

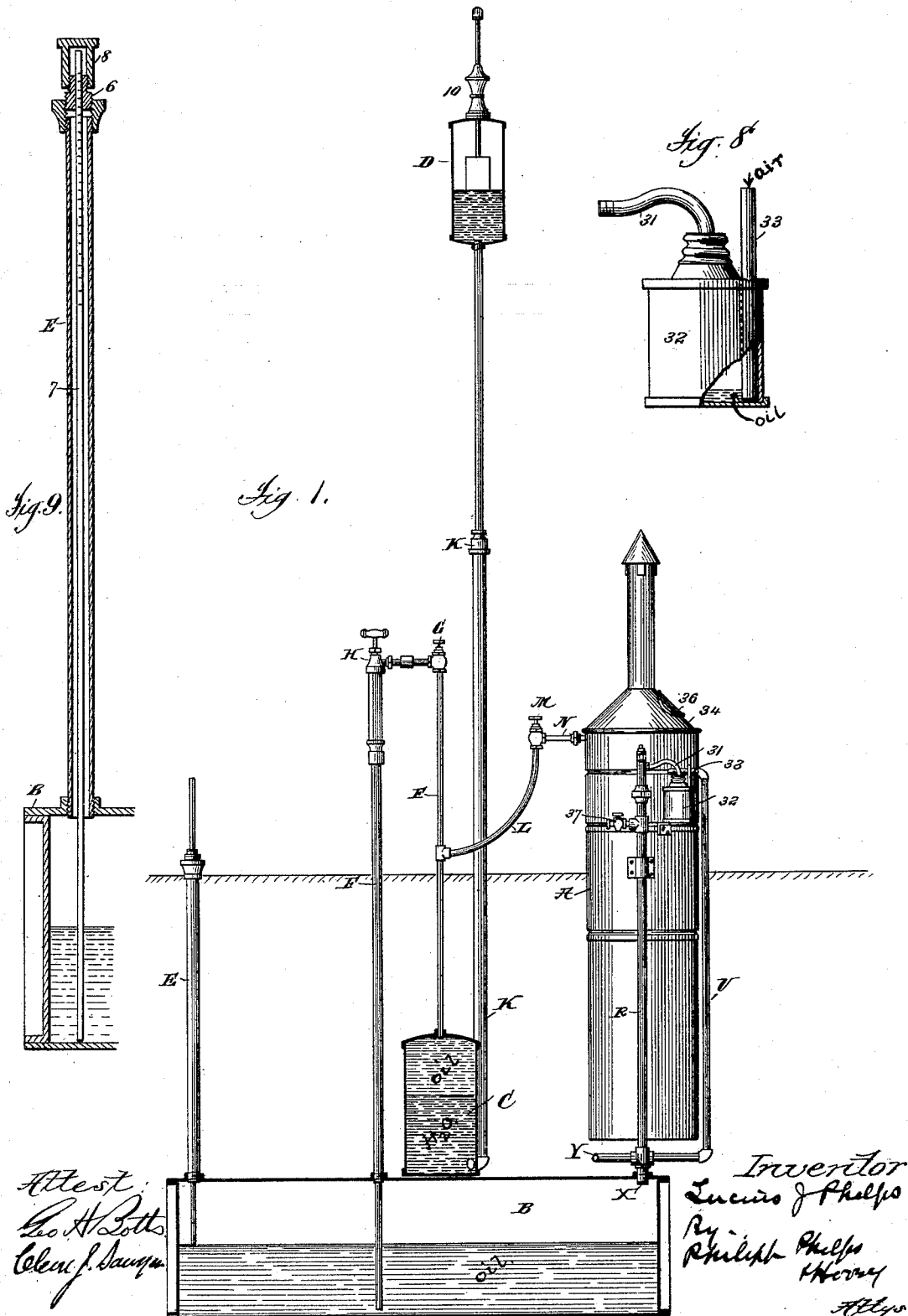
(No Model.)

3 Sheets—Sheet 1.

L. J. PHELPS.
GAS MACHINE.

No. 485,134.

Patented Oct. 25, 1892.



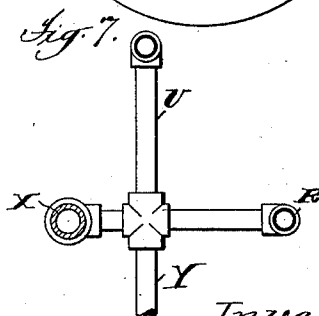
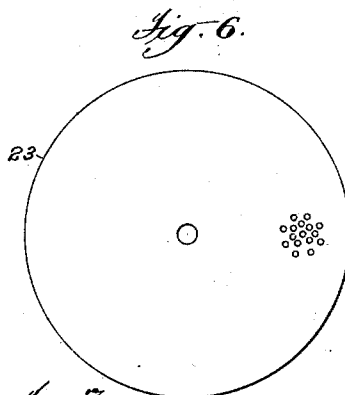
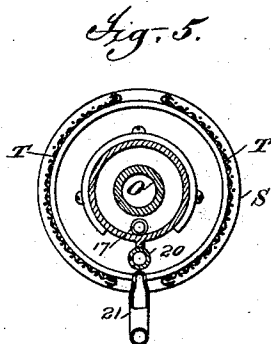
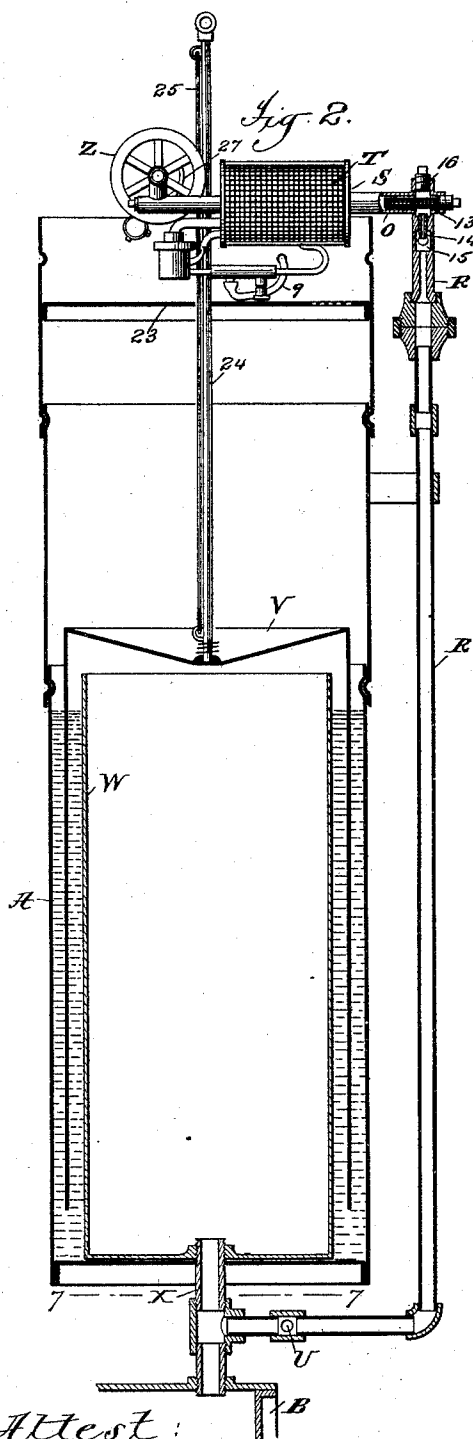
(No Model.)

3 Sheets—Sheet 2.

L. J. PHELPS.
GAS MACHINE.

No. 485,134.

Patented Oct. 25, 1892.



Attest:
Geo. H. Wotts.
Clara J. Sawyer

Inventor:
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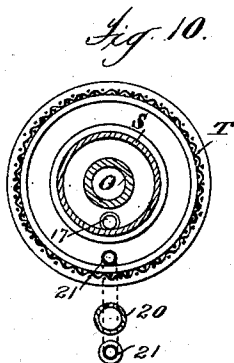
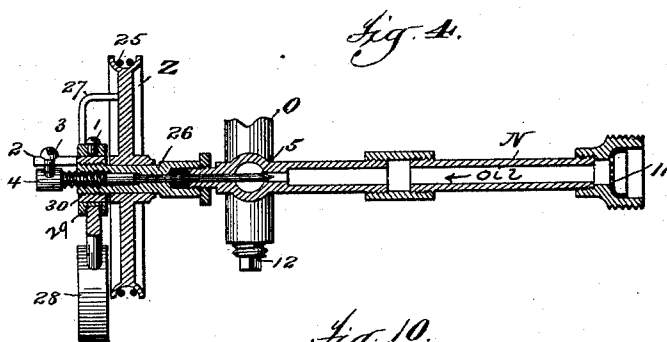
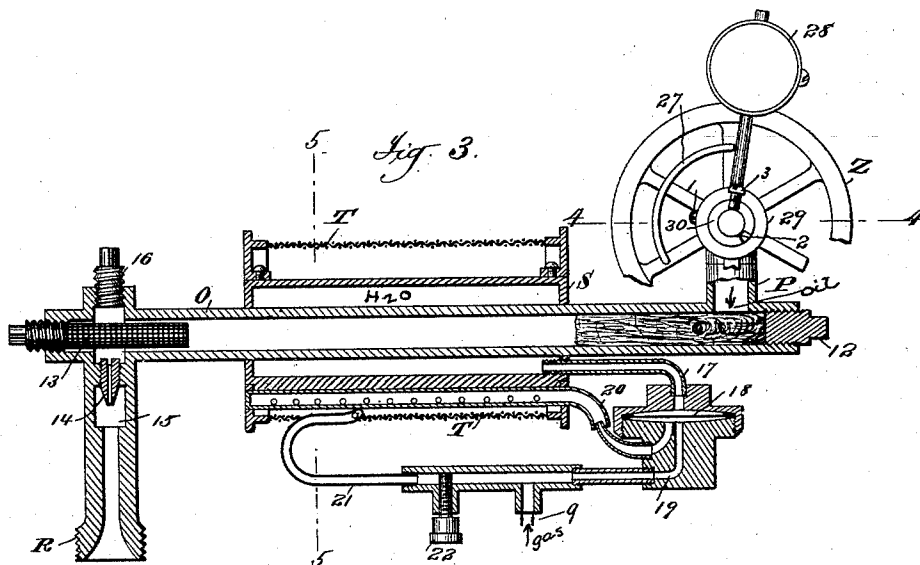
(No Model.)

3 Sheets—Sheet 3.

L. J. PHELPS.
GAS MACHINE.

No. 485,134.

Patented Oct. 25, 1892.



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UNITED STATES PATENT OFFICE.

LUCIUS J. PHELPS, OF PASSAIC, NEW JERSEY.

GAS-MACHINE.

SPECIFICATION forming part of Letters Patent No. 485,134, dated October 25, 1892.

Application filed October 28, 1889. Serial No. 328,451. (No model.)

To all whom it may concern:

Be it known that I, LUCIUS J. PHELPS, a citizen of the United States, residing at Passaic, county of Passaic, and State of New Jersey, have invented certain new and useful Improvements in Gas-Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

10 This invention relates to that class of apparatus by which a volatile hydrocarbon is vaporized and mixed with atmospheric air to produce an illuminating vapor which is popularly known as "illuminating-gas" and which
15 for convenience will therefore be called "gas" in the following specification.

This invention relates particularly, however, to an apparatus of that class in which the vaporization of the hydrocarbon is effected by heat as contradistinguished from
20 the well-known cold process in which the vaporization is effected by passing atmospheric air through or in contact with the volatile hydrocarbon.

25 The invention consists in various details of construction and combinations of parts in an organized machine, whereby the construction of the machine is greatly simplified, its cost reduced, and its operation rendered more
30 certain, reliable, and satisfactory.

A full description of my invention will now be given, reference being had to the accompanying drawings, in which—

35 Figure 1 is a side elevation showing the complete machine. Fig. 2 is a partial sectional elevation of Fig. 1 on an enlarged scale, showing the gas-holder in section and the vaporizing apparatus in elevation. Fig. 3 is a longitudinal section of the retort and connections, showing the valve-operating mechanism in elevation, the weight being shown as
40 about to operate the valve. Fig. 4 is a section on the line 4 4 of Fig. 3, showing the parts in a different position, the valve being closed. Fig. 5 is a cross-section on line 5 5 of Fig. 3. Fig. 6 is a plan view of the diaphragm separating the retort from the holder. Fig. 7 is a longitudinal section taken on the line 7 7 of
45 Fig. 2, showing the connections between the holder, the main, and the pipes leading to and from the retort. Fig. 8 is a detailed view of

the trap-box. Fig. 9 is a vertical section showing a detailed construction of the measuring device, and Fig. 10 a view of a modified form of retort.

Referring now to the drawings, A represents the casing, preferably partly sunk in the ground, as indicated in Fig. 1.

B is a reservoir for containing the hydrocarbon.

C is a supply-tank, and D a pressure-tank for forcing the hydrocarbon from the supply-tank into the retort.

The reservoir B is provided with a filling-pipe E and is connected with the supply-tank C by the pipe F, closed by the cock G and having connected therewith the pump H for drawing oil from the reservoir to the supply-tank. The supply-tank is partially filled with some suitable liquid heavier than hydrocarbon, preferably glycerine, although water
65 may be used when not subjected to freezing.

From the bottom of the supply-tank C a stand-pipe K extends to the elevated pressure-tank D. The tank D is preferably provided with some means for indicating the height to which the glycerine or other liquid has been forced therein. As shown, the whistle 10 is operated by the passage of the air through the top of the pressure-tank and a float on
75 the top of the glycerine indicates the filling of the pressure-tank by closing the air-opening and stopping the whistle. The supply-tank C communicates, also, through the pipe L, controlled by the cock M, with the feeding-
80 pipe N, through which the hydrocarbon passes to the retort.

By means of the pump H the hydrocarbon is drawn from the reservoir B until a sufficient amount has been forced into the supply-tank C, and the cock G is then closed and the cock M opened, when the pressure of the glycerine in the pressure-tank C and stand-pipe K forces the hydrocarbon through the pipe L and feed-pipe N to the retort.

95 The vaporizing apparatus in which the hydrocarbon is converted into vapor to be afterwards supplied with air to form illuminating-gas consists, primarily, of a retort formed of the straight cylinder O, connected at one end with the feed-pipe N through the short connecting-pipe P and connecting at the other
100

end with the pipe R, through which the gas passes to the holder. The feeding-pipe N is preferably provided with a gauze diaphragm 11, which serves to remove any foreign particles from the hydrocarbon as it passes into the retort, and the end of the retort at which the feed-pipe enters is provided for the same purpose with a screw-plug 12, to which is attached cotton-wicking or other loose fibrous material, filling a portion of the end of the retort through which the hydrocarbon passes. This plug has also the important function of securing a more even and regular flow of the hydrocarbon into the retort. The other end of the retort connects with the nozzle 14 through a gauze cylinder 13, connected to a screw-plug for convenient removal, and through the nozzle 14 with a small chamber 15, through which the gas passes to the pipe. This gauze cylinder acts as a strainer, the waste material being collected on the inside of the cylinder and removed with it. This end of the retort is also provided with a screw-plug 16. On account of the straightness of the retort and the use of the screw-plugs and cylinder it is evident that the inside of the retort and of the pipe R may readily be reached for cleaning.

Surrounding the retort O is the sealed cylindrical water-jacket S, and outside of this and partially surrounding it is the wire-gauze F, open above and below, as shown in Fig. 5. This water-jacket S communicates by a pipe 17 with a small chamber upon one side of a flexible diaphragm 18, which forms a valve for controlling the supply of gas to the flame which heats the retort, as will be hereinafter explained. This flame is fed by gas issuing from the perforations in a horizontal burner 20, which extends inside the gauze and in close proximity to the water-jacket and from the perforations of which the gas passes to envelop the water-jacket. This burner 20 is fed from a chamber beneath the diaphragm 18, which chamber communicates, also, through a small pipe 19 with the pipe U, which in turn communicates through the rubber tube 9 with the pipe U outside the gas-holder. The diaphragm 18 is so arranged that so long as the water in the jacket S and pipe 17 is not heated above the boiling-point the diaphragm will remain in such a position as to leave the openings to the burner 20 unobstructed, and thus permit the gas to flow freely to the burner. As soon, however, as the water in the jacket becomes heated above the boiling-point, the increased pressure thus caused will depress the diaphragm 18 and close the pipe opening into the burner, thus shutting off the supply of gas from the burner and extinguishing the flame, which will allow the water in the jacket to cool, and thus reduce the pressure upon the diaphragm 18 and restore it to its original position, when the gas will again pass to the burner 20. The pipe U also communicates with a small pipe 21, which terminates just inside the gauze below the burner and is pro-

vided at each side with perforations, through which the gas passes around and to the perforations of the burner. This pipe is provided with the cock 22, by which the supply of gas may be readily and accurately adjusted. This pipe 21, with its perforations, forms a burner and has a permanent flame to relight the burner 20 when extinguished by the movement of the diaphragm shutting off the supply of gas.

As the wire-gauze T does not entirely surround and inclose the flame, it is evident that some means must be used to prevent the flame from reaching the gas in the holder V or in the upper part of the casing A above the holder. For this purpose the upper part of the casing A, containing the retort and connections, is separated from the lower part of the casing containing the holder by a diaphragm 23, fitting tightly in the casing and provided with a small piece of wire-gauze, through which any gas formed in the lower part of the casing may pass, but which, on the principle of the well-known safety-lamp, will not permit passage of the flame. The perforations in the diaphragm 23 also serve to permit the air to pass through when the holder is raised, thus preventing an air-cushion being formed to oppose the movement of the holder.

The gas holder or receiver V is located in the lower part of the casing A and is of the usual inverted-cup form, its lower edge being immersed in a body of sealing liquid, preferably oil, in the lower part of the casing. In order to reduce the volume of the sealing liquid, the bottom of the casing A is provided with an upwardly-extending cylinder W, which is slightly smaller than the holder V and which forms an annular chamber inside the casing, in which the sides of the holder V enter. The pipe R enters the holder through the short vertical pipe X, which extends from the holder to the reservoir B, the upper part of the vertical pipe forming with the pipe R a conducting-pipe from the retort to the holder. This pipe R is entered at opposite sides by the main Y and the pipe U, through which, respectively, the gas is conveyed to the place of using and to the pipe 19 for feeding the burner. This short vertical pipe X, connecting the holder to the pipe R and reservoir B, permits any condensation or unpurified hydrocarbon in the retort or pipes to pass back into the reservoir, thus preventing any waste.

The holder V rises and falls as the gas accumulates in and is withdrawn from the holder and is provided with an upwardly-extending rod 24, having connected to its upper and lower ends a wire 25, which passes around a grooved pulley Z, which is mounted to turn freely upon a tubular journal 26, formed upon a lateral extension of the pipe P. This pulley is provided upon its outer face with a segment 27, the two ends of which are placed almost diametrically opposite each

other and which are arranged to engage a weighted lever 28. This weighted lever 28 is carried by a collar 29, adjustable upon the screw-collar 30, mounted upon the journal 26.

5 A set-screw 1 serves to hold the weighted lever in position when adjusted. The screw-threads upon the collar 30 serve to hold it upon the journal, and this collar is provided with a stud 2, which is arranged to engage with a stud 3, extending from a threaded rod 4. This rod passes through and works in a nut formed in the tubular journal 26, and its end forms a valve 5 for controlling the opening through which the pipe N communicates with the pipe P and retort O. The purpose of this arrangement will be made clear when the operation of the apparatus is described. The chamber 15, into which the gas enters through the nozzle 14, connects through a small pipe 31 with a receiver 32, which forms a trap-box, it being provided with a pipe 33, communicating with the outer air and entering some suitable liquid, preferably oil, placed in the lower part of the receiver. This trap-box furnishes the air for mixture with the vaporized hydrocarbon for the formation of illuminating-gas, the air being drawn in through the liquid seal by the injecting force of the gas as it passes through the nozzle 14. This nozzle, as shown in Figs. 2 and 3, is screw-threaded, thus enabling it to be readily adjusted by a screw-driver inserted through the retort, so as to extend more or less over the port by which the pipe 31 communicates with chamber 15. The injecting force of the nozzle and the supply of air through the port may thus be regulated as desired.

As shown in Fig. 1, the casing A is provided with a cover 34, provided with a chimney or ventilator and a hand-hole normally closed by the cover 36. This cover 34 may be readily removed, as shown in Figs. 1 and 2, permitting access to the retort and connections; or these may be reached through the hand-hole 36.

The receiver B being sunk in the ground, it is necessary to provide some means whereby the quantity of hydrocarbon for the receiver may be ascertained. For this purpose I use the following device: The filling-pipe E is normally closed by a bushing 6, which may be removed for the purpose of filling the reservoir. Through this bushing 6 passes the small tube 7, extending into the hydrocarbon in the reservoir B. This tube 7 is normally in its lowest position and is covered by a screw-cap 8. This tube is provided with a scale at its upper end, which will indicate when read against the top of the bushing 6 the amount of hydrocarbon in the reservoir. The operation of this device will be explained hereinafter.

In Fig. 10 is shown a modification in which the flame is wholly retained within the wire-gauze surrounding the jacket, thus obviating the necessity for the diaphragm 23. In this construction the jacket S is entirely sur-

rounded by the wire-gauze and the burner 20 extends below and near the outside of the gauze in such a position as to permit the gas to be thrown from the perforations to the inside of the gauze. The small burner formed by the pipe 21 enters the chambers formed by the gauze through the end support and serves to feed the flame as before.

The operation of the machine is as follows:

To put the machine in condition for operation, the supply-tank C will be supplied with hydrocarbon from the reservoir B, as previously explained, the reservoir being filled through the filling-pipe E. Any gas contained in the reservoir B will be forced through the pipe X into the holder V during the process of filling.

In describing the gas-making operation it will first be assumed that the holder V is full or nearly full of gas, so as to be raised to its highest point. When the holder is in this position, the weighted lever 28 will be in a pendent position and the valve 5 will close the supply or feeding pipe N and prevent the entrance of hydrocarbon to the retort. No hydrocarbon flowing into the retort, the flame within the burner will quickly heat the water within the jacket S to the boiling-point, and thereby create a pressure within the jacket, which, being transmitted through the pipe 17, will press the diaphragm 18 down and close the opening from the chamber to burner 20, and thus shut off the supply of gas to feed the flame to the burner. This will in turn allow the water to cool, so as to permit the diaphragm to rise and allow the gas to again pass to the burner, when the operation will be repeated, the gas as it emerges from the perforations in the burner being lighted by the permanent flame at the end of pipe 21. This operation will be repeated, the burner being alternately extinguished and relighted as the valve is closed and opened. The parts, however, will be so adjusted, which can readily be done, that the amount of gas consumed in this lighting and extinguishing of the main flame will be very small. As soon as the gas contained in the holder V commences to be withdrawn, as will be the case when any burner connected with the main Y is lighted, the holder V will fall and will carry with it by means of the wire 25 the grooved pulley Z and the segment 27. As this pulley revolves the segment will raise the weighted lever 28 from its pendent position, and when the holder approaches the lower end of the casing the weighted lever 28 will have reached its vertical position and will drop over, thus actuating the screw-rod 4 through the studs 2 and 3 and opening the valve 5 to permit hydrocarbon to enter the retort. As the valve 5 is opened, the hydrocarbon will pass from the pipe N into the retort, and thus lower the temperature of the water in the jacket S, so as to reduce the pressure upon the diaphragm 18 and allow it to rise, thus admitting gas to the burner 20. The heat thus generated will vaporize the hy-

drocarbon in the retort, and as the hydrocarbon is vaporized it will pass through the gauze cylinder 13 and nozzle 14, drawing in through the trap-box a supply of air to form gas, and pass through the pipe R to the holder. Whenever the consumption of gas falls below the rate of production, the surplus gas will pass into and accumulate in the holder V and the holder will rise and actuate the grooved pulley Z in the opposite direction, thereby carrying through the other end of the segment 27 the weighted lever 28 back to the vertical position, from which the lever will drop to the other side, actuating the stud 4 in the opposite direction and closing the valve 5, thus shutting off the supply of hydrocarbon to the retort. Should the weighted lever 28 for any reason not fall by its own weight, the length of the casing A is such as to permit the further ascent of the holder, when the segment 27 will follow the weighted lever 28 and force it to close the valve 5, thus making a positive connection between holder V and the valve. As soon as the supply of hydrocarbon is shut off the flame within the wire-gauze will raise the temperature of the water in the jacket, so as to depress the diaphragm 18, and the alternating lighting and relighting of the burner will be resumed and continued as soon as the valve is closed. If through any accident the permanent flame at the end of the pipe 21 should become extinguished, so as not to relight the main flame upon the raising of the diaphragm, the result will be that the gas in the holder will continue to escape through the burner 20 until the holder is empty. The gas so escaping will pass upward through the chimney 35 and be wasted. There will, however, in practice be little danger of the permanent flame becoming extinguished in this manner, and even if it does the waste of gas will be comparatively trifling. In case of the permanent flame being extinguished the downward movement of the holder will of course operate the valve 5 through the weighted lever and permit the hydrocarbon to pass into the retort. The hydrocarbon in this case, not being vaporized, will pass through the retort and pipe R to the vertical pipe X and be restored to the reservoir B, thus causing no waste.

When it is necessary to put the machine in operation when the holder V is entirely empty—as, for example, when the machine is first put in operation, or after the permanent flame has been extinguished for some time and the holder has become empty by the leaking of the gas—the operation is as follows: The supply-tank C having been filled and the cock M opened to permit the hydrocarbon to pass to feed-pipe N, the cover 34 is removed and the vent-cock 37 opened. The holder being in its lowest position, the valve 5 is open and the hydrocarbon enters the retort. The holder is now raised by hand, thus closing the valve 5 and drawing air in through the vent-cock 37. As the air is drawn in and comes

in contact with the hydrocarbon flowing through the pipe R, a portion of the hydrocarbon will be vaporized, and thus fill the holder with gas. Upon releasing the holder the gas thus formed will be forced through the pipes R and U and will enter the pipe 21 and through the pipe 19 and chamber to the burner 20. By then applying a match to the end of the pipe 21 the permanent flame will be lighted, which will at once ignite the burner and start the process of gas-making, as before described. It is evident that air may be drawn in through the trap-box 32 instead of the vent-cock 37, thus doing away with the latter; but this would be a slower and less satisfactory method.

In machines of this class as heretofore constructed the pressure in the main has been greater when the holder was being filled than when the holder was being emptied. This was due to the fact that when the holder was being filled the pressure in the main was equal to the weight of the holder and connected parts plus the friction occasioned by their upward movement. When the holder was being emptied, of course the pressure in the main was only equal to the weight of the holder minus the friction of its downward movement. In the present machine this is overcome by connecting the main Y to the side of the conducting-pipe through which the gas enters the holder, by which means the pressure of the gas as it enters the vertical pipe X directly from the pipe R and at right angles to the main Y is sufficiently in excess of the pressure in the main to compensate for the increased weight and resistance of the holder and connecting parts. As shown, the main is connected to the pipe R; but it may be connected to the short pipe X and perform the same function. The construction shown is preferable.

By locating the retort and other parts of the vaporizing apparatus inside the casing A the flame which heats the retort also keeps all the other parts within the casing warm and secures a more regular operation of the machine. Moreover, by this location it is possible to connect the holder V centrally to the pulley, and thus prevent any friction of the holder against the sides of the casing, which would be occasioned by a sidewise strain upon the holder.

In the construction shown in Fig. 1, with the diaphragm 23 separating the upper and lower parts of the casing, any gas passing from the holder V into the casing or any overflow of gas caused by the defective operation of the valve permitting the continued formation of gas after the holder is full will pass through the perforations in the diaphragm and be consumed by the flame of the burner. In the construction shown in Fig. 10 any such excess of gas passing into the upper part of the casing will fill the upper part of the casing A, thereby excluding the air therefrom, and consequently smothering and extinguish-

ing the flames within the gauze T. In either case any accident from this cause is fully prevented.

The operation of the device for measuring the quantity of hydrocarbon in the reservoir is as follows: The reservoir B being connected with the holder by pipe X, the upper part of the reservoir above the hydrocarbon is filled with gas. If the cap 8 be removed from the top of the small tube 7 and the tube be drawn up so that its lower end does not extend into the hydrocarbon, the gas will escape through the tube and may be heard readily as it bubbles through it. The tube being lowered to the point at which the escape of gas ceases, this being the point at which the lower end of the tube reaches the hydrocarbon, the supply in the reservoir will be indicated by the scale on the upper part of the tube, which may be graduated as desired.

I do not claim the flexible-diaphragm valve in this specification, as this forms the subject of another application, Serial No. 269,649, filed April 5, 1888, and patented October 29, 1889, No. 413,762.

What I claim is—

1. The combination, with a hydrocarbon-reservoir, of a supply-tank normally filled with water or other heavy liquid, a pump for drawing hydrocarbon from the reservoir and forcing it into the supply-tank above the liquid, an elevated pressure-tank connected with the base of the supply-tank for receiving the liquid when hydrocarbon is forced into the supply-tank, a retort connected with the supply-tank, and connections between the retort and reservoir, whereby any unvaporized hydrocarbon coming through the retort passes to the reservoir, substantially as described.

2. The combination of a hydrocarbon-reservoir, a supply-tank receiving hydrocarbon from the reservoir, means for holding the hydrocarbon in the supply-tank under pressure, a retort connected with the supply-tank, and connections between the retort and reservoir, whereby any hydrocarbon coming through the retort passes directly to the reservoir, substantially as described.

3. In a gas-machine, the combination of a hydrocarbon-reservoir, a supply-tank receiving hydrocarbon from the reservoir, means for holding the hydrocarbon in the supply-tank under pressure, a retort connected with the supply-tank, a gas-holder, a pipe for conducting the gas from the retort to the holder, and connections independent of the holder between the retort and the reservoir, substantially as described.

4. In a gas-machine, the combination, with a vaporizing apparatus, of a vertically-movable gas-holder, a pipe conducting the gas from the vaporizing apparatus and entering the base of the holder, and a main connecting with the side of the conducting-pipe at right angles to the flow of gas at that point, whereby the gas passes to the holder at right angles to the main and an even pressure of gas

is maintained in the main, substantially as described.

5. The combination, with a gas-holder and vaporizing apparatus located directly above the same, of a single casing A, inclosing both the gas-holder and vaporizing apparatus, and the diaphragm 23 between the gas-holder and vaporizing apparatus, separating the casing into two parts and constructed to permit the passage of air and gas, but to prevent the passage of fire, substantially as described.

6. In a gas-machine, the combination, with the supply-pipe, retort, and gas-holder, of a valve in the supply-pipe, controlling the hydrocarbon-supply to the retort, a weighted lever for operating said valve, and a pulley for operating the weighted lever, said pulley being mounted with its rim directly above the center of the holder and having a direct connection thereto, substantially as described.

7. In a gas-machine, the combination, with the supply-pipe, retort, and gas-holder, of the valve 5 in the supply-pipe, the screw-rod 4, operating said valve and having the stud 3, adjustable weighted lever 28, constructed and arranged to engage the stud 3, a pulley for operating the weighted lever to open or close the valve, and connections between the pulley and gas-holder, substantially as described.

8. In a gas-machine, the combination, with the retort, of the water-jacket surrounding the retort, the wire-gauze outside the water-jacket, the burner feeding a flame upon the inside of the gauze, and the pipe 21, feeding a permanent flame to light the burner, substantially as described.

9. In a gas-machine, the combination, with the retort and the water-jacket surrounding the same, of the wire-gauze surrounding the water-jacket and forming a chamber between it and the jacket, the valved burner located outside of the gauze and adapted to deliver its vapor through the gauze, and a pipe 21, terminating inside the gauze to feed a permanent flame, substantially as described.

10. In a gas-machine, the combination, with a vaporizing apparatus and the pipe R for conducting the gas from said apparatus, of the pipes 31 33 for admitting air and a trap-box 32, provided with a liquid seal through which air is drawn in, but which prevents the escape of gas, substantially as described.

11. The combination, with the vaporizing apparatus and the pipe R for conveying the gas from said apparatus, of the trap-box 32 for admitting air and the adjustable injector 14, opposite the trap-box, whereby the amount of air drawn in may be adjusted, substantially as described.

12. The combination of a hydrocarbon-reservoir constructed to contain gas under pressure and a sealed pipe entering the reservoir and constructed to be lowered and raised by hand, so as to be inserted into and withdrawn from the hydrocarbon, whereby the level of the hydrocarbon in the reservoir may be determined by the sound of the gas escaping

through the pipe when the latter is raised above the level of the hydrocarbon, substantially as described.

13. In a gas-machine, the combination of
5 the hydrocarbon-reservoir B, connected with the gas-holder and constructed and arranged to contain gas under pressure, and a sealed pipe entering the reservoir through a gas-tight
bushing and constructed to be lowered and
10 raised by hand, so as to be inserted into and withdrawn from the hydrocarbon, whereby the level of the hydrocarbon in the reservoir

may be determined by the sound of the gas escaping from the pipe when the latter is raised above the level of the hydrocarbon, 15 substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LUCIUS J. PHELPS.

Witnesses:

GEORGE P. RUST,
JAMES J. KENNEDY.