No. 697,618. Patented Apr. 15, 1902.

L. G. GEBHARD & J. M. ROWLEY.

HYDROCARBON VAPORIZER OR BURNER.

(Application filed Dec. 4, 1900.)

(No Model.) 3 Sheets—Sheet 1.

FIG. 2.

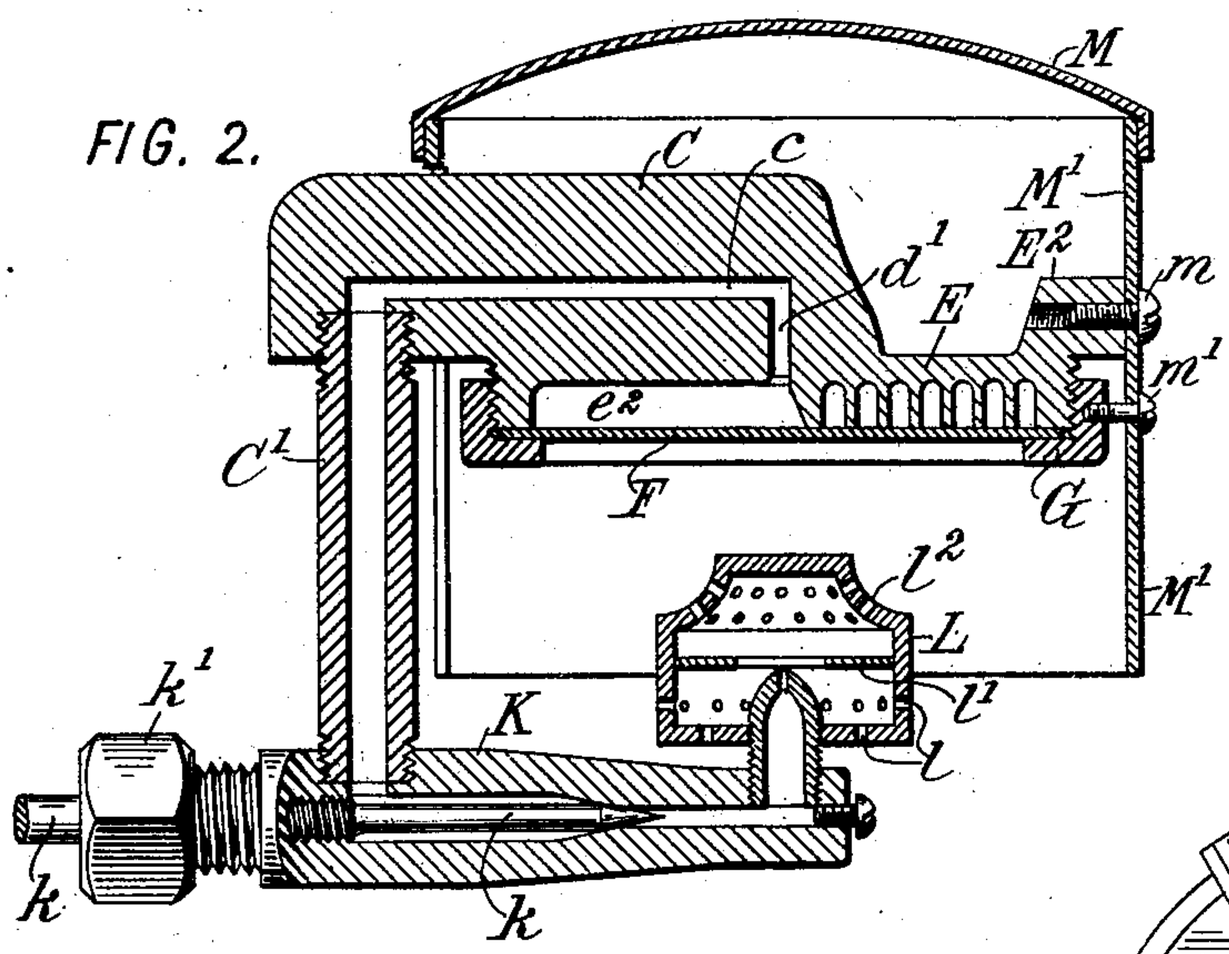


FIG. 1.

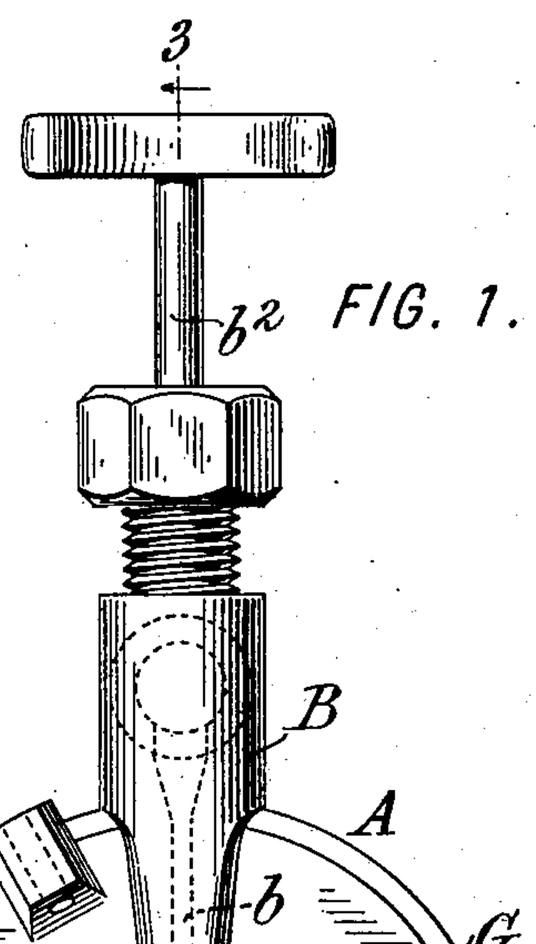


FIG. 6.

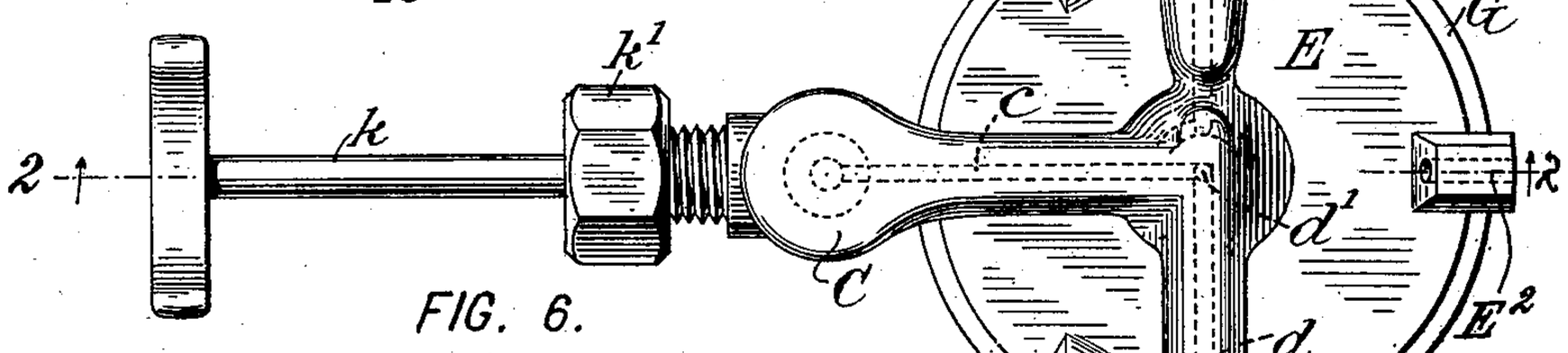
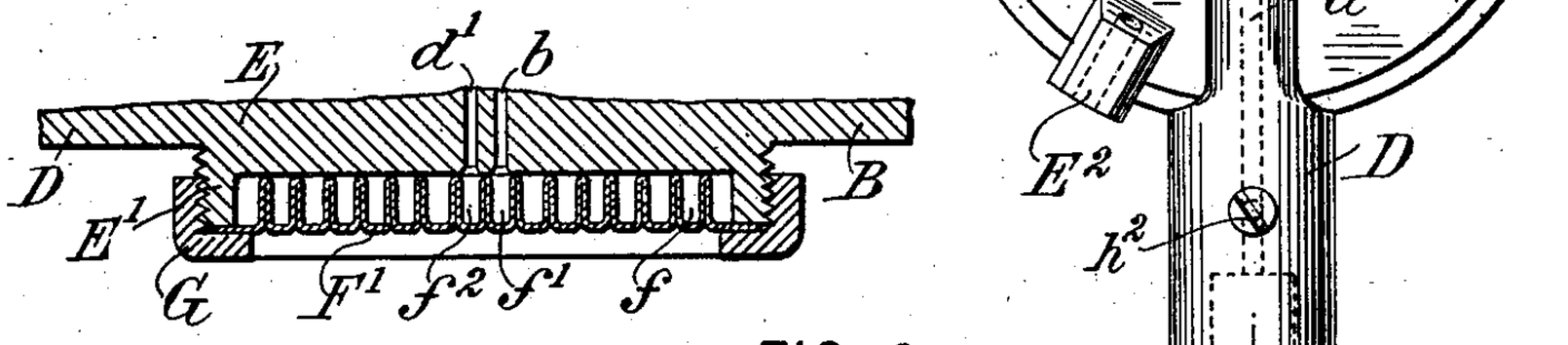


FIG. 3.



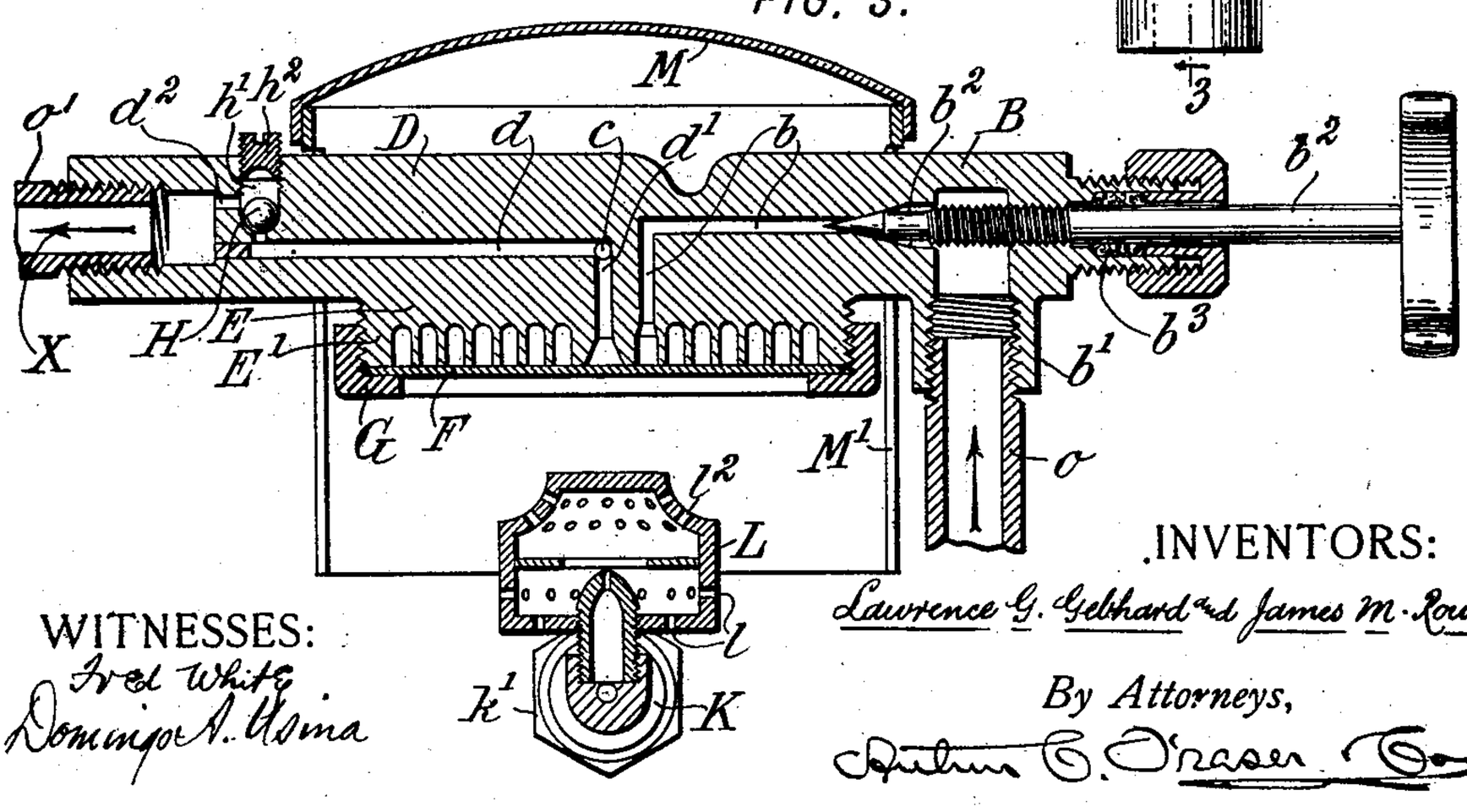


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FIG. 4.

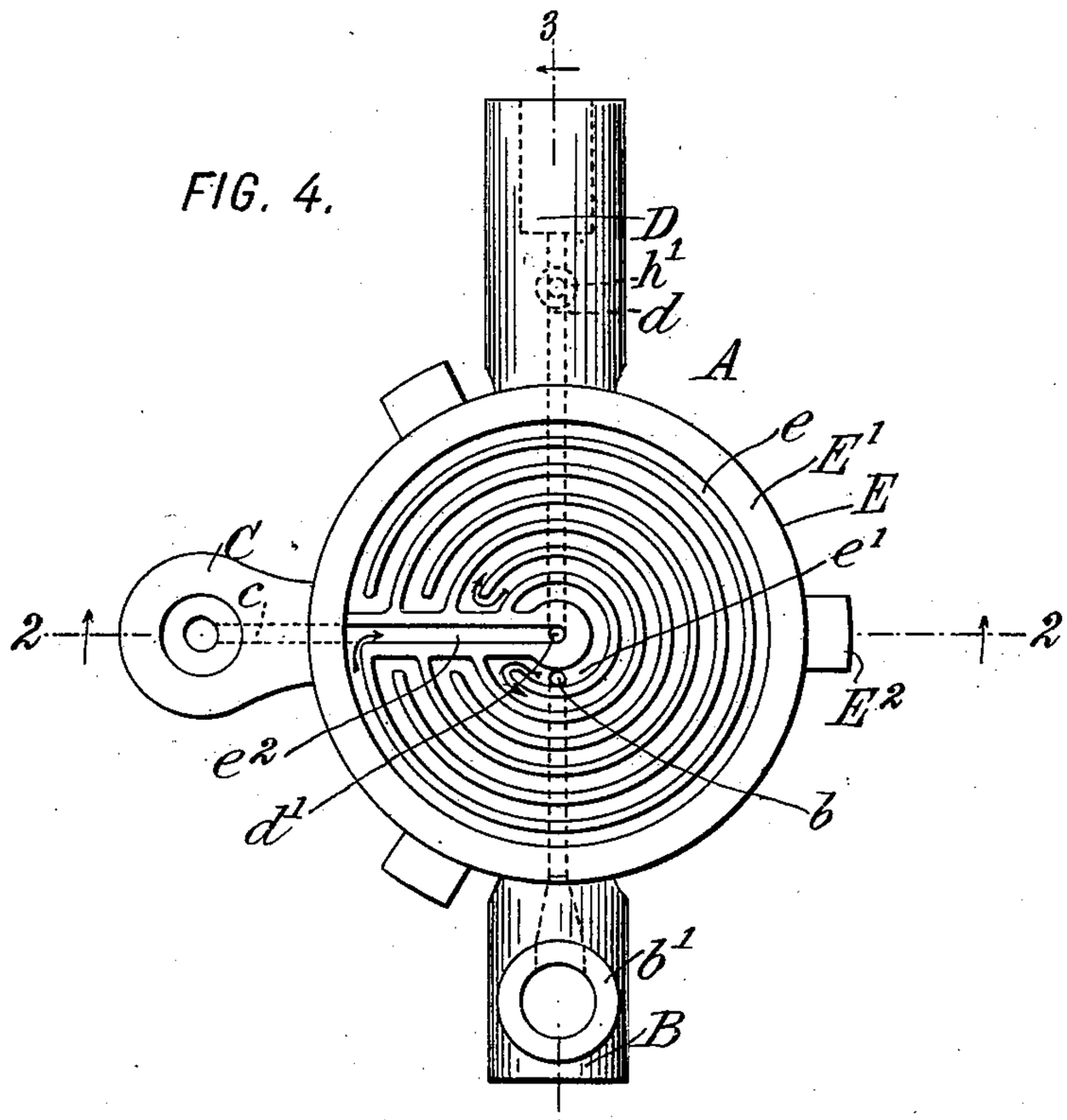

FIG. 5.

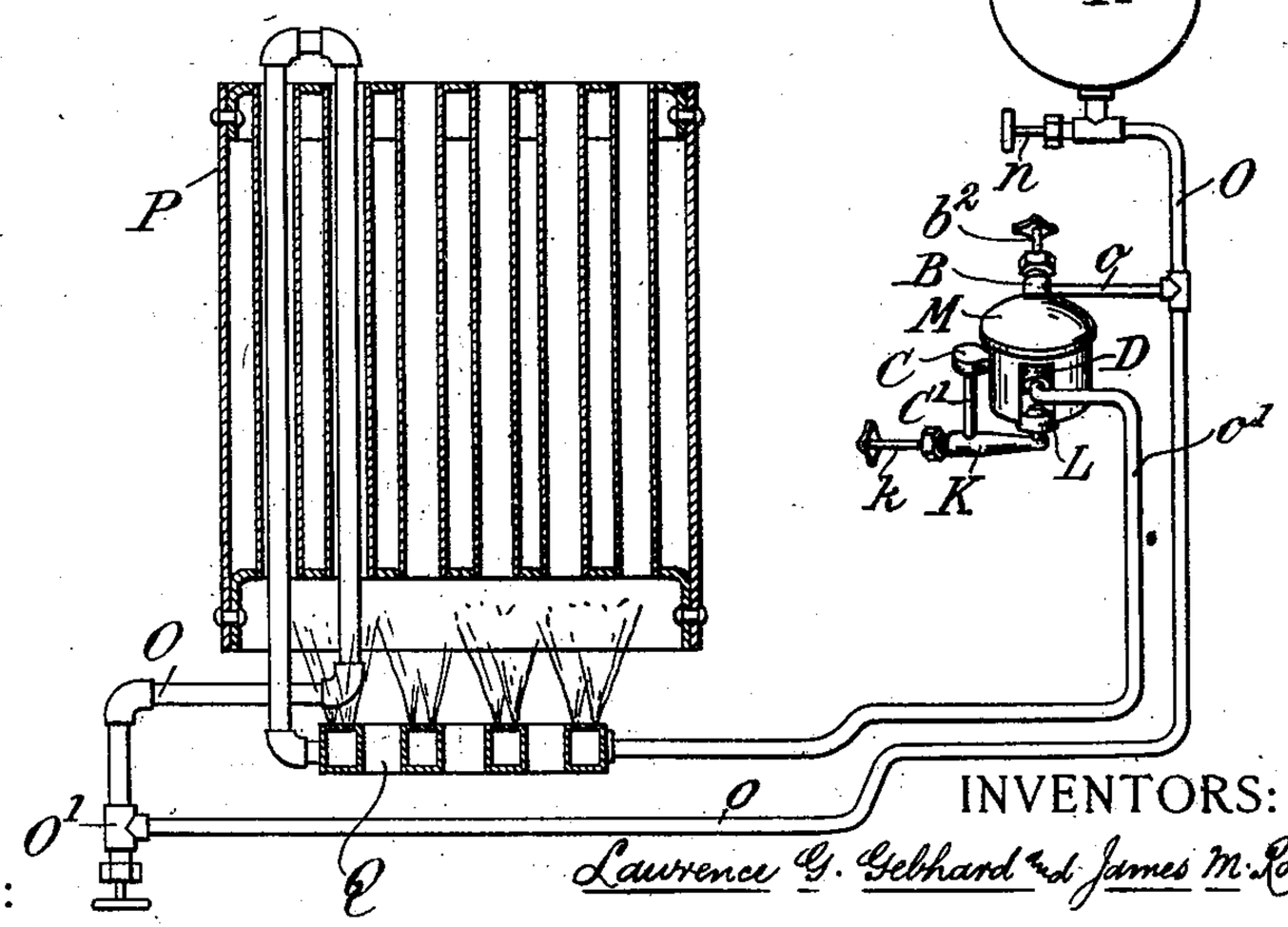

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FIG. 8.

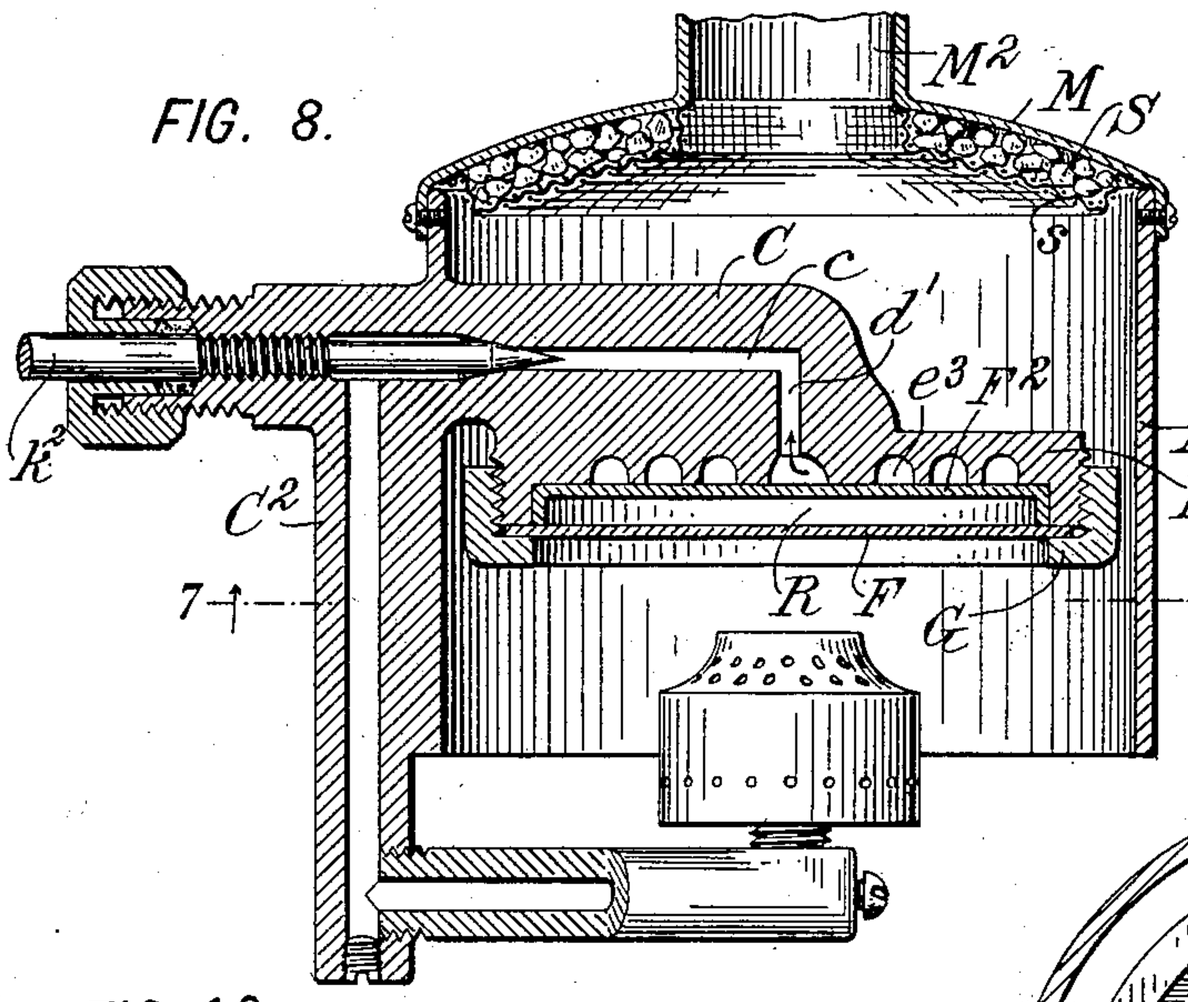


FIG. 7.

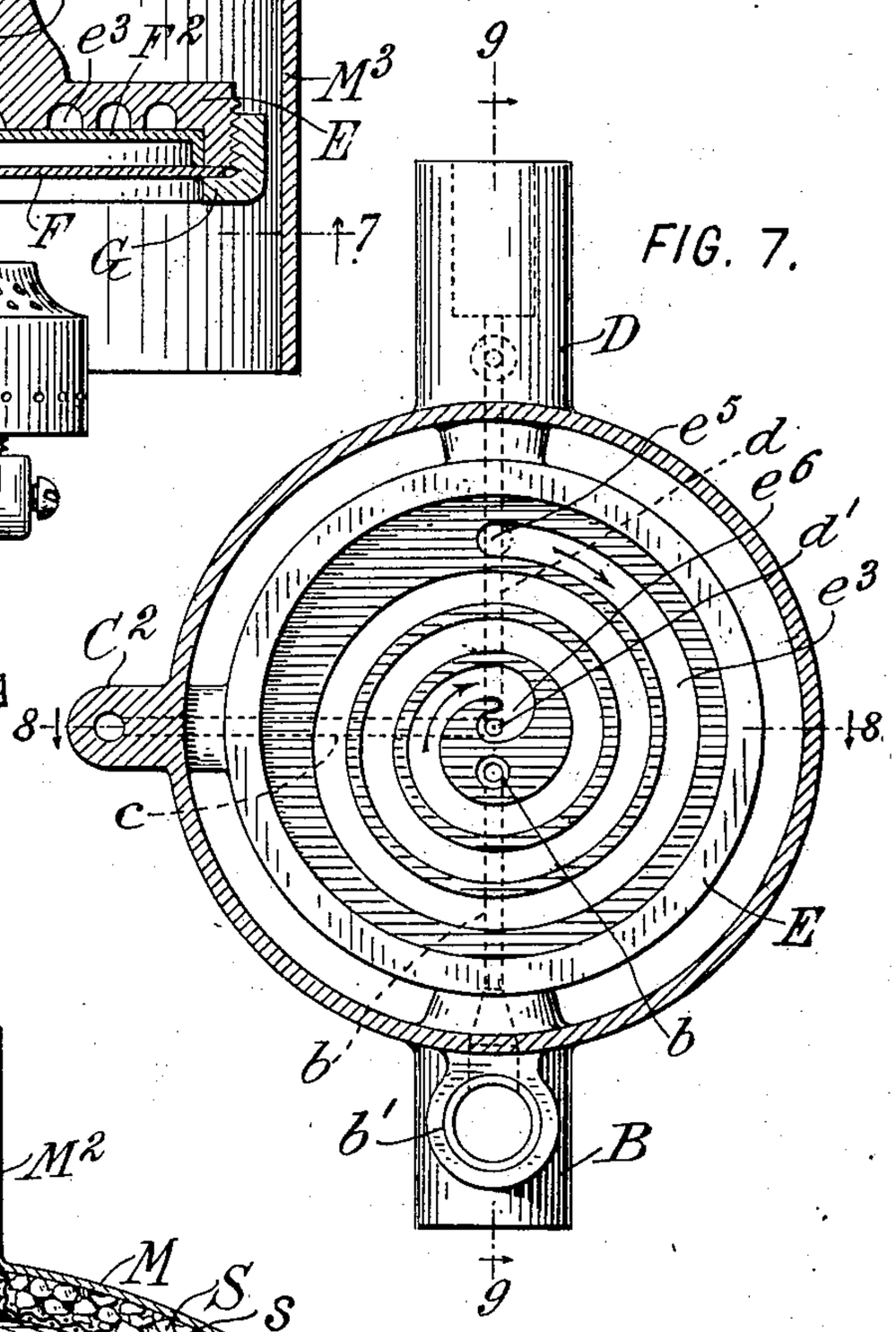


FIG. 10.

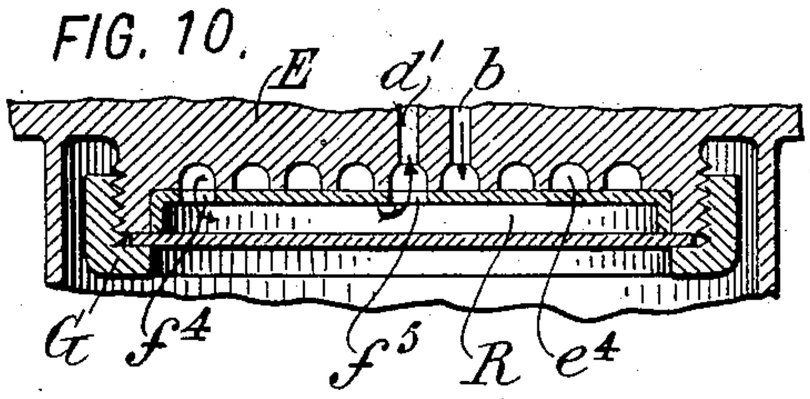
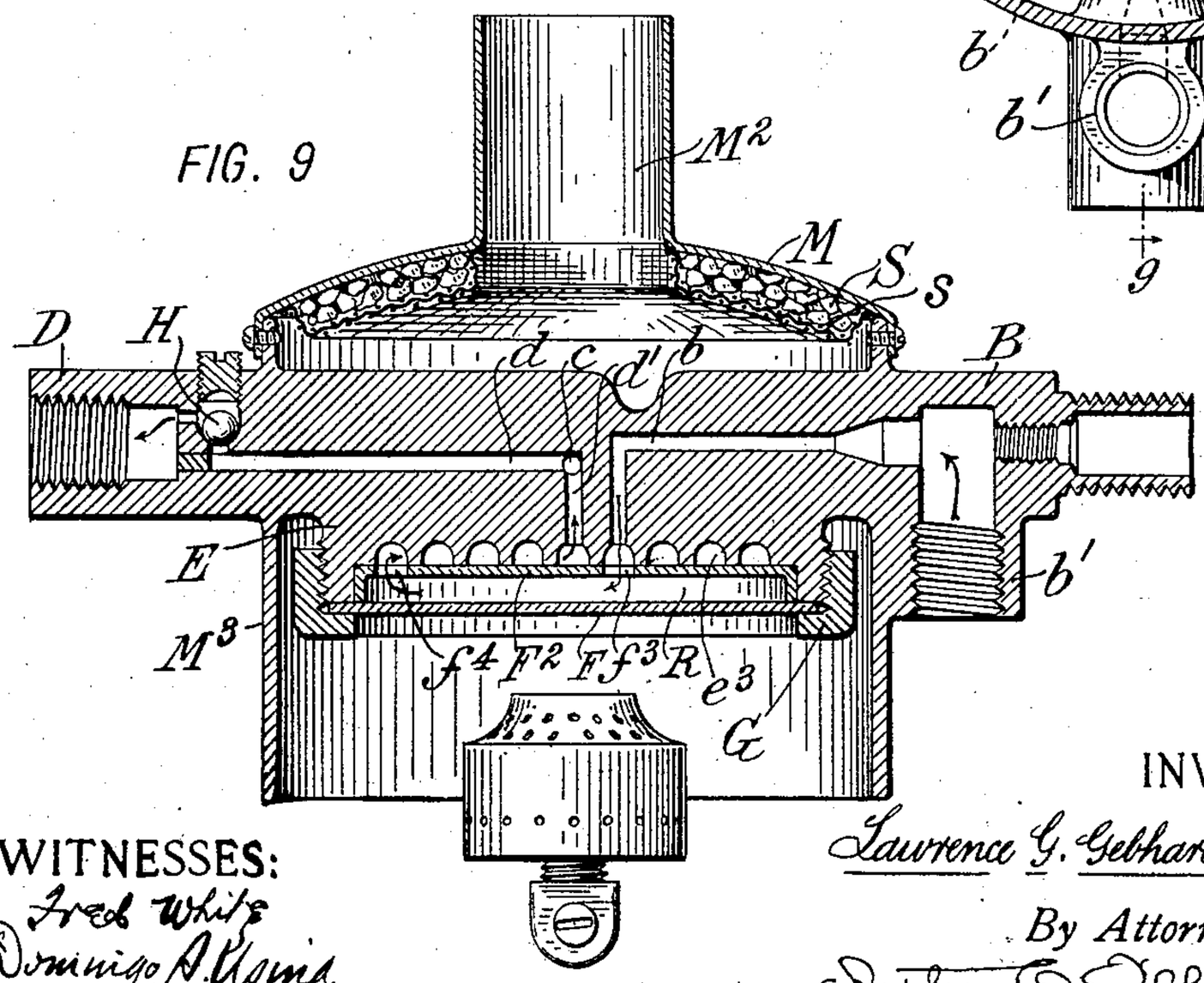


FIG. 9



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UNITED STATES PATENT OFFICE.

LAWRENCE G. GEBHARD AND JAMES M. ROWLEY, OF BUFFALO, NEW YORK.

HYDROCARBON VAPORIZER OR BURNER.

SPECIFICATION forming part of Letters Patent No. 697,618, dated April 15, 1902.

Application filed December 4, 1900. Serial No. 38,608. (No model.)

To all whom it may concern:

Be it known that we, LAWRENCE G. GEBHARD and JAMES M. ROWLEY, citizens of the United States, residing in Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Hydrocarbon Vaporizers or Burners, of which the following is a specification.

Our invention aims to provide an improved vaporizer for generating gas from gasolene and similar liquid hydrocarbons; and it provides especially an extremely compact mechanism whereby the preliminary generation of a considerable volume of gas for use in connection with automobile-boilers and the like may be effected in the quickest possible time, and which can be taken apart and cleaned without difficulty.

Our invention provides also a vaporizer embodying various other features of advantage, as will be hereinafter set forth.

In the accompanying drawings, showing an apparatus embodying our invention, Figure 1 is a plan of the apparatus with the hood of the vaporizing-chamber removed. Figs. 2 and 3 are vertical sections on the lines 2 2 and 3 3 of Figs. 1 and 4, respectively, the hood being in place. Fig. 4 is an under side plan view of the casting forming the admission and discharge branches and part of the vaporizing-chamber. Fig. 5 is a diagrammatic view showing the application of our invention to a well-known type of automobile-boiler; and Fig. 6 is a section, on the same plane as that of Fig. 3, of a modification. Figs. 7 to 11 are views similar to Figs. 4, 2, 3, and 6, respectively, of a modification.

The complete apparatus includes a branch which admits the liquid to a chamber, a chamber into which the liquid passes and is vaporized, a burner which receives a portion of the vapor from such chamber and maintains the chamber heated so as to continue the generation of vapor, and a branch which receives the remainder of the vapor from the chamber, and which is adapted to be connected to a main burner, such as the burner under the boiler of an automobile.

Referring to the drawings, A indicates as a whole the casting which forms a portion E of the vaporizing-chamber, an admission branch B, and branches C and D, adapted to be connected, respectively, to the vaporizing-burner and to the main burner. The portion E of the casting has on its under side a projecting annular flange E′, which, in connection with a covering plate or diaphragm F, forms the vaporizing-chamber. The diaphragm F is made of thin metal—such, for example, as sheet-copper—and is held against the flange E′ by any suitable means, such as a ring G screwing on said flange and L-shaped in cross-section to engage the diaphragm F. The branch B contains a passage *b*, through which the liquid is admitted to the vaporizing-chamber, the liquid-tank being connected in any suitable way, as by a pipe *o* at *b*′, and the flow of liquid being controlled by the needle-valve b^2, which is screw-threaded in the branch B and works in a stuffing-box b^3 of any desired type.

The branch D is connected with the vaporizing-chamber by a passage *d d*′, the gas generated in the vaporizing-chamber being passed through the passage *d* and through a retarding means to the pipe *o*′, which connects with the main burner under the boiler. The preferred retarding means consists of a check-valve whose resistance to the outward flow of the gas forces the gas when the pressure is not very great to find its exit by way of the vaporizing-burner, as hereinafter explained. As shown in Fig. 3, this check-valve consists of a ball H, operating in a chamber *h*′, the lower end of which is connected with the passage *d*, coming from the vaporizing-chamber, and the upper portion of which is connected with a passage d^2, connecting with the main burner-pipe *o*′. The chamber *h*′ is preferably formed by boring from the outside of the branch D and closing the outer end of the bore by a screw-plug h^2.

The branch C is connected with the vaporizing-chamber and with the main-burner branch D. It contains a passage *c*, connecting with the passage *d*′ and with a pipe C′, which in turn connects with the pipe K, which directly supplies the vaporizing-burner L, Fig. 2. The pipe K carries a needle-valve *k*, working through a stuffing-box *k*′. At the end of pipe K is attached the vaporizing-burner L, having a series of perforations *l* for admis-

sion of air, a diaphragm l', and perforations l^2 for the escape of the combustible mixture of air and gas.

The relative positions of the branches and passages as explained above make a most convenient and compact structure; but it will be understood that the relative positions of the parts may be considerably varied without altering the mode of operation of our invention.

The operation of the device as far as described is as follows: The tank of gasolene or similar oil being connected at b' under a pressure due either to its elevation or to the use of compressed air or any other convenient means, the valve b^2 is opened to admit a very slight quantity of gasolene to the evaporating-chamber, the oil entering through the passage b and dropping onto the diaphragm F. A torch being held under this diaphragm, the heat from it acts through the thin metal almost immediately to generate gas from the gasolene. The gas passes upward into the passage d' and the passages d and c. The retarding device in the passage d prevents the escape of the gas in that direction, and it is consequently forced to escape from the passage c through the pipes C' and K to the burner L, where it mixes with air and is ignited by the torch. It will be understood that the valve k is also opened at this time. There is no further use for the torch. The process up to this time is much more rapid with our apparatus than with any other of which we have knowledge. The vaporizer-burner L having started to burn and continuing to generate gas, the valve b^2 is opened so as to increase the supply of gasolene which falls upon the diaphragm F. The pressure increases as the quantity of gas increases until it becomes so great as to raise the ball H and permit to escape through the pipe o' whatever excess of gas there is over that necessary to supply the vaporizer-burner L. The amount of gas required by the burner L is controlled by the valve k. Were the vaporizing-chamber entirely open, so that the vapor from a drop of gasolene admitted through the passage B might be immediately discharged through the passage d', it is evident that but a small quantity of gasolene could be maintained in the vaporizing-chamber, and all the heat of the vaporizing-burner would be concentrated on this small quantity of gasolene, in consequence of which instead of merely volatilizing the gasolene a portion of it would be so highly heated as to be changed to a fixed gas, some of the carbon being deposited in the orifices of the burners and in the passages of the vaporizer, which in the course of time would clog these parts. We prefer, therefore, to make our volatilizing-chamber as a long passage, substantially the entire length of which is exposed to the action of the vaporizing-burner. (See Figs. 4 and 6.) We thus distribute the heating action of the burner over a large quantity of gasolene and prevent overheating of the same and the resultant clogging of the parts. This conversion of the chamber into a long passage is most conveniently effected by constructing the under face of the portion E of the main casting with a circuitous groove e, to the entrance end e' of which the passage b is connected, and whose exit end e^2 discharges into the passage d' leading to the burner. It will be understood that any relative arrangement of the parts which will secure the existence of an extended passage between the point of entrance to the vaporizing-chamber and the point of exit therefrom would secure the advantageous mode of operation referred to. The face of the portion E of the main casting, however, may be plane, as shown in Fig. 6, except for the flange E' or some other means of fastening the diaphragm F', and the diaphragm may be grooved to compel the gasolene or gas to be exposed to the heat of the burner during its passage through an extended groove f, whose entrance f' and exit f^2 may be arranged exactly similarly to the corresponding parts of the groove e in Fig. 4, or in any other equivalent arrangement.

In order to concentrate the heat of the burner L and to thereby economize the amount of gasolene consumed by such burner, we use a hood M, which forms a hot-air chamber above the central portion E of the main casting, the sides M' of the hood being extended below the vaporizing-chamber, as shown in Figs. 2 and 3, and to approximately the lower level of the burner L. The heat accumulating in the chamber between the hood M and the top of the vaporizing-chamber retains the heat against the upper wall of the vaporizing-chamber, so as to produce a much more efficient vaporizer. The hood M is preferably attached by means of lugs E^2, cast integral with the portion E and screw-threaded to receive screws m, passing through the side walls M' of the hot-air chamber, these lugs being preferably extended somewhat beyond the edge of the portion E, so as to form a space between the ring G and the walls M. For preventing the accidental unscrewing of the ring G we may use a screw m', passing through M' and screwing into the ring G. The hood M and the side member M' are readily detached by unscrewing the screws m m'. Access may be then had to the vaporizing-chamber throughout its entire length by merely unscrewing the ring G and removing the diaphragm F or F'. Another advantage of this construction is that it allows the putting of as many braces or bars across the lower clamp from one point of the circumference to another as may be desired, depending on the pressure, and yet without interfering to any appreciable extent with the degree of heat which can be produced, thereby giving the under side of the vaporizing-chamber the required support for high pressure without appreciably diminishing the heating-surface. As the vaporizing-chamber of high-pressure vaporizers is the part which most often needs

attention, our invention is especially designed to facilitate access thereto and accomplishes this function in the simplest possible manner, at the same time providing a thin diaphragm which transmits the heat quickly to the gasolene. The removal of the diaphragm for cleaning or other purposes may be effected without interference by or the necessary removal of any other part easily and quickly, and the reinsertion of the same or a new diaphragm is equally easy. Facility of inspection and cleaning (a property most valuable in high-pressure vaporizers) is thus combined by our device with the necessary qualities for obtaining a high pressure quickly. Access to the admission and exhaust passages b, d, d', and c is also readily obtained by detaching the pipes connected thereto. The valve H is of the cheapest as well as the simplest construction, and can be exposed for cleaning by merely withdrawing the screw-plug h^2. The connections of the parts are simple and strong, so that there is no danger of leakage or getting out of order by usage. The design of the main portion E and the various branches so that they may be cast in a single integral piece simplifies and cheapens the construction and makes it practicable to use aluminium for this purpose, which is highly desirable on account of its lightness.

In Fig. 5 N is the gasolene-tank, having the valve n, through which the oil discharges into a pipe O. A branch o leads thence to the branch B of the vaporizer, the main pipe O leading through a valve O', through one of the flues of the boiler P, and back through another flue to the main burner Q. The gas entering the vaporizer through the branch B circulates through the vaporizing-chamber and a portion is supplied to the burner L. The remainder, constituting when in full operation the greater part of the gas, escapes through the branch D past the check-valve to the pipe o', and thence to the burner Q. It will be understood that the boiler, burner, gasolene-tank, and connections shown are merely for the purpose of illustrating the application of our vaporizer and that any other variety of these parts may be substituted therefor.

The operation of our vaporizer in connection with such parts is as follows: After the vaporizing-burner L is burning at full pressure the valve b^2 is opened more and more to increase the supply of vapor, the excess of which passes through the pipe o' to the burner Q, where it is lighted. At the same time the valve O' is opened to admit gradually-increasing quantities of oil to the pipe O as it passes above the burner Q and through the flues of the boiler. The main burner Q heats the pipe O, so as to generate gas therein, which gas in turn is fed to the burner Q and increases the combustion, the main feed to the burner Q being controlled by the valve O'. As soon as there is a sufficient supply passing through the valve O' and vaporized in the boiler to supply the burner Q the vaporizer is cut out by shutting off the valve b^2. The automatic check-valve H then acts to prevent back pressure.

A great advantage of the construction shown is that the automatic valve H provides against the explosion of the generating-chamber in case of sudden generation of an undue pressure in starting the operation of the vaporizer, a very slight pressure being sufficient to raise the ball and allow the gas to escape. The ball also acts as an automatic shut-off when the generator is not in use, the pressure then forcing the ball downward against its seat, as explained. By the use of this valve or a similar retarder a certain amount of gas is always supplied to the vaporizing-burner under the diaphragm, the weight of the valve causing the gas to escape in that direction before escaping to the main burner.

It is obvious that various modifications may be made in the arrangement of the parts or in the individual features of our invention, and it will be understood that we do not limit ourselves to the exact construction shown and described. We desire to include in our invention all vaporizers having substantially the novel features and mode of operation above described or having any one or more of such novel features.

A modification of the apparatus in several of its features is shown in Figs. 7 to 10, inclusive, Fig. 7 being a section on the line 7 7 in Fig. 8 of the main casting, Figs. 8 and 9 being sections of the complete apparatus on lines 8 8 and 9 9 in Fig. 7, and Fig. 10 being a section similar to Fig. 9 of a modification. One feature of this modification is the construction whereby the first drop of gasolene is immediately vaporized, so as to supply the small burner at once, the advantages of a long passage in utilizing all the heat applied being maintained. The vaporizing-chamber consists, as in the previous case, of a long passage e^3 and has in addition at one end of said passage a large chamber R, thus forming a double chamber. The large chamber can be either at the entrance end of the long passage, as shown in Fig. 9, or at the exit end, as shown in Fig. 10, the passage e^4, Fig. 10, being properly modified to bring its exit-opening in connection with the discharge-passage d'. By arranging the passage as shown in Fig. 9 the gasolene passes first into the large chamber R, which is preferably adjacent to the vaporizing burner or torch and receives at once a large quantity of heat sufficient to vaporize it. It then passes immediately into the circuitous passage, where it receives additional heat, as the upper and lower walls of the circuitous passage are heated both from the chamber below and from the heat confined in the hood above. This arrangement of the vaporizing-chamber is obtained by the introduction of an additional plate or diaphragm F^2 between the main portion E and the diaphragm F, the diaphragm

F^2 being spaced above the diaphragm F a sufficient distance to form the chamber R. Two apertures f^3 f^4 are provided for admitting the liquid and discharging the vapor, respectively, in the construction shown in Fig. 9. In the construction shown in Fig. 10, f^4 is the admission-opening and f^5 a discharge-opening. For conducting the gas from the outlet of the large chamber R we show in Fig. 7 a circuitous passage e^3, consisting of a spiral having its admission-point at e^5 and its discharge-point into the passage d' at e^6. For the arrangement shown in Fig. 10 the passage e^4 will be similar to e^3, its inlet and outlet being properly changed.

In Figs. 8 and 9 we show an orifice at the top of the hood M and a short chimney M^2 for the escape of smoke and for the forming of a draft.

Our generator is also adapted for continual use in the heating of boilers—such, for example, as the small boiler of a yacht—that is to say, the generator will take the place of a burner, such as Q, Fig. 5, under a boiler and no preliminary or auxiliary generator of gas would be necessary. When used in this way, we propose to have the roof of the hood M covered with cement or fire-brick on the inside for the purpose of retaining the heat, so that if the flame in the burner below should be accidentally extinguished—as, for example, by a puff of wind—the gas rising from the burner and coming in contact with the fire-brick, which would probably be maintained at a white heat, would again ignite the burner. This fire-brick lining S may be attached to the roof of the hood in any suitable way and may be either in the form of solid plates bolted in place or in the form of broken pieces, as shown, held in place by a wire-netting *s*, attached to the hood.

In order to cheapen the construction, our main casting may consist of, in addition to the branches and face portions previously described, a lower portion M^3 of the hood, corresponding to the portion M' of Fig. 2. It may also include as an integral part thereof the pipe C^2, corresponding to the separate pipe C' of Fig. 2. It may also have the branch C extended and arranged to receive the valve k^2, as shown in Fig. 8, the passage *c* being suitably modified for this purpose. By including any one or more of these features in the main casting we may considerably cheapen the manufacture of the apparatus and at the same time contribute to its strength.

What we claim, and desire to secure by Letters Patent, are the following-defined novel features and combinations, each substantially as described:

1. In a vaporizer, a vaporizing-chamber, an admission-passage thereto, and two discharge-passages therefrom adapted to conduct the vapor to the vaporizing and main burners respectively, and a check-valve in the main-burner passage opening outward from said vaporizing-chamber.

2. In a vaporizer, a vaporizing-chamber, an admission-passage thereto, and two discharge-passages therefrom adapted to conduct the vapor to the vaporizing and main burners respectively, and means in the main-burner passage resisting the discharge of vapor therethrough so as to insure that the first vapor generated shall pass to the vaporizing-burner.

3. In a hydrocarbon-vaporizer, the combination with a member comprising a main portion E recessed on one face, of a pair of diaphragms F F^2 removably attached to said recessed face and with a space between them so as to form with said recessed face and with each other a double vaporizing-chamber.

4. In a hydrocarbon-vaporizer, the combination with a member comprising a main portion E recessed on one face, of a pair of thin metal diaphragms F F^2 removably attached to said recessed face and with a space between them so as to form with said recessed face and with each other a double vaporizing-chamber.

5. In a hydrocarbon-vaporizer, the combination with a member comprising a main portion E having on one face a long groove, of a pair of diaphragms F F^2 removably attached to said grooved face and having a space between them so as to form with said recessed face and with each other a double vaporizing-chamber composed of a long passage e^3 and a large chamber R.

6. In a hydrocarbon-vaporizer, the combination with a member comprising a main portion E having on one face a long groove, of a diaphragm F^2 forming with said grooved face a long passage e^3, a diaphragm F spaced apart from said diaphragm F^2 and forming therewith a large chamber R, and a ring G holding said diaphragms removably attached in position.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

LAWRENCE G. GEBHARD.
JAMES M. ROWLEY.

Witnesses:
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MYRON M. LUDLOW, Jr.