

(No Model.)

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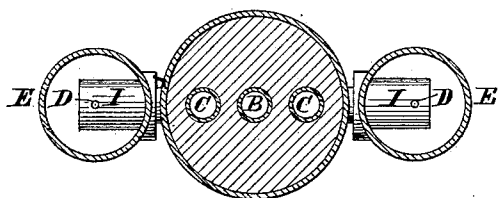
W. G. BUSSEY.

APPARATUS FOR VAPORIZING AND BURNING LIQUID HYDROCARBONS.

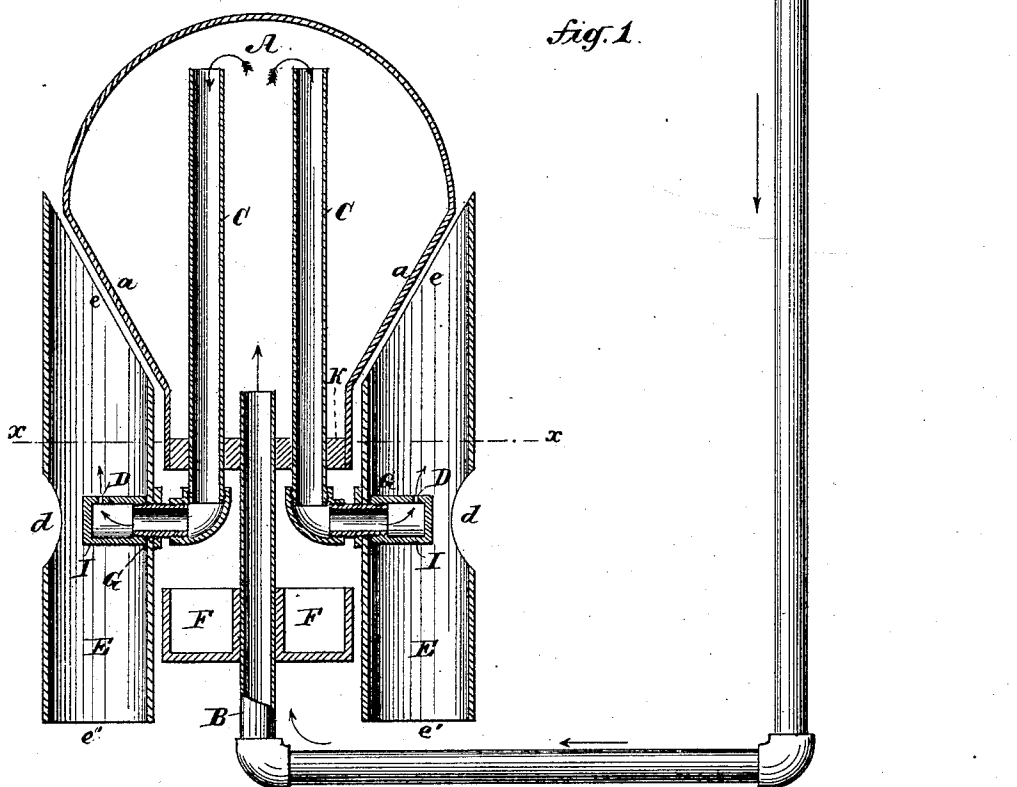
No. 360,558.

Patented Apr. 5, 1887.

*Fig. 2.*



*Fig. 1.*



*Witnesses:*

*Henry E. Loring*  
*A. F. Merritt*

*Inventor*

*W. G. Bussey*

(No Model.)

2 Sheets—Sheet 2.

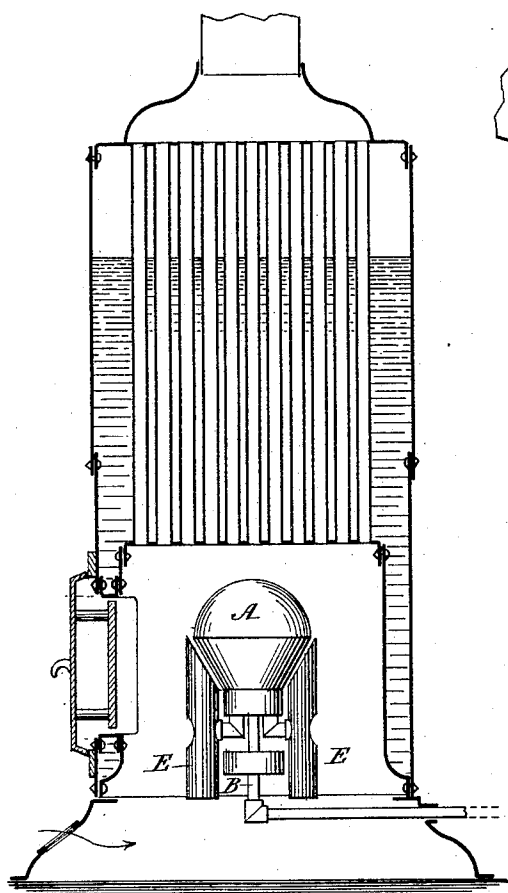
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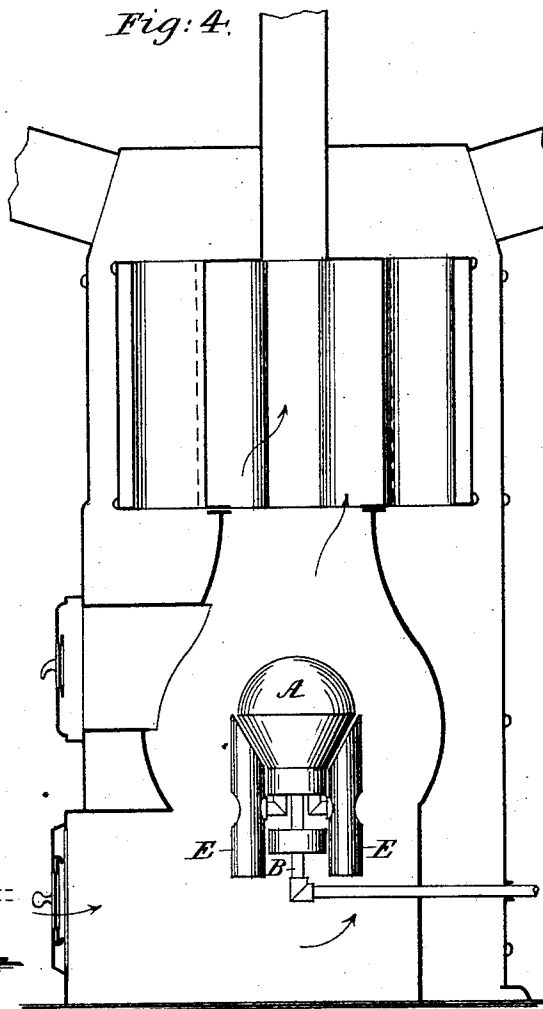
No. 360,558.

Patented Apr. 5, 1887.

*Fig: 3.*



*Fig: 4.*



WITNESSES:

*A. S. Clum*  
*Cyrus Palmer*

INVENTOR

*W. G. Bussey*

# UNITED STATES PATENT OFFICE.

WILLIAM G. BUSSEY, OF NEW YORK, N. Y.

APPARATUS FOR VAPORIZING AND BURNING LIQUID HYDROCARBONS.

SPECIFICATION forming part of Letters Patent No. 360,558, dated April 5, 1887.

Application filed November 6, 1886. Serial No. 218,129. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM G. BUSSEY, a resident of the city, county, and State of New York, and a citizen of the United States, have  
5 invented an Improved Apparatus for Vaporizing and Burning Liquid Hydrocarbons, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this  
10 specification.

My invention relates to an apparatus for burning liquid hydrocarbons—such, for example, as kerosene-oil—in which the liquid is vaporized and then mingled with air, and this  
15 mixture is burned; and my invention consists in the devices and their combinations, as hereinafter particularly described, adapted to operate as and for the purpose specified, and as more at length hereinafter set forth.

20 Figure 1 is a vertical central sectional view of an apparatus containing my invention and showing the liquid-supply tube and reservoir in elevation; and Fig. 2 is a cross-section of the apparatus on the line *x x*, Fig. 1. Fig. 3  
25 is designed to illustrate a method of applying my apparatus to an ordinary upright steam-boiler. Fig. 4 is designed to illustrate a method of applying my apparatus to an ordinary heating-furnace, such as are commonly used for  
30 heating dwellings.

Corresponding letters of reference indicate corresponding parts.

A is a vaporizing or gas-generating chamber. It is preferably constructed in the form  
35 shown—namely, with its upper part or dome hemispherical and its lower part a section of an inverted cone, thus furnishing the flaring side walls, *a a*, which, however, may be either straight or curved. I find this form effective,  
40 but do not confine myself to it as essential. It is essential that the lower sides of this chamber shall project outwardly from the base sufficiently to permit the mixing-tubes E E to be located wholly or partly under the same. It  
45 may be made of cast-iron or other suitable material. A pipe or tube, B, leads into this chamber through its base K, as shown, from a reservoir at H, and the hydrocarbon is thus supplied to the chamber.

50 C C are outlet-tubes leading from the interior upper part of said chamber to the tubular mixing-chambers E E. These mixing-tubes,

as shown, are simply tubes open at both ends, having their combustion or burner ends located wholly or partly under the lower sides of the  
55 vaporizing-chamber, and so directed toward the under sides of the vaporizing-chamber that the flame from said tubes will impinge upon the under sides of said chamber. I preferably  
60 cut these tubes off diagonally at the top, as shown, in order to more effectually direct the flame against the under sides of the chamber A. Each of the tubes C C may be provided  
at G with a cap, I, in which the aperture D  
(one or more) is formed as shown, and there  
65 may be an opening, *d*, in the wall of the mixing-tube E, as shown, to permit the cap I to be screwed to the end of the tube C and to be  
unseated at pleasure. Below the chamber A  
may be placed the cup F, which may conven-  
70 iently be mounted on the supply-tube, as shown.

When operated, the cup F may be filled with asbestos or other similar material saturated with oil or alcohol and ignited. The flame  
75 from the cup F will heat the chamber A. The oil or other hydrocarbon to be vaporized is then allowed to flow through the supply-tube B into the chamber A. As soon as the hydrocarbon comes into contact with the interior of  
80 the heated chamber A, the generation of vapor from the hydrocarbon commences, and the vapor rising from the hydrocarbon fills the upper interior part of the vaporizing-chamber A, and is forced through the outlet-tubes C C  
85 into the interior of the mixing-tubes E E, and is mixed with air in the open space therein, and the mixture of vapor and air rising through said mixing-tubes is ignited and burns at the  
combustion or burner ends *ee*. The flame arising from the said mixing-tubes coming in con-  
90 tact with the sides of the chamber A keeps it hot and causes the generation of vapor to continue as the hydrocarbon continues to flow into chamber A, and the vapor continues to be  
forced through the outlet-tubes C C into the  
95 mixing-tubes E E, thus making the flame from the mixing-tubes continuous.

The tubular mixing-chamber E as constructed and used in my apparatus has its interior space open and unobstructed from the  
100 point where the vapor enters the tube to and including the top or combustion end of the tube, and the combustion end is located either wholly or partly under the lower side of the

vaporizing-chamber. The special advantages of this method of construction and location are as follows: The vapor enters the chamber in a strong jet from the orifice D, and the open space in the mixing-tube between the point where the vapor enters and the mouth or combustion end thereof allows the mixture of vapor and air to take place quickly and freely without in any way obstructing or retarding the upward flow of the vapor, so that all of the vapor which enters the tube is rapidly and freely discharged from the top of the tube, the mixture with air taking place on its way upward without retarding it. The top of the tube being open, the mixture of vapor and air escapes freely therefrom. The force of the jet of vapor, combined with the natural draft resulting from the heat at the top of the tube, causes the mixture of vapor and air to be driven from the top of the tube in a strong and rapid current. The rapidity of the current through the tube prevents combustion from taking place below the top. The result of this construction is that the mixture of vapor and air burns at the top of the tube in a strong and vigorous flame, which strikes directly upon the under side of the vaporizing-chamber, and then rising above it becomes available for heating purposes. The vigor and strength of the flame result from the force of the vapor-jet, the rapid mingling of the vapor with air in an open and unobstructed space, and the free exit of the mixture from the top of the tube.

The force of the jet is the result of the rapid and continuous generation of vapor, caused by throwing a strong flame directly upon the under sides of the vaporizing-chamber. Another result of the strong heat thrown directly upon the under sides of the vaporizing-chamber is that the hydrocarbon is almost entirely vaporized, and the residuum does not accumulate so rapidly, so that the vaporizing-chamber does not require frequent cleaning. I commonly arrange two or more mixing-tubes under opposite or nearly opposite sides of the vaporizing-chamber, and thereby produce a flame which surrounds the vaporizing-chamber and rises some distance above it.

Whenever I deem it desirable, in order to prevent the possibility of the combustion taking place within the tube, I cover the top of the tube with wire-gauze or perforated metal, which offers but slight resistance to the passage of the vapor and air, but effectually prevents the flame from running down within the tube.

My vapor-generator differs from any other form of generator used in hydrocarbon-burners and known to me in this, that it combines three essential features: first, the exposure of its under sides or walls to the direct action of the flame from the mixing-tubes; second, that the hydrocarbon is fed into the chamber under pressure without admixture with steam; and, third, that the vapor generated escapes only from a point in the upper interior part

of the chamber. Though generators have been constructed having one or two of these characteristics, I know of none which combine all three.

By my method of construction I am enabled to use vaporizing-chambers of very much greater proportionate capacity than any I have seen or known of. The advantages are obvious. Vapor is generated more rapidly and more steadily, the volume of vapor remaining continuously in the chamber during use is greater, and impurities or sediment from the hydrocarbon cause less difficulty. I therefore deem it desirable, though not essential, that the generator should be of twenty-five cubic inches interior capacity or more.

It is essential that the tube or tubes which convey the vapor from the vaporizing-chamber to the mixing-tube shall in each case lead from the upper interior part of the vaporizing-chamber, and shall terminate in one or more apertures opening into the interior of the mixing-tube. There may be one tube only extending to the interior of the vaporizing-chamber and branches leading to the several mixing-tubes, or there may be distinct tubes to each mixing-tube.

It is essential in the use of my apparatus that the hydrocarbon shall be introduced into the generator under pressure. This feature, taken alone, is not novel, but forms an essential part of my combination. This pressure may be obtained either by elevating the reservoir H above the level of the generator or by making the reservoir H air-tight, and by connecting therewith an air-pump or equivalent device, by means of which air may be forced into the reservoir until the desired pressure is obtained. Steam-pressure may be used for the same purpose. The outlet-tubes C C are constructed (as at the aperture D) so that the vapor generated is retarded in its escape from the chamber A. The result of this arrangement of parts is that the vapor generated stands in the chamber A at considerable pressure, and this back-pressure retards or holds back the flow of the hydrocarbon into the chamber A, so that as matter of fact when the apparatus is in actual use the hydrocarbon usually stands in the chamber A as water stands in a steam-boiler, the pressure from the vapor generated preventing it from rising in the chamber sufficiently to overflow into the outlet-tubes C C. I am thus enabled to so construct my apparatus by making the size of the orifices in the outlet-tubes through which the vapor escapes in proper proportion to the side of the chamber A, and the pressure at which the hydrocarbon enters the chamber, that the flow of the hydrocarbon into the chamber A is controlled automatically, largely independent of valves upon the supply tube or tubes, and is prevented from overflowing into the outlet tube or tubes, thus producing a comparatively steady flame, and I have determined by actual experiment what these proportions

should be. I claim this method of adjustment in connection with my apparatus as a distinctly novel feature.

I now give the following rule of proportion-  
 ate adjustment. When ordinary kerosene-oil  
 is introduced at a pressure of one pound per  
 square inch into a vaporizing-chamber having  
 an interior capacity of thirty-five cubic inches,  
 the total area of all the orifices D, (whether  
 one or more,) through which the vapor escapes  
 into the mixing-tubes, (whether one or more,) should be from one one-hundredth to one five-hundredths of a square inch. It is obvious that when a hydrocarbon of more or less specific gravity than kerosene-oil is used, or when the interior capacity of the vaporizing-chamber is materially increased or lessened, or when the pressure at which the hydrocarbon is introduced into the vaporizing-chamber is increased or lessened, a corresponding variation in the stated area of the orifices D will be necessary. A variation somewhat upon these proportions will not produce a wholly ineffective operation of the apparatus; but I find that by using these proportions the apparatus operates effectively and well. There may be one or more apertures to the outlet-tubes C C opening into each of the mixing-tubes E E.

Any convenient method of heating the generator preparatory to starting may be used. I do not confine myself to the use of the cup F. Any suitable means for introducing the hydrocarbon to the vaporizing-chamber may be used. I do not confine myself to the special construction of supply-tubes as shown.

Fig. 3 illustrates a method of applying my apparatus to an ordinary upright steam-boiler. It is shown as placed in the fire-box. Any convenient means of support may be used, and a supply-tube, B, may be connected with a reservoir placed at any convenient point. I have not thought it necessary to show the reservoir.

Fig. 4 illustrates a method of applying my apparatus to an ordinary hot-air furnace, such as are commonly used for heating dwellings. It is shown as placed in the fire-box. Any convenient means of support may be used, and a supply-tube, B, may be connected with a reservoir at any convenient point. I have not thought it necessary to show the reservoir.

My apparatus is mainly designed to be used in connection with steam-boilers and hot-air furnaces; but I do not confine myself to its use for these purposes.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an apparatus for the burning of liquid hydrocarbons, the combination, with a vaporizing-chamber having its lower sides inclined, said chamber being provided with suitable means for the introduction therein of a liquid hydrocarbon under pressure, of a mixing-tube adapted for the mingling of hydrocarbon vapor and air within the same before combustion, the interior of said tube being open and unobstructed from the point where the vapor enters the same to the mouth or combustion end thereof, said tube being provided with a suitable opening at its bottom or side for the admission of air, and having its combustion end located wholly or partly under the lower side of said vaporizing-chamber and adjacent thereto, together with a vapor-outlet tube leading from the upper interior part of said vaporizing-chamber, and terminating outwardly in an orifice opening into the interior of said mixing-tube at a point below the combustion or burning end thereof, constructed substantially as described, and for the purpose specified.

2. In an apparatus for the burning of liquid hydrocarbons, the combination, with a vaporizing-chamber having its lower sides inclined, said chambers being provided with suitable means for the introduction therein of a liquid hydrocarbon under pressure, of two or more mixing-tubes adapted for the mingling of hydrocarbon vapor and air within the same before combustion, the interior of each of said tubes being open and unobstructed from the point where the vapor enters the same to the mouth or combustion end thereof, each of said tubes being provided with a suitable opening at its bottom or side for the admission of air, and having its combustion end located wholly or partly under the lower side of said vaporizing-chamber and adjacent thereto, together with two or more vapor-outlet tubes leading from the upper interior part of said vaporizing-chamber and terminating outwardly in an orifice opening into the interior of each of said mixing-tubes at a point below the combustion or burning end thereof, constructed substantially as described, and for the purpose specified.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 4th day of November, 1886.

WILLIAM G. BUSSEY.

Witnesses:

CYRUS PALMER,  
 A. S. CHURCH.