No. 669,987. Patented Mar. 19, 1901.

A. HAYES.

APPARATUS FOR THE PRODUCTION OF VAPOR FROM OILS.

(Application filed Oct. 27, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

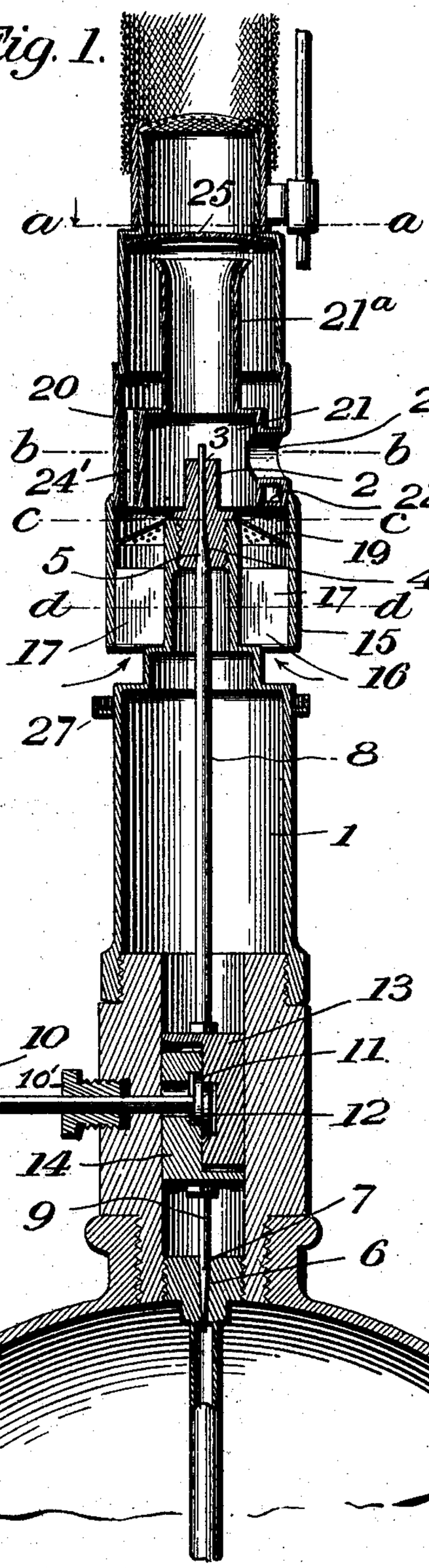

Fig. 2.

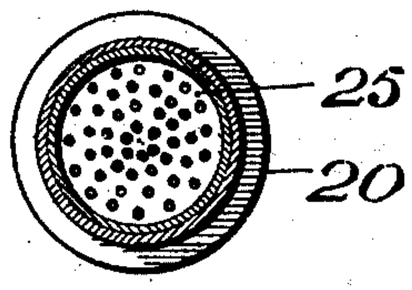

Fig. 3.

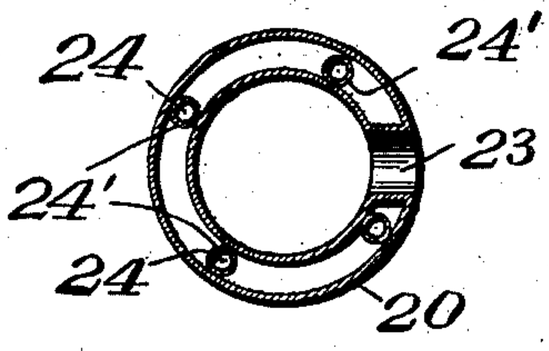

Fig. 4.

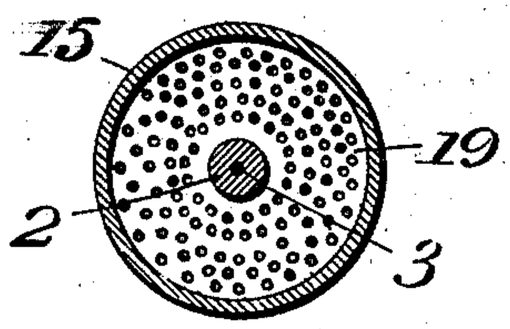

Fig. 5.

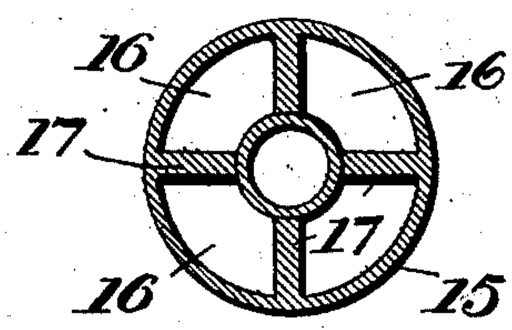

Fig. 6.

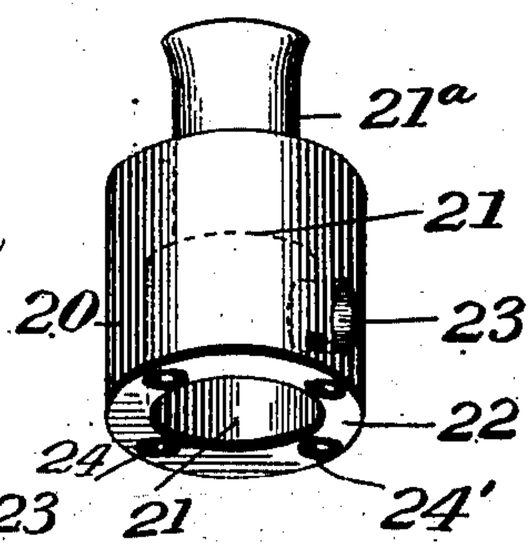

Fig. 7.

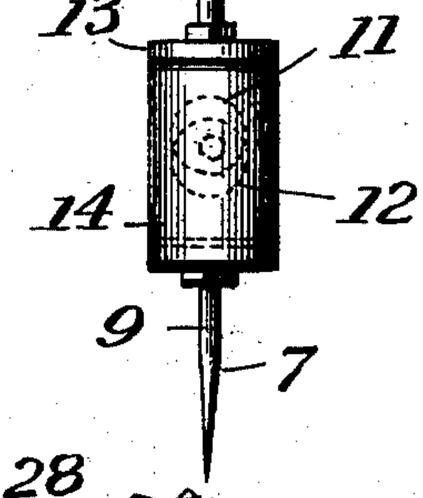

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Fig. 8.

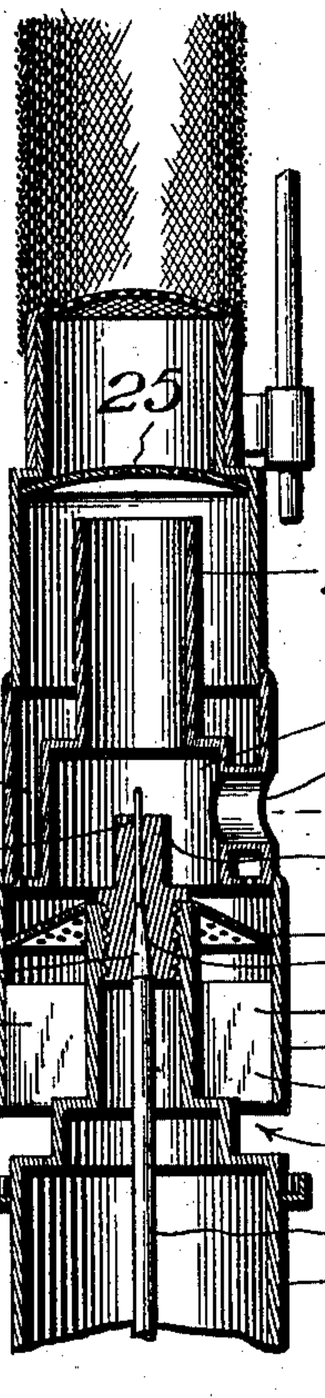


Fig. 10.

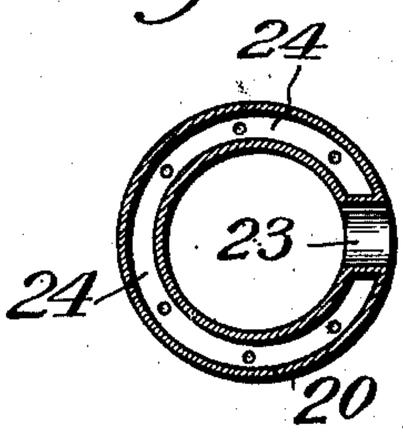
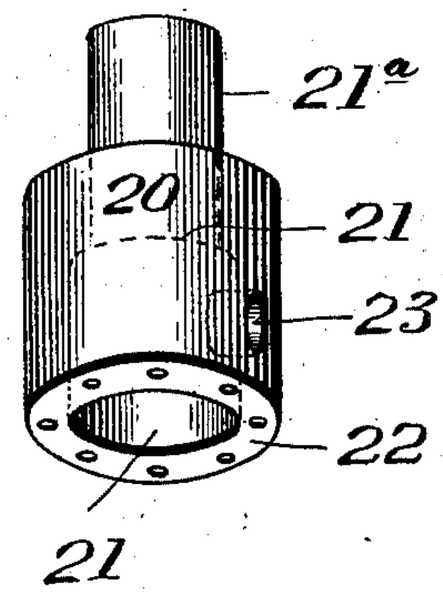


Fig. 9.



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UNITED STATES PATENT OFFICE.

ALBERT HAYES, OF SALT LAKE CITY, UTAH, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NEW LIGHT HEAT & POWER CO., OF UTAH.

APPARATUS FOR THE PRODUCTION OF VAPOR FROM OILS.

SPECIFICATION forming part of Letters Patent No. 669,987, dated March 19, 1901.

Application filed October 27, 1900. Serial No. 34,531. (No model.)

To all whom it may concern:

Be it known that I, ALBERT HAYES, a citizen of the United States, residing at Salt Lake City, in the county of Salt Lake, State of Utah, have invented certain new and useful Improvements in Apparatus for the Production of Vapor from Oils, of which the following is a description, reference being had to the accompanying drawings and to the figures of reference marked thereon.

My invention relates to improvements in vaporizing and burning hydrocarbon oils, particularly the heavier or less volatile oils, such as kerosene, for the production of heat, for lighting, or other purposes. Devices for this general purpose comprise generally an oil-supply, means for vaporizing the oil, means for mixing the vapor with air to form a combustible mixture having the general qualities of a gas, and a burner in which this gaseous mixture is burned. Where such devices are used for lighting purposes, a mantle of refractory material, of the type generally known as a "Welsbach" mantle, is placed above the burner and is heated by it to incandescence. When such devices are used for heating purposes generally, the object to be heated is placed above the burner.

In devices of this class the oil is vaporized in a closed tube, to the exterior of which the heat necessary to cause vaporization is applied, and the vapor formed passes into the mixing-chamber without at any time coming in contact with flame. The outlet for the vapor is necessarily made of very small diameter, and by reason of the changes in temperature to which it is subjected much difficulty is found in preventing the clogging of this outlet by the deposit of the tarry matters carried by the oil.

My improvement is designed to do away with this liability of clogging the vaporizer by doing away with the vaporizer and effecting the vaporization of the oil by the direct action of a flame upon the oil fed from the oil-supply; and my invention consists in the means, hereinafter described, by which the vaporization is thus effected and the vapor mixed with air and supplied to the vaporizing-flame, as well as to the main burner.

Figure 1 is a longitudinal sectional view of my improvements. Figs. 2, 3, 4, and 5 are horizontal sectional views on the lines *a a*, *b b*, *c c*, and *d d* of Fig. 1, respectively. Fig. 6 is a perspective view of the double chamber, in which the vapor is mixed with air. Fig. 7 is a detail view of the oil-chamber valves and the means for operating them. Fig. 8 is a horizontal sectional view corresponding to Fig. 1, but showing a modification. Fig. 9 is a perspective view corresponding to Fig. 6, showing a modified form; and Fig. 10 is a horizontal sectional view corresponding to Fig. 3, showing the modified form.

In the drawings, 1 is a chamber for containing the oil to be vaporized. As shown, this chamber comprises an upper and lower portion united by a screw-joint. The chamber may be of any desired form, it being essential only that the chamber be of sufficient capacity to contain the necessary amount of oil. The upper end of the chamber is preferably somewhat reduced in diameter and is provided with a removable nozzle or plug 2, having through it an outlet-opening 3, of small diameter. The outlet-opening is made conical toward its lower end to form a valve-seat 4, in which fits the needle-valve 5. In the bottom of the oil-chamber is an inlet-opening 6, controlled by a valve 7. This inlet-opening is preferably at the center of the bottom, directly in line with the opening 3. The needle-valve 5 is carried by a valve-stem 8, and the valve 7 is carried by a valve-stem 9. The valves are operated to control the outlet-opening 4 and the inlet-opening 6, respectively, by a key 10, extending through the wall of the chamber 1 and having on its shaft, within the chamber, means for effecting simultaneously the movement of the two valve-stems. In the drawings I have shown the shaft of the key provided with oppositely-placed eccentrics 11 and 12, the valve-stems 8 and 9 being provided with yokes 13 and 14, respectively, in which the eccentrics are received, the form of the yokes being such that the movement imparted to the valve-stems will be directly toward and from the valve-seats only. By turning the key in one direction both valves will be withdrawn from their seats, and by turning the key in the opposite direction both valves will be forced to their

respective seats. It should be understood that any means for simultaneously operating the two valve-stems other than the means shown may be used, it being essential only that the inlet and the outlet valves be so regulated that as an increased amount of oil is permitted to escape a correspondingly-increased amount of oil is permitted to enter the chamber. A stuffing-box 10′ is provided to prevent leakage about the shaft of the key.

Surrounding the upper end of the oil-chamber and extending, preferably, slightly above the level of the top of the oil-chamber, but below the top of the nozzle, is a tube 15. Between this tube and the outer wall of the oil-chamber are formed air-inlet passages 16. These are preferably formed by a metal piece 17, of the form shown in cross-section in Fig. 5, having the arms 18 and fitting snugly in the space between the tube and the oil-chamber, the air-passages being formed between the arms. This metal piece extends, preferably, from the lower end of the tube 15 to a point slightly below the top of the oil-chamber. Above the metal piece 17 is placed a ring 19, of perforated metal, fitting between the tube 15 and the oil-chamber. The size of the air-inlet passages is so proportioned that the supply of air is somewhat restricted, and the length of the passages is such that the air will enter with some force. The perforated ring 19 serves to distribute the air entering through the air-passages equally on all sides of the center and probably acts also to further restrict the supply of air.

Above the tube 15 is placed a double chamber comprising an outer tube 20 and an inner tube 21, which may be termed a "mixing-tube." The outer tube 20 is preferably of somewhat smaller diameter than the tube 15 and is connected to it by an ordinary slip-joint or other joint. The inner or mixing tube 21 is supported within the outer tube 20 by a flat ring or diaphragm 22 at its base. An air-inlet tube 23 extends through the walls of the inner and outer tubes to supply air to the interior of the mixing-tube. This air-inlet tube is arranged a short distance above the base of the mixing-tube. The upper portion 21^a of the mixing-tube is preferably of smaller diameter than its lower portion; but the tube may be of the same size throughout its length. The upper end of this tube is preferably made slightly flaring; but this is not essential. Two or more air-inlet tubes may be used, if desired; but I prefer to use one only.

The space between the inner and outer tubes forms an annular downtake-passage 24, the ring or diaphragm 22 being provided with a series of perforations communicating with this passage. I prefer to form this downtake-passage by a series of tubes 24′, placed in the space between the outer tube 20 and the mixing-tube, with their ends extending through the perforations in the ring or diaphragm 22, as shown in Figs. 1, 3, and 6; but these tubes may be dispensed with, the space between the outer tube and mixing-tube forming the downtake-passage, as shown in Figs. 8, 9, and 10. The purpose of the downtake-passage is to convey gas formed in the mixing-tube from above the upper end of the mixing-tube into the space below its base, delivering it in a ring about the base of the mixing-tube, so that when ignited the gas issuing through the perforations in the ring or diaphragm 22 or from the lower ends of the tubes, above described, will form a ring of flame which, as hereinafter described, is caused to take a substantially conical form. Any convenient arrangement by which this can be done may be employed, and my invention is not limited to the specific arrangement for this purpose described and shown.

Above the upper end of the inner tube 21 is an obstruction 25, which, as shown, is a diaphragm of perforated metal within and supported by the outer tube 20. The purpose of this obstruction is to interpose sufficient resistance to the free passage of the gas from the mixing-chamber to cause a portion of it to enter the downtake-passage and pass downward therethrough to support the flame. Any means other than the perforated diaphragm shown which will effect this purpose may be used.

Above the obstruction 25 in the construction shown is placed a perforated metal diaphragm, which forms the top of the burner. The main portion of the gas formed in the mixing-chamber passes through this diaphragm and is burned above it. The mantle 26 is supported above the burner by the usual means and is heated to incandescence by the flame.

Surrounding the upper portion of the oil-chamber at a point below the lower end of the outer tube 15 is a cup 27 for containing alcohol or other liquid for use in starting the action of the device. Any other means—such, for instance, as a removable torch—by which the parts may be heated sufficiently to prevent condensation of the vapor when formed and to furnish a vaporizing-flame to start the operation of the device may be employed in place of this alcohol-cup.

Oil is supplied to the inlet of the oil-chamber from a pressure-tank 28, which may be of any convenient form.

The operation of the device is as follows: The oil-chamber being filled with oil, the cup 27 is filled with alcohol and ignited, or if a removable torch is used it is lighted and placed in position. The flame from the burning alcohol will pass upward about the exterior of the tube 15 and the outer tube of the double chamber through the passages between the tube 15 and the upper portion of the oil-chamber and into the mixing-tube. As soon as the parts are sufficiently heated so that the vapor coming in contact with them will not be condensed the needle-valve is opened, permitting oil to escape through it in a fine stream or spray. By the movement of the key in open-

ing the needle-valve the inlet-valve will also be opened, permitting the entrance of oil from the tank 28, so that the supply of oil in the chamber will be maintained. As the oil passes from the needle-valve upward into the mixing-chamber 21 it will be vaporized by the heat, and by the admixture of air entering through the air-inlet 23 a combustible gaseous compound will be formed. A portion of this gas will, by reason of its free escape being prevented by the obstruction 25, be caused to pass downward through the downtake-passage between the mixing-tube and the outer tube 20 and passing through the perforations in the ring or diaphragm 22 will be ignited below it. A ring of flame will thus be formed, and as the outer tube 15 prevents the flame from finding an exit other than through the mixing-tube it will tend to draw into the mixing-tube about the outlet-nozzle of the oil-chamber. The outer tube 15 prevents access of air to the flame from the side and air can enter only in an upward current through the air-passages 16. This upward current of air distributed by the perforated diaphragm 19 on all sides of the center will aid in forcing the flame into the mixing-tube and the flame will be caused to assume substantially the form of a hollow cone within the mixing-tube about the outlet-nozzle, with the apex of the cone directly above the outlet. The air entering through the air-inlet 23 above the flame and acting upon the upper surface of the flame probably aids to some extent in causing it to assume the conical form. The oil is forced from the needle-valve directly into and through the apex of the cone of flame and in its passage therethrough it is vaporized; but the vapor thus formed is not consumed in this flame. Air entering through the air-inlet 23 is mixed with the vapor thus formed within the mixing-tube. From the mixing-tube the larger portion of the gas passes upward to the burner, a portion of it sufficient to maintain the cone of flame being deflected downward, as above described, through the downtake-passages to maintain the vaporizing-flame, as above described. As soon as the vaporization is started the means used for the preliminary heating may be dispensed with. The oil will continue to be vaporized and the gas formed as long as the supply of oil is maintained.

The brilliance of the light may be regulated by reducing or increasing the discharge of oil from the needle-valve, the vaporizing-flame being maintained constant at all times, so far as its vaporizing effect is concerned, whatever variation there may be in the supply of oil, so long as the supply is not completely shut off.

By the improvements thus described the vaporizing tube or retort heretofore used in vapor-burners is dispensed with. The vaporization being effected in a cone of flame in a mixing-tube of comparatively large diameter, there is nothing to be clogged by the deposit of tarry or other matter from the oil. The vaporization being effected after the oil leaves the needle-valve, the oil-chamber is not subjected to direct flame and is not heated sufficiently to vaporize the oil contained in it. The oil is discharged practically cold through the needle-valve and will therefore have no tendency to clog the valve. The vaporization being effected at the center of the cone of flame is effected at a very high heat and is for this reason more complete than can be effected in a closed retort, with the result that the gas produced is of better quality and when burned produces a higher degree of heat than can be secured with an equal quantity of gas from the vaporizers heretofore used. By the use of my improvements the heavier hydrocarbon oils, such as kerosene, are vaporized and burned as readily as the lighter oils, such as gasolene or naphtha, are vaporized and burned in devices heretofore employed and with materially better results.

While my improvements have been herein described as particularly adapted for use for lighting purposes, it will be understood that they are equally adapted for heating purposes generally.

The gas produced in the mixing-tube of my device may, if desired, be used in an explosive-engine or for any purpose for which a gaseous compound of vapor and air, such as is there formed, may be adapted.

The method of vaporizing hydrocarbon oils by direct contact with flame which is effected by the apparatus herein described and shown is not claimed in this application, but is made the subject of a separate application for patent, filed November 5, 1900, Serial No. 35,566.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an apparatus for vaporizing hydrocarbon oils, the combination with a mixing-tube, of means for forcing a fine stream or spray of oil into the mixing-tube, and means for maintaining a vaporizing-flame within the mixing-tube about the stream or spray of oil.

2. In an apparatus for vaporizing hydrocarbon oils, the combination with a mixing-tube, of means for forcing a fine stream or spray of oil into the mixing-tube, means for maintaining a vaporizing-flame within the mixing-tube about the stream or spray of oil, and means for supplying air above the flame to mix with the vapor generated from the stream or spray to form a gas.

3. In an apparatus for vaporizing hydrocarbon oils, the combination with means for feeding a fine stream or spray of oil under pressure, of means for maintaining a vaporizing-flame in the path of the stream or spray, means for supplying an upward current of air to the flame from below and means for supplying air above the flame to mix with the vapor generated from the stream or spray of oil.

4. In an apparatus for vaporizing hydrocarbon oils, the combination with means for feeding a fine stream or spray of oil under pres-

sure, of means for maintaining a vaporizing-flame within an inclosing chamber in the path of the stream or spray, means for supplying an upward current of air to the flame from below and means for supplying air above the flame to mix with the vapor generated from the stream or spray of oil.

5. In an apparatus for vaporizing hydrocarbon oils, the combination with an oil-chamber having an outlet, of a mixing-tube arranged in line with said outlet, and into which said outlet extends, means for maintaining a vaporizing-flame within the lower end of the mixing-tube about the outlet and means for admitting air to the mixing-tube above the flame.

6. In an apparatus for vaporizing hydrocarbon oils, the combination with a chamber containing oil under pressure, provided with an outlet, of a mixing-tube above the chamber to receive the oil from said outlet, means for maintaining a flame about the base of the mixing-tube and means for admitting air to the flame from below to force it into the mixing-tube to vaporize the oil discharged from the outlet.

7. In an apparatus for vaporizing hydrocarbon oils, the combination with a chamber containing oil under pressure, provided with an outlet, of a mixing-tube above the chamber to receive the oil from said outlet, means for maintaining a flame about the base of the mixing-tube, means for admitting air to the flame from below to force it into the mixing-tube to vaporize the oil discharged from the outlet and means for admitting air into the mixing-tube above the flame.

8. In an apparatus for vaporizing hydrocarbon oils, the combination with an oil-chamber having an outlet, of a mixing-tube arranged in line with said outlet, means for admitting air to the interior of the mixing-tube, an outer tube surrounding the mixing-tube, a downtake-passage between the two tubes for delivering gas into the space below the lower end of the mixing-tube to maintain the flame therein and means for admitting air into the space below the lower end of the mixing-tube to force the flame into the mixing-tube about the outlet.

9. In an apparatus for vaporizing hydrocarbon oils, the combination with an oil-chamber having a valve-controlled outlet, of a mixing-tube arranged in line with said outlet, means for admitting air to the interior of the mixing-tube, an outer tube surrounding the mixing-tube and extending above and below its ends, a downtake-passage between the two tubes for delivering gas into the space below the lower end of the mixing-tube to maintain a flame therein, means for causing an upward current of air into the space below the lower end of the mixing-tube to force the flame into the mixing-tube about the outlet and an obstruction to the free passage of gas above the mixing-tube.

10. In an apparatus for vaporizing hydrocarbon oils, the combination with an oil-chamber having a valve-controlled outlet at its upper end, a mixing-tube above and in line with said outlet, means for admitting air to the interior of the mixing-tube, an exterior passage leading from the upper end of the mixing-tube into the space below its lower end for delivering gas into such space to maintain a flame therein, means for diverting a portion of the gas from the mixing-tube into said passage and means for admitting an upward current of air into the space below the lower end of the mixing-tube to force the flame into the mixing-tube about the outlet.

11. In an apparatus for vaporizing hydrocarbon oils, the combination with an oil-chamber having a valve-controlled outlet at its upper end, of an outer tube surrounding the upper end of the oil-chamber, a mixing-tube above the oil-chamber in line with its outlet, means for maintaining a flame about the base of the mixing-tube, means for admitting air in an upward direction about the oil-chamber to cause the flame to assume a conical form within the end of the mixing-tube and means for admitting air into the mixing-tube above the flame.

12. In an apparatus for vaporizing hydrocarbon oils, the combination with an oil-chamber having an outlet at its upper end, of an outer tube surrounding the upper end of the oil-chamber, a double chamber arranged above the oil-chamber and comprising an inner or mixing tube and an outer tube, the two tubes being spaced apart and having a perforated ring between them at the base of the mixing-tube, means for admitting air in an upward direction between the oil-chamber and the outer tube surrounding it, and means for admitting air to the mixing-tube at a point above its base.

13. In an apparatus for vaporizing hydrocarbon oils, the combination with an oil-chamber having an outlet at its upper end, of an outer tube surrounding the upper end of the oil-chamber, a double chamber arranged above the oil-chamber and comprising an inner or mixing tube and an outer tube, the two tubes being spaced apart and having a perforated ring between them at the base of the mixing-tube, means for admitting air in an upward direction about the oil-chamber, means for admitting air to the mixing-tube at a point above its base, a perforated diaphragm above the upper end of the mixing-tube within the outlet-tube surrounding it, a burner above the mixing-tube and a mantle supported in position to be heated by the burner.

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

ALBERT HAYES.

Witnesses:

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