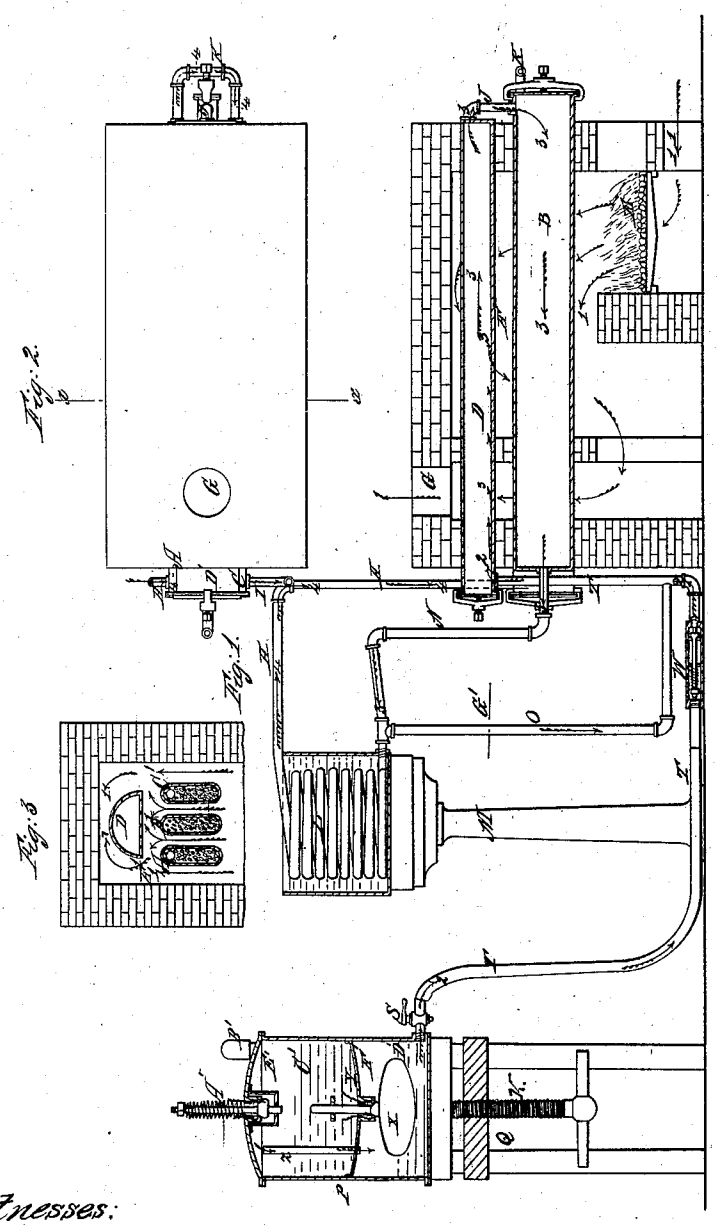
D. Davison.

Making Oil Gas.

No. 99,860. Patented Feb. 15, 1870.



Witnesses:
Fred. Haynes
M. J. Stanley

Inventor:
Darius Davison

UNITED STATES PATENT OFFICE.

DARIUS DAVISON, OF NEW YORK, N. Y.

IMPROVED APPARATUS FOR GENERATING ILLUMINATING-GAS.

Specification forming part of Letters Patent No. **99,860**, dated February 15, 1870.

To all whom it may concern:

Be it known that I, DARIUS DAVISON, of the city, county, and State of New York, have invented a new and useful Improvement in Apparatus for Generating Illuminating-Gas from Hydrocarbon and other Liquids, which I denominate "Davison's Illuminating-Gas Generator;" and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, and in which—

Figure 1 represents a sectional elevation of an apparatus for generating illuminating-gas in accordance with my improvement; Fig. 2, a plan of thef urnace portion of the same; and Fig. 3, a transverse section thereof, taken as indicated by the line *x x* in Fig. 2.

Similar letters of reference indicate corresponding parts.

My improvement has reference to the generation of gas for illuminating purposes from any suitable hydrocarbon liquid or carbonaceous matter in a liquid state, and more particularly relates to that process for producing said gas in which the liquid is first passed in a thin film or stream through a retort heated to a low temperature for the purpose of evaporating it, and afterward leading the vapor through a retort or retorts heated to a higher temperature; and my invention consists in certain novel combinations and arrangements of devices for perfecting the production of the gas under such process.

Referring to the accompanying drawings, A, B, C, and D are retorts made of fire-clay, iron, or other suitable material.

E is the fire-grate of the furnace, F the hot-air chamber, and G the smoke pipe or outlet thereto.

The arrangement of the several retorts relatively to each other and the furnace is more clearly seen in Fig. 3. The upper one, D, being a vaporizing-retort, is of different construction to the others.

H is a return-gas pipe to the right-hand outside retort, A, and I an escape-pipe for the gas from the apparatus, the same being connected with the left-hand outside retort, C, and leading to or establishing connection with any suitably-arranged gasometer; or the same may connect directly with the pipes leading to the burners when the gas is to be used without the intervention of a gasometer.

J is a vapor-pipe connecting the one end of the vaporizing-retort D with the one end of the middle retort, B; and K is a pipe connecting the two outside lower retorts, A and C.

L is a condensing-worm, arranged within a vessel that rests on a support, M, and which contains water or other cooling-fluid; N, a pipe connecting the end of the middle retort with the worm L, and O a pipe to receive the liquid of condensation from the gas passing through the worm. This last-mentioned pipe is made to connect the pipe leading to the worm with the pipe T, which leads from the supply-tank P to the vaporizing-retort D. The tank P, which contains the hydrocarbon or gas-producing liquid, is supported on a stand, Q, in such manner as to be capable of being raised or lowered by a screw, R, or other suitable device.

S is a stop-cock to let on or shut off the flow of liquid from the tank to the vaporizing-retort D. The pipe T, that connects the supply-tank P with the vaporizing-retort D, is provided with a horizontal check-valve, W, that is acted upon by a spring of sufficient force to gently draw the valve to its seat, said valve opening in direction of the flow from the supply-tank to the vaporizing-retort.

X is a float arranged within the tank P, and carrying a valve that in the descent of the float serves to open communication between an upper and lower chamber formed by a diaphragm, Y, in said tank.

Z is an air-pipe connecting such upper and lower chambers, and serving to establish an equilibrium of pressures therein.

A′ is an air-valve to the upper chamber of the tank P. This valve, which opens inward and is held up to its seat by a spring, serves to admit air to the tank P on any tendency to the formation of a vacuum therein by the descent of the liquid in its supply of the vaporizing-retort.

B′ is a capped filling nozzle or aperture for supplying the tank P with the gas-producing liquid.

C′ and D′ represent the liquid as it may be supposed to stand in the upper and lower cham-

bers of the tank, and E′ F′ the air-spaces therein. The level of the liquid in the pipe O is represented by the dotted line G′.

The three retorts A, B, and C, which are preferably of vertical oblong form in their transverse section and are arranged side by side at a suitable distance apart, are designed to be filled throughout their entire lengths with wrought-iron turnings or other like filling that will take up the heat from the exterior of said retorts and form an extensively-diffused and equable heating-surface for or to the vapor as it slowly permeates said filling, so as to convert the vapor into gas. Such filling to the lower retorts is seen in Fig. 3 of the drawings. These retorts A, B, and C it is proposed to heat to a temperature of about 800° Fahrenheit, or what is technically known as a "cherry red." The upper or vaporizing-retort, D, which is shown as of a different shape—that is, of a spread bottom form—being farther removed from the fire, is heated to a lower temperature, but should be kept sufficiently hot to freely vaporize the liquid flowing into it in a thin film along its flat or nearly level bottom.

The pressure of the vapor and gas in the apparatus during the operation of the latter is produced and controlled by the height of the surface of the liquid in the lower chamber of the tank P above the level of the inside bottom surface of the vaporizing-retort D. By raising and lowering the tank through means of the screw R the pressure is varied as required, while the float X in the lower chamber of the tank operates to keep the supply of liquid in said lower chamber at a uniform height irrespective of the head in the upper chamber. This gives regularity to the pressure after the tank has been adjusted up or down in setting the apparatus to work under any particular pressure. Thus when the surface of the liquid is lowered slightly in the lower chamber of the tank the float X descends and opens the valve which it carries. This induces a supply of liquid from the upper to the lower chamber of the tank till the original level has been reached in the latter chamber, when the rising of the float closes said valve, that thus serves to equalize the head within the lower chamber. The air-pipe Z and air-inlet valves A′ operate to perfect this action and insure a proper and steady flow of the liquid to the vaporizing-retort by establishing an equilibrium of atmospheric pressure between the upper and lower chambers of the tank, and by preventing the formation of a vacuum therein. The valve A′ being kept closed when the pressure of the air externally and internally are equal, escape is prevented of all volatile matter or vapor from the tank.

The arrows marked 1 indicate the course of the air into and through the fire and of the heated air and gases through the hot-air chamber in which are the retorts. The arrows marked 2 show the course of the liquid used in the apparatus from the tank and through the pipe or pipes leading to the vaporizer and through the pipe O from the condenser. The arrows marked 3 indicate the course of the vapor from the vaporizing-retort into and through the lower middle retort, B, and into the condenser, from whence the uncondensed gas and vapor pass, as indicated by the arrows 4, into the one lower side retort, through it, and by a connecting-pipe to and through the other lower side retort in a reverse direction. The vapor and gas thus generated from the film of liquid flowing into or along the bottom of the vaporizing-retort D, after passing through the apparatus, as described, will finally issue therefrom as a dry, permanently and persistently uncondensable illuminating-gas of great purity and strength, all condensable matter having been removed from it in its passage through the condenser, and such condensed matter being returned by the pipe O to mingle with the supply of liquid by the pipe T for passage again through the vaporizing-retort, thus doing away with all loss.

The condenser and supply-tank may be placed in any convenient positions relatively to each other and to the furnace containing the retorts, provided they are placed at proper relative heights to each other and to the vaporizer to produce the same results or action in the operation of the apparatus as hereinbefore described, the supply of liquid to the vaporizer being effected by gravity through the greater height of the tank or liquid in its lower chamber to that of the vaporizer. The liquid produced by condensation of the gas or vapor in the worm is also returned by gravity to the vaporizer, and will stand in the pipe *o* at the height of the film in the vaporizer, or thereabout, as indicated by the dotted line G′, said liquid mingling, as before observed, with the liquid in the supply-pipe T, and passing through the apparatus again and again till all the liquid is ultimately converted into permanently dry illuminating-gas.

The horizontal check-valve W operates to prevent any excess of back-pressure over what is required to balance the height of the liquid in the lower chamber of the tank P, and preventing such back-pressure from acting in the tank.

In the operation of the apparatus the liquid flowing into the vaporizing-retort spreads itself into a thin film or stream over the bottom thereof, and is rapidly converted into vapor, which fills the apparatus with vapor and gas at a pressure equal to the head of liquid as regulated by the height of the same in the lower chamber of the tank. A slight increase of such pressure checks the flow of the liquid and a slight decrease re-establishes the flow. Hence no very large quantity of the liquid can pass into the vaporizing-retort at a time; but the supply is gradual and proportioned to the pressure.

This apparatus may be used to convert crude petroleum or any of the liquid-hydrocarbon products thereof into gas; or, as previously remarked, other hydrocarbon liquids or car-

bonaceous matter in a liquid state may be worked in said apparatus.

What is here claimed, and desired to be secured by Letters Patent, is—

1. The combination, with the vaporizing-retort, of a liquid-supply tank made adjustable in height to vary the feed by gravity to said retort, substantially as specified.

2. The tank P, divided into upper and lower chambers, as described, and provided with a valve-float for regulating the supply from the upper to the lower chambers, also with an air-inlet valve and air-pipe connecting the upper spaces of said chambers, essentially as herein set forth.

3. The arrangement, in an apparatus of the character described, of the condenser with the primary gas-producing retort and return retort or retorts for the gas after its passage through the condenser, essentially as described.

4. The combination of the check-valve W with the vaporizing-retort D and supply-tank P, essentially as herein described.

5. The combination of the one flat or level bottomed vaporizing-retort D with two or more gas-producing retorts, A B C, connected together for operation as described.

6. The arrangement for feeding the liquid to be converted into gas through the bottom of the vaporizing-retort at one end in a vertical direction upwardly by means of the pipe T, connecting the same with the empty tank P, substantially as shown and described.

Witnesses: DARIUS DAVISON.

C. C. GOSS,

HENRY PALMER.