

(No Model.)

2 Sheets—Sheet 1.

G. K. CUMMINGS.

DEVICE FOR BURNING HYDROCARBON OILS.

No. 377,146.

Patented Jan. 31, 1888.

Fig. 1.

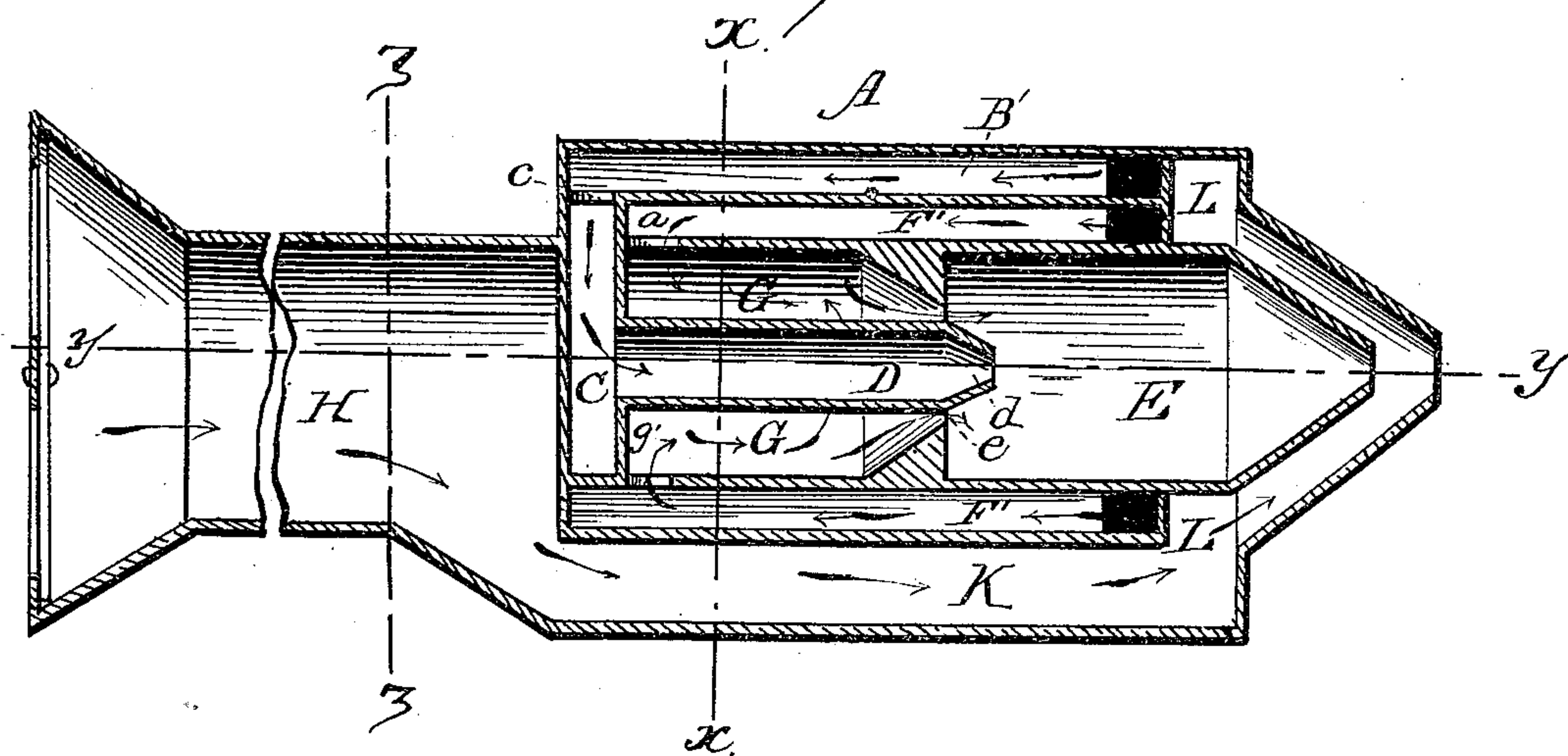


Fig. 2.

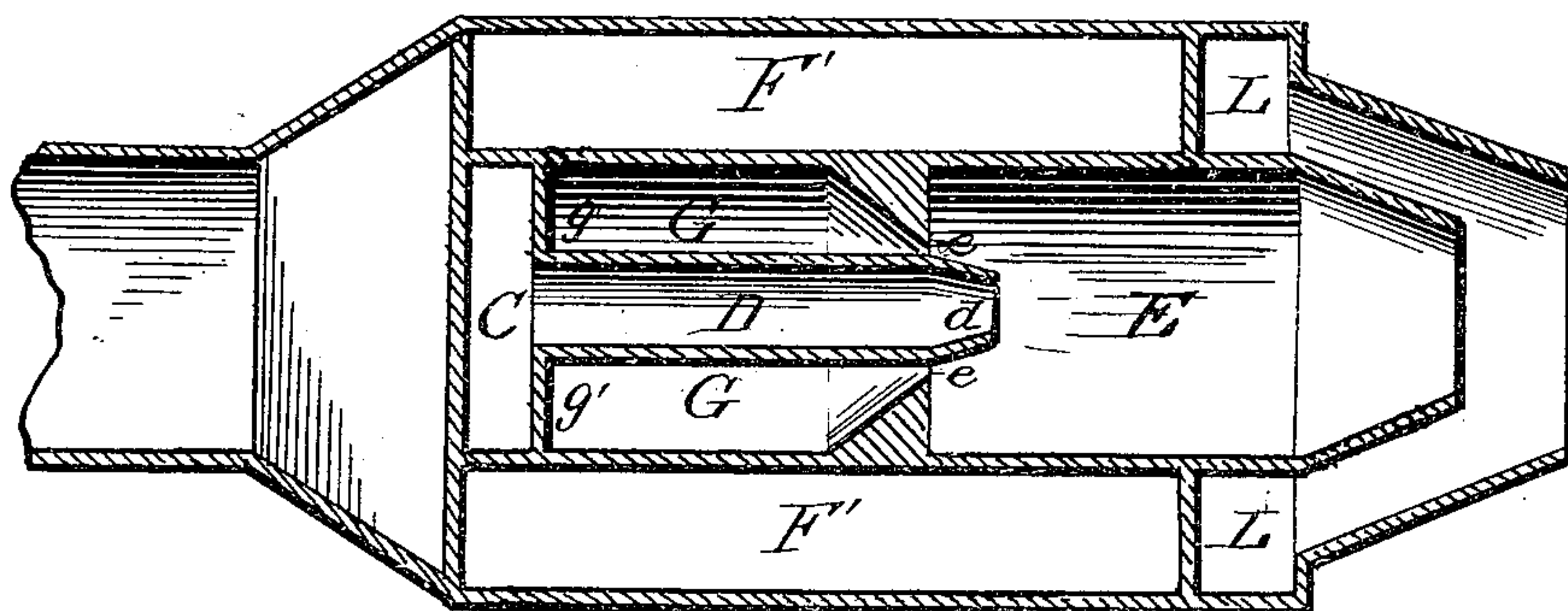
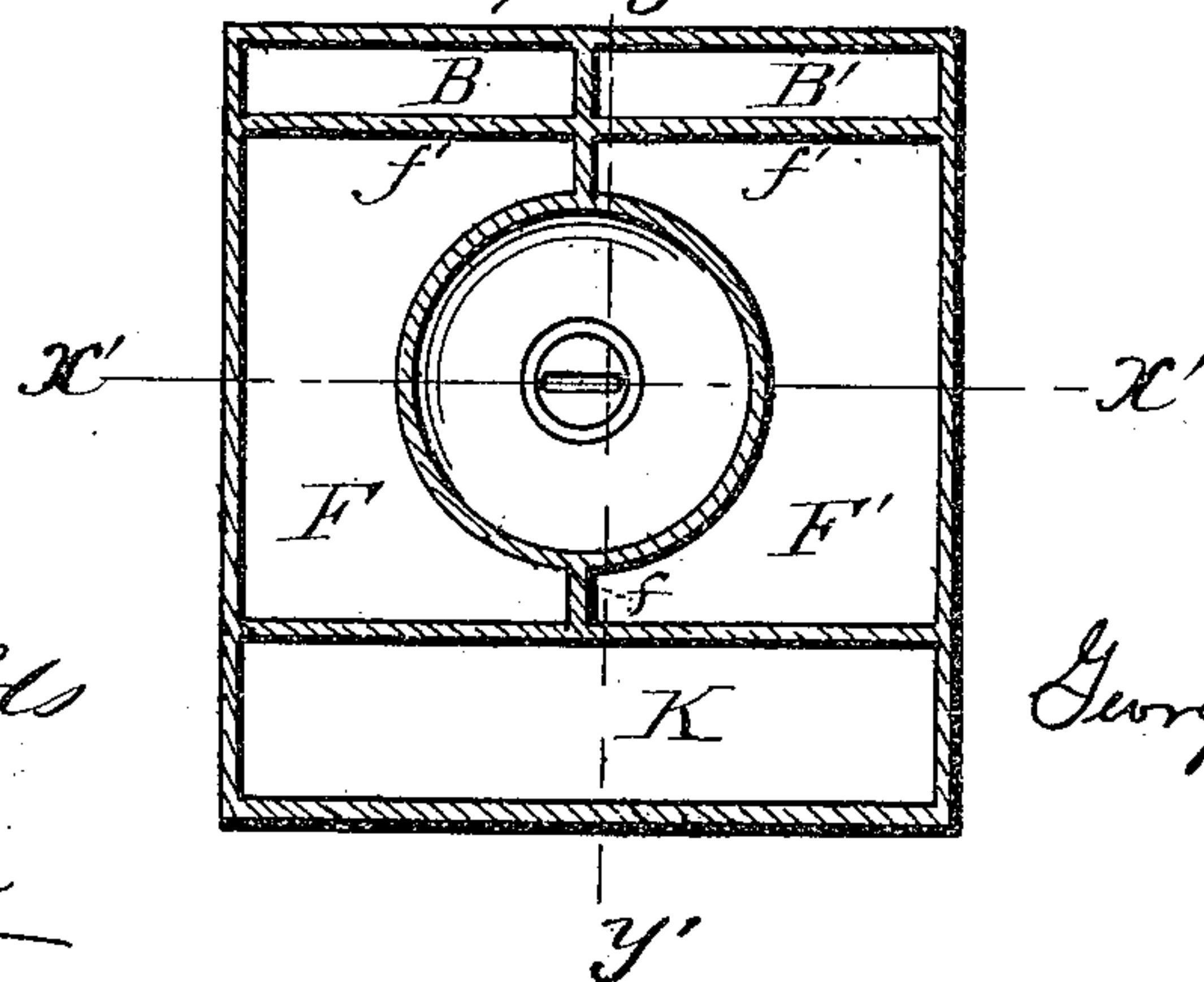


Fig. 3.



Witnesses

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(No Model.)

2 Sheets—Sheet 2.

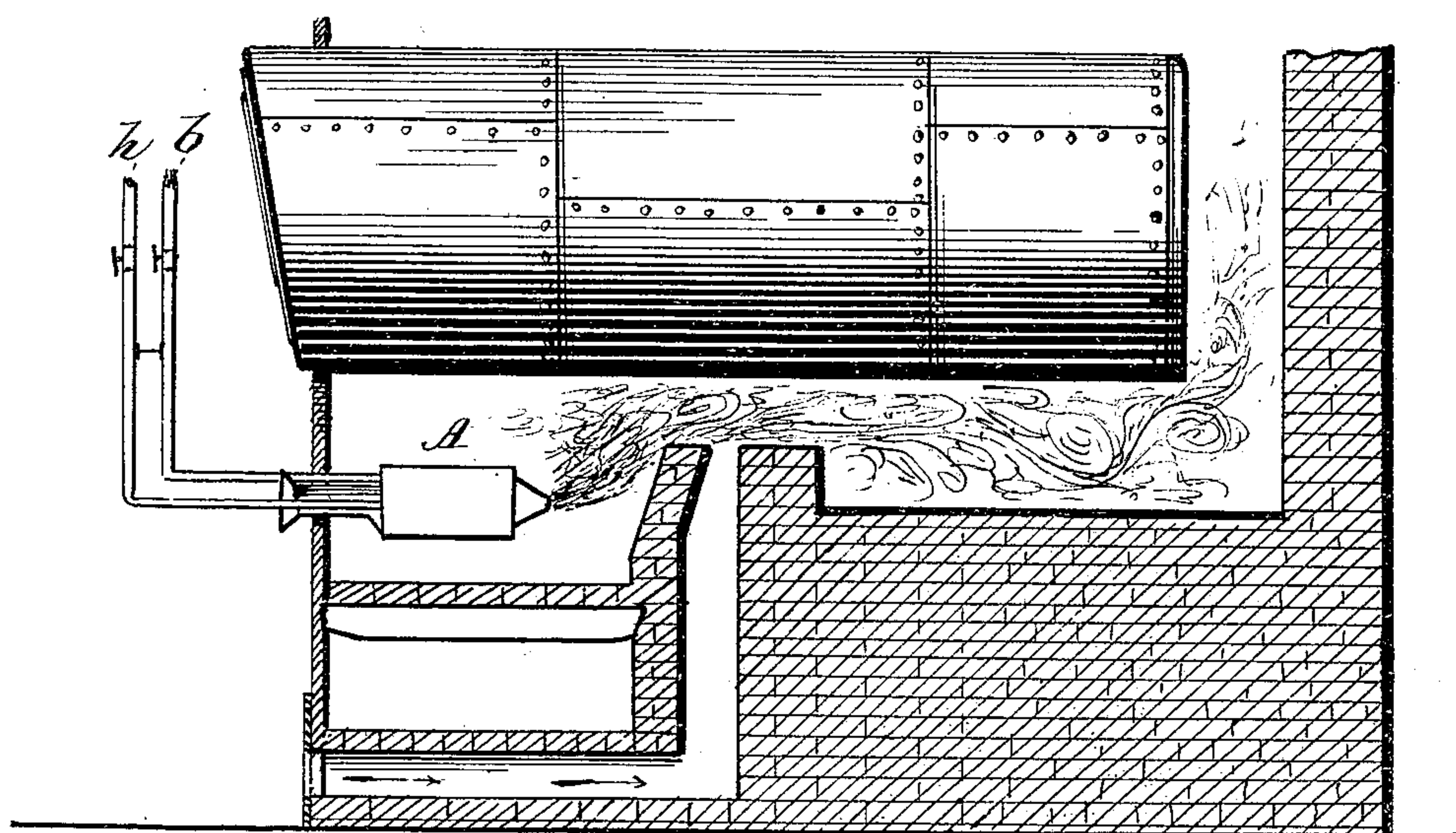
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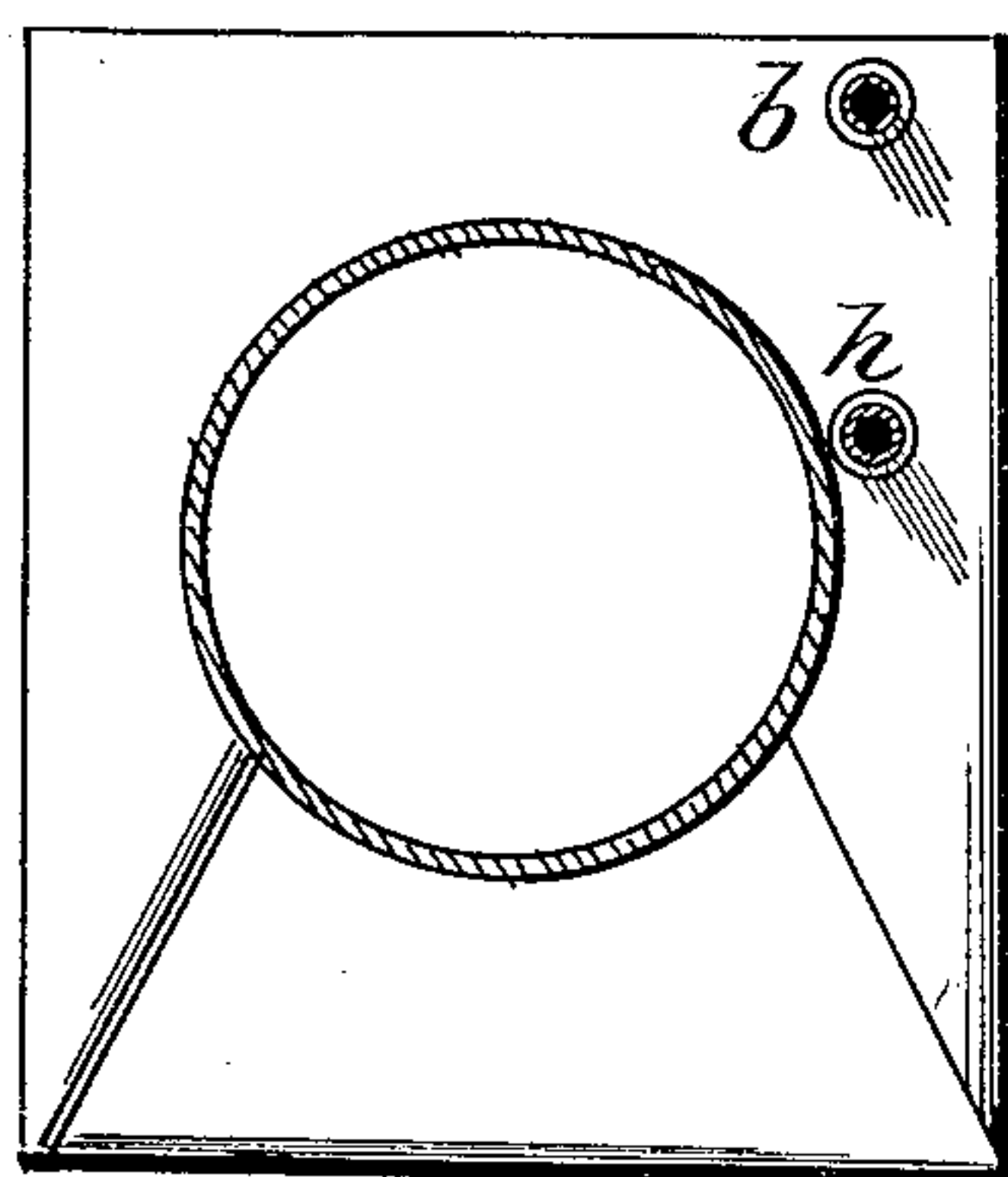
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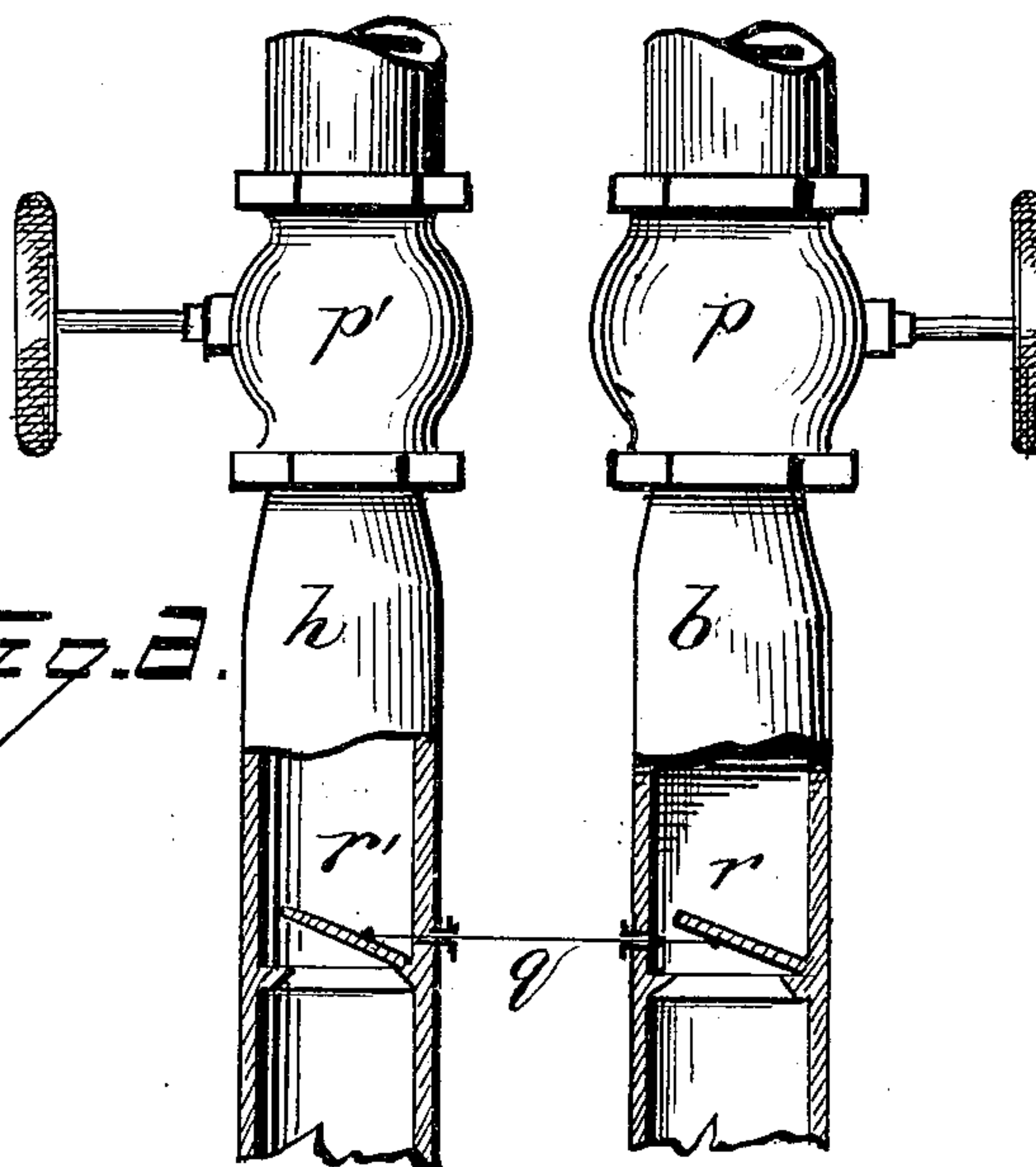
*Fig. 4.*



*Fig. 5.*



*Fig. 6.*



Witnesses

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# UNITED STATES PATENT OFFICE.

GEORGE KING CUMMINGS, OF NEW YORK, N. Y.

## DEVICE FOR BURNING HYDROCARBON OIL.

SPECIFICATION forming part of Letters Patent No. 377,146, dated January 31, 1888.

Application filed July 30, 1887. Serial No. 245,752. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE KING CUMMINGS, a resident of New York, in the county and State of New York, have invented a certain  
5 new and useful Device for Burning Hydrocarbon Oils in the Form of Vapor, of which the following is a full, clear, concise, and exact description, which, taken in connection with the drawings, clearly describes and illustrates the  
10 construction and operation of the same.

In the present state of the art in burning hydrocarbon oil, it is customary to inject the oil by means of steam or air under pressure, thus spraying the oil into a combustion-chamber for ignition.  
15

Objections are found to this crude and impracticable method on account of the waste of the oil used, due to incomplete combustion, which of necessity must be the case, as it is  
20 practically impossible to supply the supporter of combustion to each minute particle of oil held temporarily in suspension by the steam; and another serious objection to this method is, that the amount of steam required to produce the necessary atomization of the heavier  
25 oils—such as Lima crude and residuum (the most practical oils as regards price with which to compete with coal)—is of such great volume that, being in the presence of the products of  
30 combustion, it detracts considerably from the intensity of the flame and limits it to a comparatively low temperature, which in many cases, especially in the different methods of working iron, renders it absolutely useless.

The principal advantage of devices of this kind is the simplicity of construction and smallness of size, which are two very important considerations.

I am also aware that in the present state of  
40 the art it is common to vaporize the hydrocarbon oil and introduce or inject this vapor, combined with steam, either wet or dry, and to supply to said mixture the necessary quantity of air to assist combustion in the fire-chamber. The principal advantage of this retort  
45 class of device is the theoretical principle therein embodied; but as far as I know there has not been any practical means of presenting this theoretical idea in a compact, simple,  
50 small, and commercial form to the public consumer. Therefore I have combined the form of the former class with the principles of the lat-

ter. It is not the purpose of my invention to produce a mere laboratory or theoretical device, but an apparatus which may be readily  
55 applied to any combustion-chamber where solid fuel shall have been used, whereby hydrocarbon oil or vapor, steam, and air are combined to produce practically perfect combustion.  
60

Referring to the accompanying drawings, Figure 1 is a vertical longitudinal section, taken on the line  $y'y'$  of Fig. 3, of my device for vaporizing hydrocarbon oil, combining  
65 therewith superheated steam and also heated air at the most efficacious point, completing combustion. Fig. 2 is a horizontal longitudinal section taken on the line  $x'x'$  of Fig. 3, showing a steam-superheating chamber, steam-reservoir, oil-delivery pipe, &c. Fig. 3 is a  
70 cross-section taken on the line  $xx$  of Fig. 1. Fig. 4 is a perspective view of the device applied to a boiler. Fig. 5 is a cross-section taken on the line  $zz$  of Fig. 1. Fig. 6 is a detailed sectional view of the oil and steam supply pipes, showing the automatic regulating-  
75 valves for controlling the oil and steam supply.

A designates the burner or generator divided into oil and steam and air compartments  
80 by means of suitable division-plates. The oil heating and vaporizing chamber is divided into two communicating compartments,  $B B'$ , and provided with a supply-pipe,  $b$ , conveying oil by gravity flow or under pressure into com-  
85 partment B from any suitable supply-tank.

C is an oil or oil-vapor reservoir communicating with the chamber  $B'$  by means of a large opening,  $c$ , and is provided with a delivery-pipe, D, having a contracted nozzle and com-  
90 municating with the mixing-chamber E, as hereinafter described.

F and F' designate the steam-superheating chamber provided with the inlet-pipe  $h$ , and divided into two communicating compart-  
95 ments by means of division-plates  $f f$ , and separated from the oil heating and vaporizing chamber by means of a division-wall,  $f''$ .

G designates a steam-reservoir for the superheated steam, communicating, by means of  
100 the large openings  $g g$ , with the steam-chamber F', and surrounding the oil-delivery pipe D, and separated from the oil or oil-vapor reservoir by means of a wall,  $g'$ , and terminating at



its forward end, frusto-conical in shape, and with a circular steam-opening annular to the oil-delivery pipe D.

E designates the mixing-chamber for the commingling of the oil or oil-vapor and the superheated steam. This chamber is provided at its forward end with a slotted, contracted, or wedge-shaped discharge-opening.

H designates the air-supply pipe, provided with any suitable common means for controlling the supply of air, and is connected to the rear end of the burner or generator proper by any suitable means and communicates with an air-chamber, K, extending the entire length of the generator and opening into an annular passage or chamber, L, surrounding the forward end of the generator, said annular passage opening into and terminating in an annular discharge-opening corresponding in shape and construction to the slotted, contracted, or wedge-shaped discharge-opening of the mixing-chamber E.

It will be understood that the air-pipe H may be of any suitable length whereby the burner or generator proper may be extended within a closed furnace and exposed to the action of the heat from the burning fuel. Thus no cold air rushes in around the sides of the burner or generator to complete the combustion; nor is any portion of the generator exposed to any cooling external element, while at the same time the inlet of the air-pipe H is in direct communication with the external atmosphere. This I consider a very important feature in the construction and operation of my device.

Referring to Fig. 6, *bh* designate the oil and steam delivery pipes, communicating with the burner or generator and provided with automatic regulating-valves *rr'*, to control the flow of oil and steam to the generator.

*pp'* designate the valves ordinarily employed for regulating the supply of oil and steam. The valve *r'*, for regulating the flow of steam, is made of finely-tempered steel fixed into a socket on the inner side of the steam-supply pipe at an angle sufficient to allow the required amount of steam to pass through the generator. Steel valves may be used of different tensile strength, according to the different pressures of steam it is desirable to hold in the boiler fired by the burner or generator.

On the valve *r'* shall be fastened a swinging rod with a swivel or pivot attachment, which rod shall pass through steam-supply pipe into oil-supply pipe, each provided with suitable packing-boxes, where it shall also be attached to the valve *r* in oil-supply pipe. Said valve *r* is hung by hinges or other suitable means, and the swinging rod *q* shall be of such length and so attached and constructed that as the position of the steel valve *r'* of the steam-supply pipe shall be changed by the different pressures of steam from the inlet so shall the valve *r* of the oil-supply pipe enlarge or diminish the oil-supply inlet, that the amount of oil supplied to the generator shall continu-

ously be in exact proportion to the amount of steam delivered thereto for proper and nice commingling of the two elements to effect the best and most efficacious gas or vapor or mixture as it issues from the generator.

The above-described attachment of valves and materials used shall not be restricted as above.

The operation of my device is as follows: The generator is placed in closed furnace, the air-supply pipe communicating with the external air. Oil and steam are admitted to their respective chambers B and F and travel to the opposite ends of said chambers around the division-walls into the chambers B' and F'. At first starting the steam sprays the oil into the combustion-chamber, where it is burned. After about fifteen or twenty minutes the generator and combustion-chamber become highly heated, and the oil in passing through the above described becomes vaporized, where it is discharged into the reservoir C, thence through the delivery-pipe D into the mixing-chamber E. The steam in its passage through the chambers F F' becomes thoroughly superheated, and assists also in vaporizing the oil, and passes into the steam-reservoir G, thence through the annular opening *e*, whence it the more efficaciously commingles with the oil vapor by means of the frusto-conical formation of the forward end of the steam-reservoir. It will also be noticed that by the particular construction of the generator the mixing-chamber becomes highly heated, thus forming a mixing-chamber for the gases. In this condition the gases are fed to the combustion-chamber and combined with air at the end of the generator, which air has become highly heated in its passage through the pipe H and chambers K L.

It will be noticed by the above construction and operation that the heating-chambers each have sufficient superficial area of heating-surface to accomplish the desired results, and are so arranged that the one does not interfere in any detrimental manner with the favorable working of the other, but they are, rather, of mutual assistance.

Having thus described my invention, what I claim is—

1. In a device for burning hydrocarbon oils, the oil-vaporizing chamber divided into compartments by means of a division plate or plates, in combination with the superheating steam-chamber and mixing-chamber, means for supplying the oil-vapor to the mixing-chamber, and an air-heating chamber, as described, the mixing-chamber and air-heating chamber terminating in nozzles, substantially as specified.

2. In a device for burning hydrocarbon oil, the oil-vaporizing and steam-heating chambers divided into compartments by means of division-plates, in combination with the mixing-chamber and means for supplying oil-vapor and superheated steam thereto from the oil-vaporizing and steam-heating chambers, and



an air-heating chamber, the mixing-chamber and air-heating chamber terminating in nozzles, substantially as specified.

3. In a device for burning hydrocarbon oil, the oil-vaporizing chamber and the steam-heating chamber, as described, in combination with a mixing-chamber terminating in a nozzle, and an air-heating chamber opening into an annular passage around the forward end of the mixing-chamber and terminating in an annular wedge shaped nozzle, substantially as described.

4. In a device for burning hydrocarbon oil, the oil-chamber B B', superheating steam-chamber F F', and air-heating chambers K L, each and every chamber having external superficial area of heating-surface, in combination with means for supplying the gases to the point of combustion, substantially as described.

5. In a device for burning hydrocarbon oil, the oil-vaporizing chamber divided into compartments, the vapor-reservoir C, and delivery-pipe D, in combination with the superheating steam-chamber divided into compartments, steam-reservoir G, surrounding the delivery-pipe D and communicating with the steam superheating chambers, a mixing-chamber, E, air-heating chambers K L, and nozzles, substantially as described.

6. In a device for burning hydrocarbon oil, the combination, with the oil-vaporizing cham-

ber and the vapor-delivery pipe D, of the superheating steam-chamber having a frusto-conical terminal formation and an annular circular opening and the mixing-chamber having a nozzle, substantially as described.

7. In a device for burning hydrocarbon oil, the combination, with the oil-vaporizing chamber and the vapor-delivery pipe D, of the superheating steam-chamber surrounding the delivery-pipe and having a frusto-conical terminal formation, an annular circular opening, and a mixing-chamber having a nozzle with an air-heating chamber opening into an annular air-passage and terminating in an annular contracted wedge-shaped nozzle.

8. In a device for burning hydrocarbon-oil, the steam-delivery pipe having an automatic regulating-valve,  $r'$ , as described, in combination with the oil-delivery pipe having a valve with connecting mechanism, as described, whereby the pressure of the steam from the inlet acting directly upon the valve  $r'$  regulates the flow of oil and steam to the generator.

Signed at New York, in the county of New York and State of New York, this 28th day of July, A. D. 1887.

GEORGE KING CUMMINGS.

Witnesses:

CHAS. P. GILL,

W. A. C. MATTHIE.