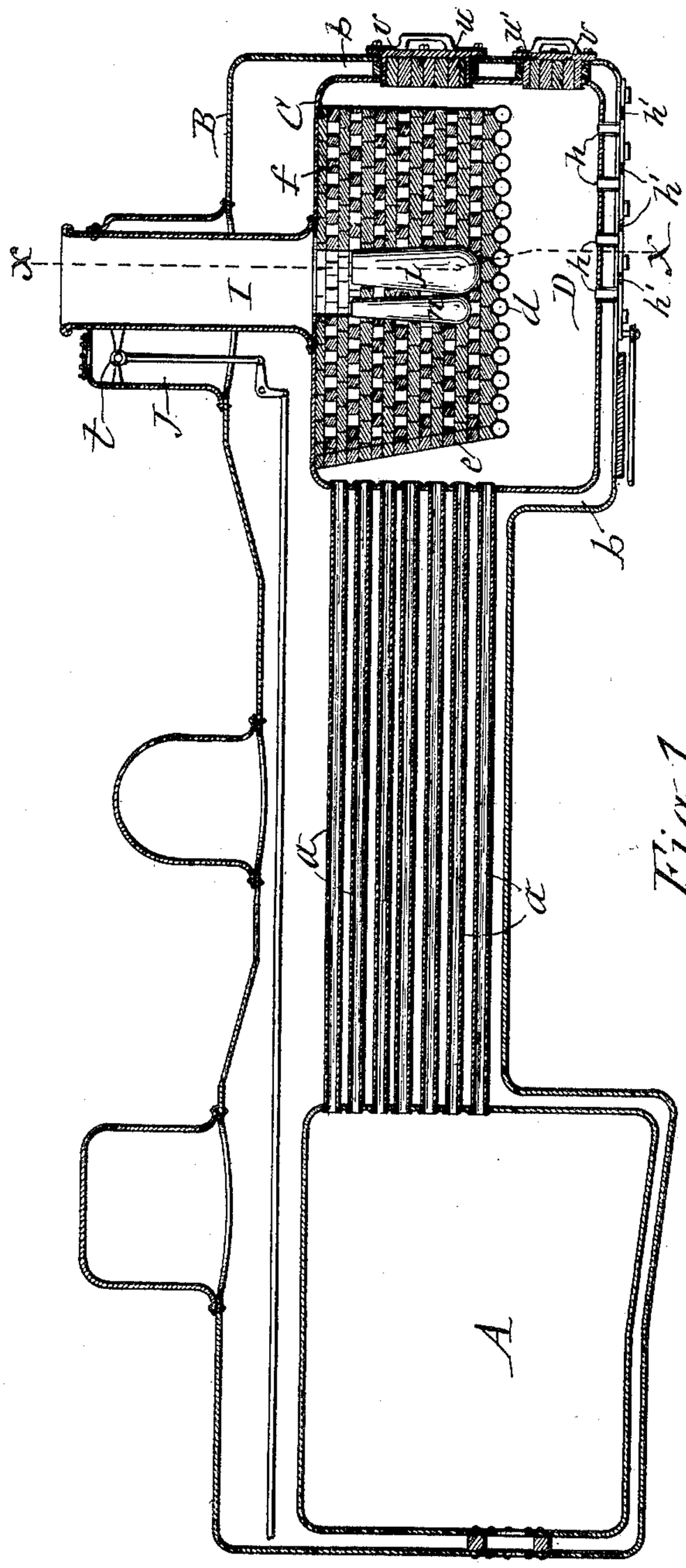

Fig. 1.

WITNESSES.

J. J. Laass

Ha B. Smith.

INVENTOR:

David G. Grant

By E. Laass

ATTORNEY

No. 667,940. Patented Feb. 12, 1901.

D. G. GRANT.

STEAM BOILER.

(Application filed Sept. 11, 1900.)

(No Model.) 4 Sheets—Sheet 2.

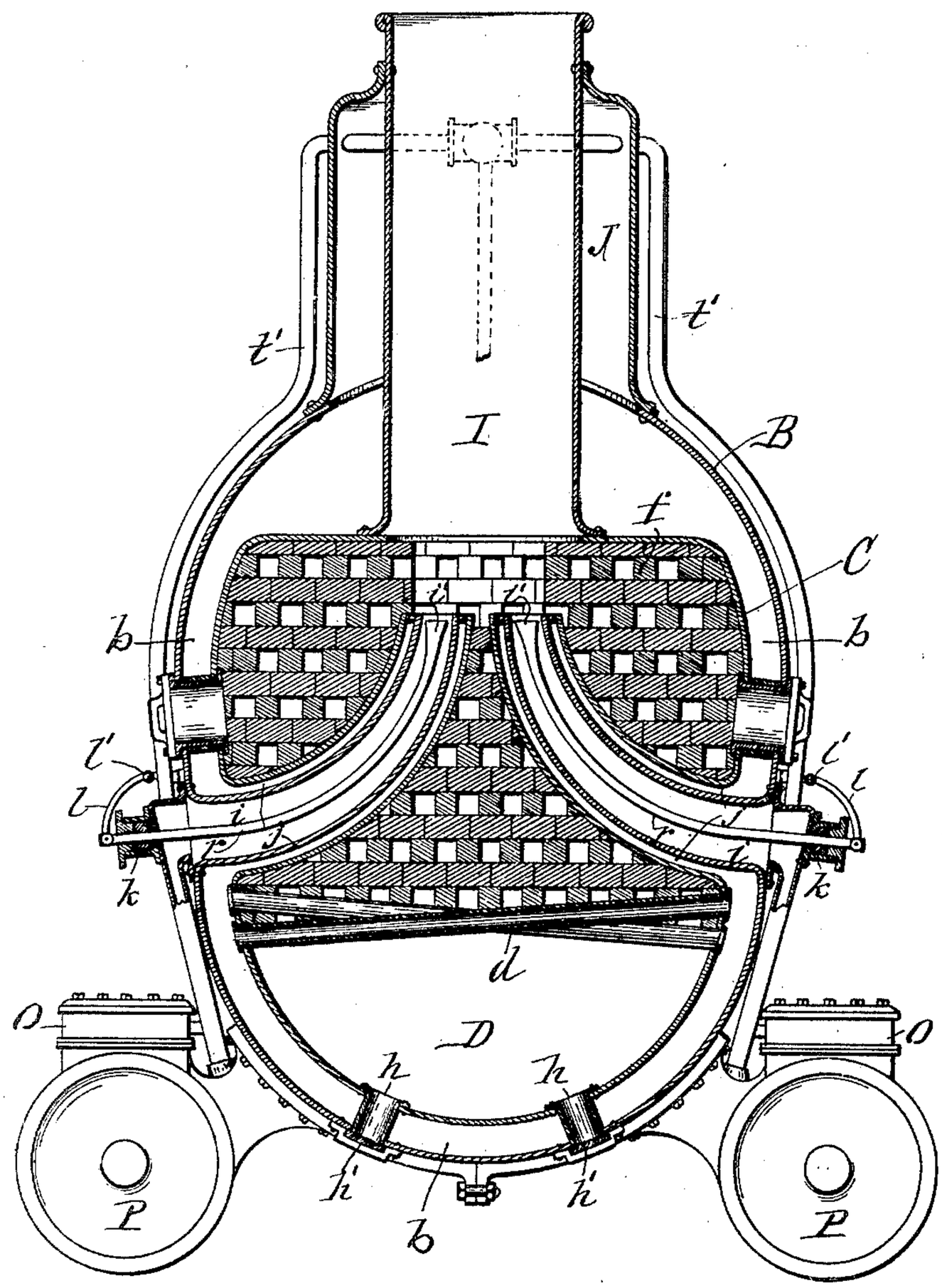

Fig. 2

WITNESSES:

J. J. Lasoo.

Ho B. Smith.

INVENTOR

David G. Grant

By E. Lasoo

ATTORNEY

No. 667,940.

Patented Feb. 12, 1901.

D. G. GRANT.

STEAM BOILER.

(Application filed Sept. 11, 1900.)

(No Model.)

4 Sheets—Sheet 3.

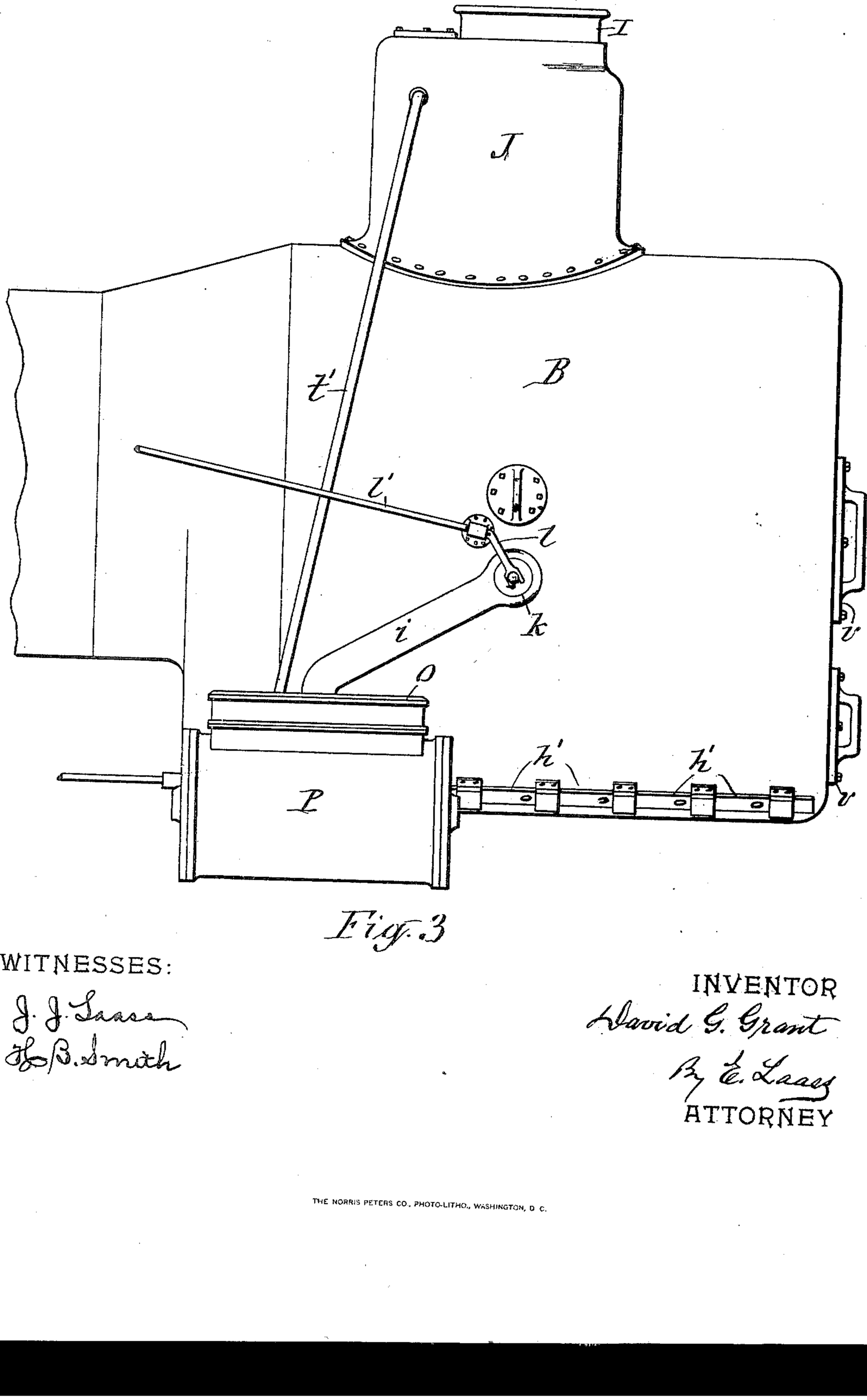

Fig. 3

WITNESSES:

J. J. Laase

H. B. Smith

INVENTOR

David G. Grant

By E. Laase

ATTORNEY

No. 667,940.

Patented Feb. 12, 1901.

D. G. GRANT.

STEAM BOILER.

(Application filed Sept. 11, 1900.)

(No Model.)

4 Sheets—Sheet 4.

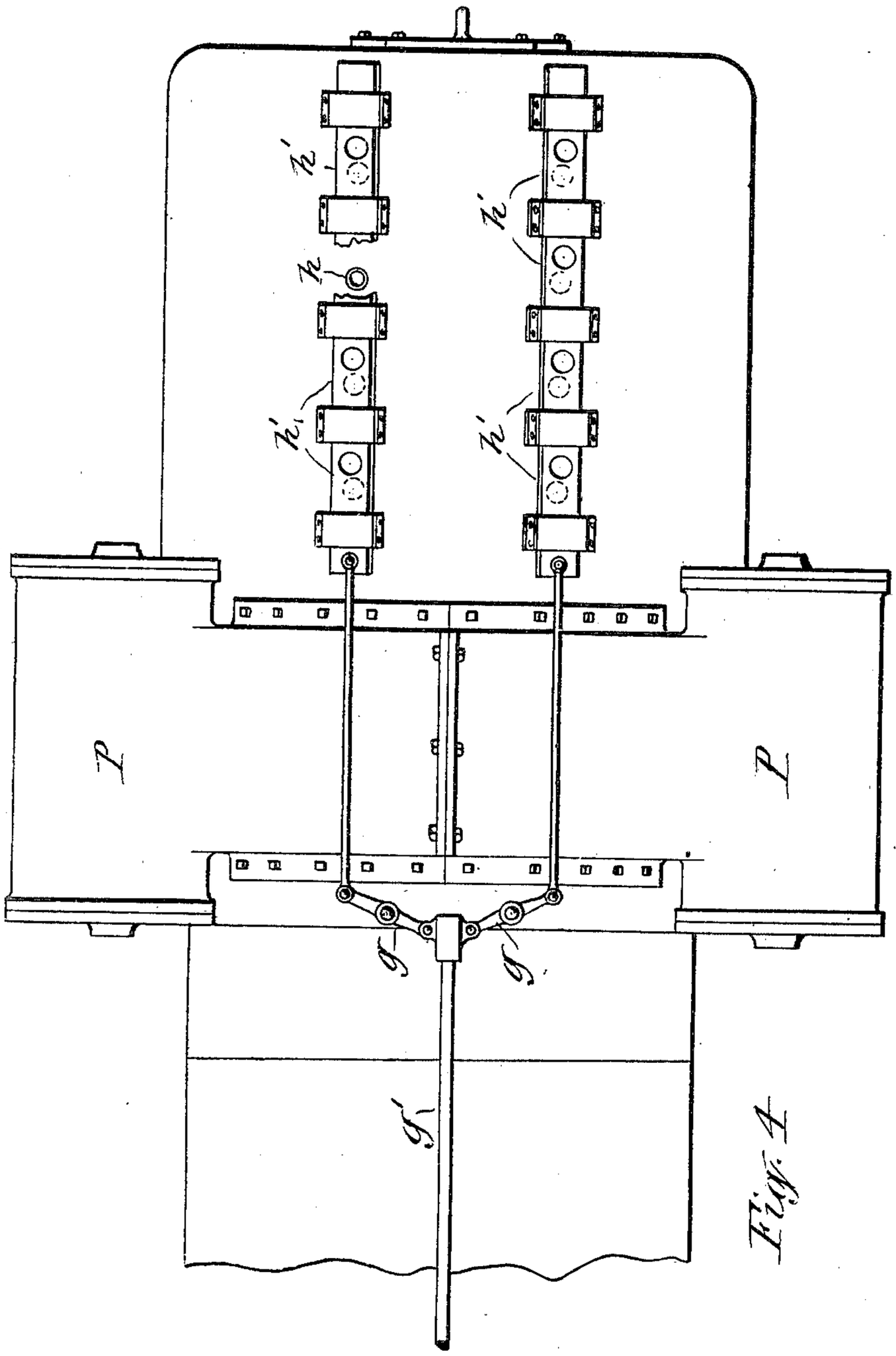

Fig. 4.

WITNESSES:

J. J. Laass

H. B. Smith.

INVENTOR

David G. Grant.

By E. Laass

ATTORNEY

UNITED STATES PATENT OFFICE.

DAVID G. GRANT, OF SYRACUSE, NEW YORK, ASSIGNOR OF ONE-HALF TO JAMES J. KAVANAGH, OF SAME PLACE.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 667,940, dated February 12, 1901.

Application filed September 11, 1900. Serial No. 29,692. (No model.)

To all whom it may concern:

Be it known that I, DAVID G. GRANT, a citizen of the United States, and a resident of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Steam-Boilers, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

The main and primary object of this invention is to equip steam-boilers with efficient, reliable, and properly-controllable means for consuming the smoke, gases, cinders, and fine particles of fuel escaping from the fire-box or furnace of the boiler and in consuming said products of combustion and hitherto-wasted fuel produce an intense heat applied to the boiler in such a manner as to greatly increase the efficiency of the boiler and materially economize in the consumption of fuel; and the object also is to guard against injury to the structure of the boiler by the aforesaid intense heat; and to these ends the invention consists in the novel construction and combination of the component parts of a combustion-chamber and its connection to the boiler, as hereinafter described, and set forth in the claims.

In the accompanying drawings, Figure 1 is a vertical longitudinal section of a steam-boiler embodying my invention. Fig. 2 is an enlarged vertical transverse section on line X X in Fig. 1. Fig. 3 is a side view of that portion of the boiler to which my invention is applied; and Fig. 4 is an inverted plan view of the same, illustrating one of the means for regulating the dampers or valves of the air-induction ports.

Similar letters of reference indicate corresponding parts.

A represents the fire-box or main furnace of a locomotive-boiler.

a a denote the flues extending from the fire-box, and C represents my improved combustion-chamber, which is disposed to receive the products of combustion from the aforesaid flues. My invention consists in the following construction and combination of the component parts of said combustion-chamber and its connection with the boiler. The shell of said combustion-chamber is arranged in an enlarged extension of the front end of the boiler-shell B and in such position in relation to the water-space of the boiler as to form a water-jacket *b* around the said combustion-chamber. Said water-jacket communicating directly with the water-space of the boiler causes the water in the boiler to absorb the heat from the combustion-chamber. Across the interior of said combustion-chamber is extended a floor *d*, formed of water-tubes, which are securely fastened at each end to the vertical walls of the combustion-chamber and communicate with the water-jacket *b*, so as to cause the water to circulate through said tubes, and thus protect them from injury by the heat they are subjected to. In order to prevent accumulation of sediment in said tubes, I incline them, preferably, alternately in opposite directions, as more clearly shown in Fig. 2 of the drawings. Said tubes are placed suitable distances apart to allow the products of combustion to pass up between the tubes. This floor *d* is arranged in the lower portion of the combustion-chamber, preferably in a plane about in range with the bottom of the boiler proper or at a suitable distance above the bottom of the combustion-chamber to form an air-chamber D under said floor. Upon the end of the floor *d*, adjacent to the ends of the flues *a*, is mounted a baffle-wall *e*, which may be either formed of fire-brick, as shown, or consist of a metal chamber charged with water from the water-space of the boiler. Upon the remainder of the floor *d*, from the baffle-wall *e* forward, is built a reticular fire-brick body *f*, constructed in such a manner as to form sinuous or tortuous fire-passages through said body, for the purpose hereinafter explained.

The bottom of the combustion-chamber is provided with suitable air-induction ports *h h* and with adjustable valves or dampers *h' h'* for regulating the ingress of air to the combustion-chamber. Said ports are preferably arranged in parallel longitudinal rows to allow the dampers of each row to be united and the entire set of dampers to be adjusted simultaneously by means of suitable levers *g*, pivoted to the under side of the boiler extension and engaging the rows of dampers,

as shown in Fig. 4 of the drawings. The levers *g* are coupled to a rod *g'*, which is extended to the cab of the engine in any suitable manner to allow the engineer or fireman to manipulate said rod, so as to regulate the dampers as may be necessary to permit the required amount of air to enter into the combustion-chamber.

I represents the smoke-stack, which extends from the top of the combustion-chamber, and *i i* are the exhaust-pipes, which lead to the smoke-stack. Inasmuch as said exhaust-pipes extend through the fire-brick body *f*, which becomes intensely heated, as hereinafter described, I envelop said pipes in water-jackets *j*, as shown in Fig. 2 of the drawings. The exhaust-pipes *i i* are tapered to their discharge ends, and inside of said ends are variable exhaust-valves *i'*, which may be formed of enlargements of the ends of rods *r*, extending longitudinally through the exhaust-pipes and through suitable stuffing-boxes *k* on the outer portions of said pipes. The outer protruding ends of said rods are connected to suitable levers *l*, attached to rods *l'*, which are extended to the cab for manipulation by the engineer or fireman, who is thus enabled to move the exhaust-valves toward and from the discharge-nozzles of the exhaust-pipes. Said movement of the valves in the tapering pipes reduces or enlarges the areas of the exhaust and increases or diminishes correspondingly the draft through the fire-flues *a a*. This variation of the exhaust is especially essential in the use of my present invention, inasmuch as it controls the intensity of the heat permeating the fire-brick body *f*, which transmits said heat to the water-jacket *b*, surrounding the combustion-chamber. Said jacket communicating directly with the water-space of the boiler causes the water throughout the boiler to partake of the heat generated in the combustion-chamber C, and thus the efficiency of the boiler is very materially augmented. To further utilize said heat, I mount upon the boiler directly over the combustion-chamber C a steam-dome J and extend the smoke-stack I through said dome, so as to subject the steam to the heat of the stack. In this dome I prefer to place the usual throttle-valve *t*, from which the steam is conducted by the pipes *t'* to the steam-chest O of the engine-cylinders P in the usual manner. The main portion of the steam-pipes *t'* may be arranged either at the exteriors of the dome and combustion-chamber, as shown, or within said dome and upper portion of the boiler-shell extension.

n in Fig. 1 of the drawings represents the usual blower-pipe of the air-pump of the locomotive.

u and *u'* denote manholes for affording access to the interior of the combustion-chamber when required for making repairs therein, and *v* represents the removable covers for said manholes. Said covers are lined with fire-brick on their inner sides to protect them from the fire in the combustion-chamber.

The operation of my described invention is as follows: After the fire has been fairly started in the fire-box by the draft produced by the action of the blowpipe *n* said draft causes the smoke and gases to pass from the flues *a* through the fire-brick body *f* to the smoke-stack I. The circulation of the said smoke and gases through said body *f* causes the latter to become heated. Then by opening the throttle-valve *t* the engine is set in motion, and the exhaust-steam passes from the cylinders P through the exhaust-pipes *i*, and by opening the valves or dampers *h'* to a proper degree the necessary air is admitted to the interior of the combustion-chamber to mingle with the smoke and gases therein and supply the necessary oxygen to produce combustion of said gases, which combustion is promoted by the heat emitted from the fire-brick body *f*. This combustion consumes all the products of combustion and produces a very intense heat in the combustion-chamber. This heat is controlled by regulating the variable-exhaust valves *i'*, so as to increase the capacity of the discharge-nozzles of the exhaust-pipes *i*, and thus reduce the draft through the flues of the boiler and by a corresponding adjustment of the valves of the air-induction ports *h*. The aforesaid intense heat in the combustion-chamber is absorbed by the water in the boiler, and thus greatly enhances the efficiency of the boiler and effects a great saving in the consumption of fuel.

What I claim is—

1. The combination with a horizontal boiler, flues extending longitudinally through said boiler, and the fire-box communicating with said flues at one end of the boiler, of a combustion-chamber formed on the opposite end of the boiler and disposed to receive the products of combustion from the flues, a reticular fire-brick body disposed in said combustion-chamber to be permeated by the products of combustion, and a water-jacket surrounding the combustion-chamber and communicating with the water-space of the boiler to absorb the heat from the combustion-chamber by the water in the boiler, as set forth.

2. In a steam-boiler, the combination with the fire-box and flues extending therefrom, of a combustion-chamber disposed to receive the products of combustion from said flues, a water-jacket surrounding said combustion-chamber and communicating with the water-space of the boiler, a reticular fire-brick body disposed in the combustion-chamber to be permeated by the products of combustion, air-induction ports communicating with the interior of the combustion-chamber, and dampers adjustably supported to open and close the ports, and means for regulating said dampers operatively arranged for the person in charge as set forth.

3. In a steam-boiler, the combination with

the fire-box and flues extending therefrom, of a combustion-chamber disposed to receive the products of combustion from said flues, a baffle-wall in the combustion-chamber adjacent to the flues, a water-jacket surrounding said chamber and communicating with the water-space of the boiler, a reticular fire-brick body disposed in the combustion-chamber, and air-induction ports communicating with the interior of said chamber to promote combustion as set forth.

4. In a locomotive-boiler the combination with the fire-box and flues extending therefrom, of a combustion-chamber disposed to receive the products of combustion from said flues, the smoke-stack extending from said combustion-chamber, the exhaust-pipes leading to said smoke-stack, a water-jacket surrounding the combustion-chamber and communicating with the water-space of the boiler, a reticular fire-brick body disposed in the combustion-chamber to be permeated and heated by the products of combustion, and air-induction ports communicating with the interior of the combustion-chamber to promote combustion therein as set forth.

5. In a steam-boiler the combination with the fire-box and flues extending therefrom, of a combustion-chamber disposed to receive the products of combustion from the flues, a water-jacket surrounding said combustion-chamber, water-tubes extending across said chamber, a reticular fire-brick body over said tubes, and air-induction ports in the combustion-chamber beneath the water-tubes as set forth.

6. In a locomotive-boiler the combination with the fire-box and flues extending therefrom, of a combustion-chamber formed in the front end of the boiler with a water-jacket surrounding it, water-tubes extending across the combustion-chamber in a plane approximately in line with the bottom of the boiler proper and forming an air-chamber in the base of the combustion-chamber, a reticular fire-brick body directly over the water-tubes, and air-induction ports through the bottom of the aforesaid air-chamber as set forth.

7. In a locomotive-boiler the combination with the fire-box and flues extending therefrom, of a combustion-chamber formed in the front end of the boiler with a water-jacket surrounding it, the smoke-stack extending from said combustion-chamber, the exhaust-pipes leading to said stack, a baffle-wall interposed between the aforesaid flues and exhaust-pipes, water-tubes extending across the combustion-chamber, a reticular fire-brick body directly over said tubes, and air-induction ports communicating with the combustion-chamber beneath the water-tubes as set forth.

8. In a horizontal-flue boiler, the combination with the fire-box and flues extending therefrom, of a water-jacketed combustion-chamber disposed to receive the products of combustion from said flues, water-tubes extending across the lower portion of said combustion-chamber and inclined alternately in opposite directions, a reticular fire-brick body seated upon said tubes, and air-induction ports in the bottom of said combustion-chamber as set forth.

9. In a horizontal-flue boiler the combination with the fire-box and flues extending therefrom, of a combustion-chamber disposed to receive the products of combustion from said flues, a water-jacket surrounding said combustion-chamber and communicating with the water-space of the boiler, a floor of water-tubes extending across said chamber, a baffle-wall mounted on said floor adjacent to the flues, a reticular fire-brick body built upon the aforesaid floor, and air-induction ports in the bottom of the combustion-chamber as set forth and shown.

10. A locomotive-boiler having a combustion-chamber formed in the front end thereof, the exhaust-pipes formed with water-jackets around them, a floor of water-tubes extending across the combustion-chamber, a baffle-wall mounted on said floor adjacent to the fire-flues of the boiler, a reticular fire-brick body built upon the aforesaid floor, and air-induction ports in the bottom of the combustion-chamber as set forth and shown.

11. A locomotive-boiler formed with a combustion-chamber in its front end, the exhaust-pipes formed with water-jackets around them, a floor formed of water-pipes inclined alternately in opposite directions and extending across the combustion-chamber above the bottom thereof to form an air-chamber beneath said floor, a baffle-wall mounted on said floor adjacent to the fire-flues, a reticular fire-brick body built upon the aforesaid floor, and air-induction ports in the bottom of the combustion-chamber as set forth.

12. A locomotive-boiler formed with a combustion-chamber in its front end, the exhaust-pipes formed with water-jackets around them, variable-exhaust valves in said pipes provided with means for control by the person in charge, a floor of water-tubes extending across the combustion-chamber beneath the exhaust-pipes, a baffle-wall mounted on said floor adjacent to the fire-flues, a reticular fire-brick body built upon said floor, and air-induction ports in the bottom of the combustion-chamber as and for the purpose set forth.

13. A locomotive-boiler formed with a combustion-chamber in its front end, a steam-dome upon the boiler over the combustion-chamber, the smoke-stack extending from the said chamber through the steam-dome, the exhaust-pipes formed with water-jackets around them, a reticular fire-brick body disposed in the combustion-chamber to be permeated and heated by the products of combustion, and air-induction ports in the bottom of the combustion-chamber to promote combustion in said chamber substantially as set forth.

14. A locomotive-boiler formed with a combustion-chamber in its front end, a steam-

dome upon the boiler over said chamber, the smoke-stack extending from the combustion-chamber through the aforesaid dome, the exhaust-pipes formed with water-jackets around them, variable-exhaust valves in said pipes under control of the engineer, a reticular fire-brick body disposed in the combustion-chamber to be permeated and heated by the products of combustion, and air-induction ports in the bottom of the combustion-chamber and provided with adjustable dampers under control of the engineer as set forth.

DAVID G. GRANT. [L. S.]

In presence of—
J. J. LAASS,
H. B. SMITH.