(No Model.) 2 Sheets—Sheet 1.

G. K. CUMMINGS.

APPARATUS FOR THE MANUFACTURE OF GAS.

No. 403,920. Patented May 28, 1889.

Fig. 1

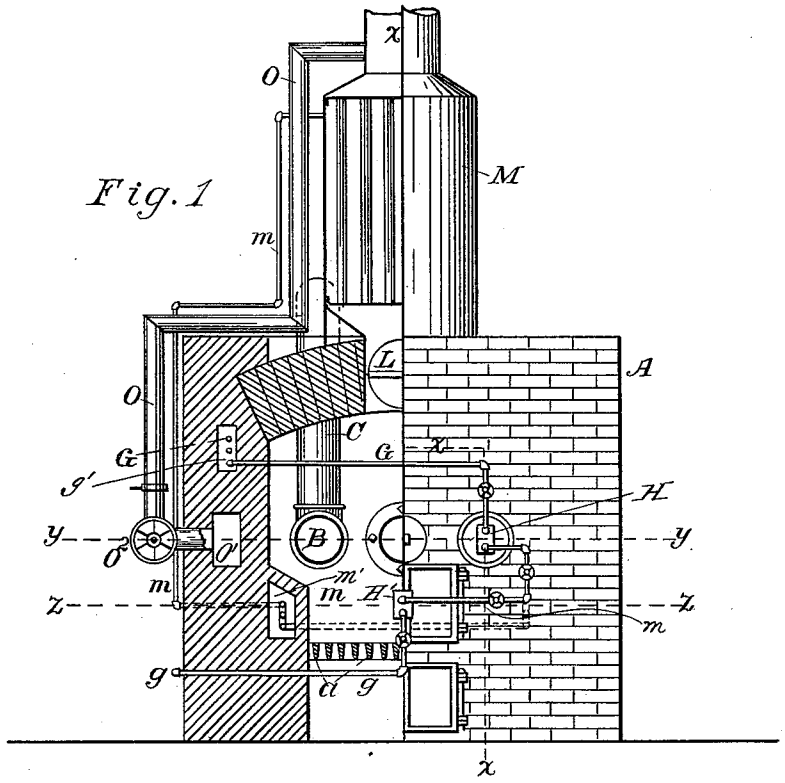
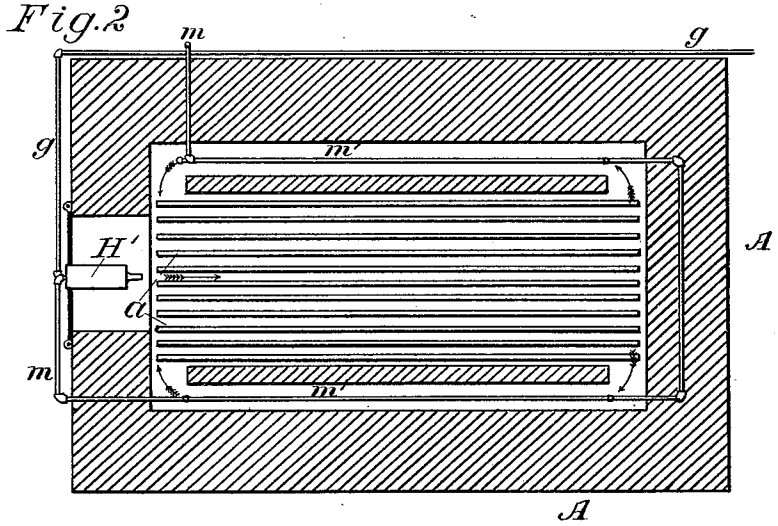


Fig. 2



WITNESSES,
Joshua Mallack, Jr.
H. C. Van Pomel

INVENTOR,
George K. Cummings

(No Model.) 2 Sheets—Sheet 2.

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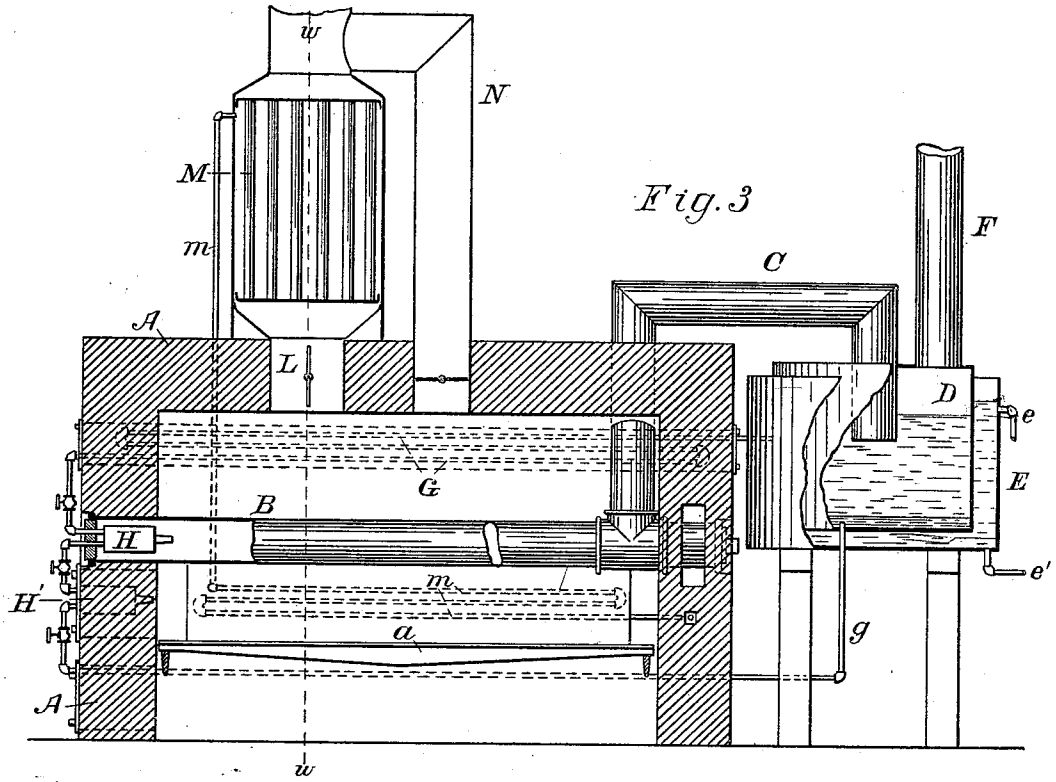

Fig. 3

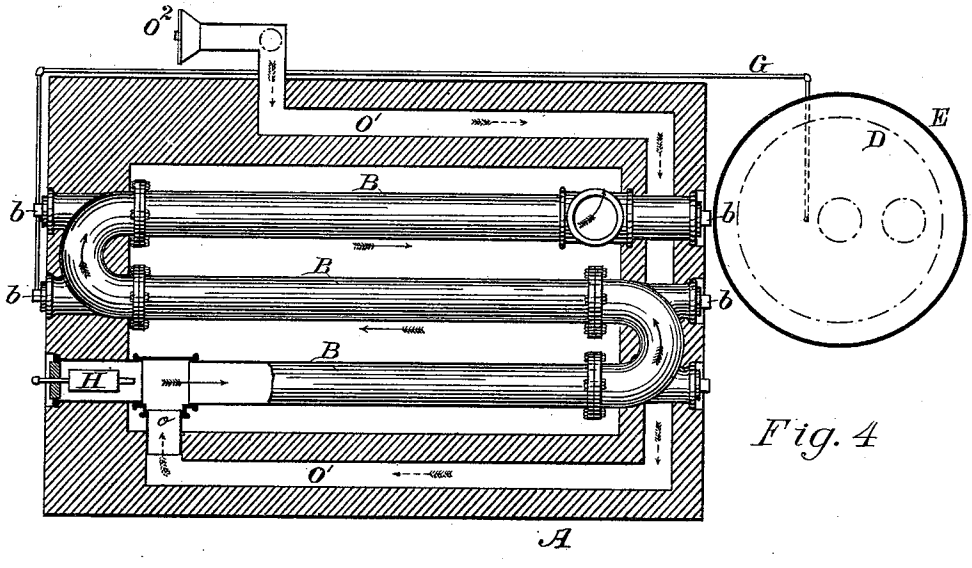

Fig. 4

WITNESSES.

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UNITED STATES PATENT OFFICE.

GEORGE K. CUMMINGS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE UNITED STATES GAS AND FUEL COMPANY.

APPARATUS FOR THE MANUFACTURE OF GAS.

SPECIFICATION forming part of Letters Patent No. 403,920, dated May 28, 1889.

Application filed May 22, 1888. Serial No. 274,679. (No model.)

To all whom it may concern:

Be it known that I, GEORGE K. CUMMINGS, of the city of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for the Manufacture of Gas, of which the following, taken in connection with the drawings hereto annexed, is a full, clear, concise, and exact description.

My invention relates to apparatus for the vaporization of hydrocarbon oils, superheating of steam, heating air, gases, or the waste products of combustion, combining and passing the same through retorts heated to a high temperature, and finally passing said gases, while in a highly-heated condition, through a tank containing crude petroleum, which is maintained at a temperature below that of the heated gases.

The object of my invention is to provide a simple, compact, durable, and cheap apparatus for the manufacture of heating and illuminating gas suitable for villages, towns, cities, &c., where expense is a consideration in the utility of construction and in the manufacture.

My invention consists of certain novel features in the construction of the apparatus, as hereinafter described, and pointed out in the claims.

In the accompanying drawings hereto annexed, Figure 1 is in part a front elevation of the apparatus and in part a vertical section taken on the line *w w* of Fig. 3. Fig. 2 is a horizontal section taken on the line *z z* of Fig. 1. Fig. 3 is a longitudinal vertical section taken on the broken line *x x x* of Fig. 1. Fig. 4 is a horizontal section taken on the line *y y* of Fig. 1.

Like letters of reference refer to corresponding parts.

A designates the walls of the furnace, provided with the usual grate, *a*, doors, &c., and constructed of brick.

B designates the retort or retorts, of any well-known refractory material, located in the combustion-chamber, the ends of the retorts supported by the walls of the furnace. The retort, as shown, consists of three flanged pipes located in the combustion-chamber, connected at their alternate ends by means of return-bends and bolted thereto, said return-bends provided with plugs *b*, whereby access may be had to the interior of the retorts for cleaning purposes.

C is a pipe connected to the rear end of the retort and leading to a closed tank, D, containing crude petroleum or other hydrocarbon oil. The pipe C extends within the body of oil contained in the tank, thereby forming a seal to the end of the pipe. The tank D is here shown as located within an open refrigerating-tank, E, whereby the oil in said tank D may be maintained at any desired temperature—say from 180° Fahrenheit to below that of the gas emitted from the retort.

e e' indicate inlet and outlet pipes, or vice versa, for the refrigerating material, whereby a continuous flow of a cooling material may be caused to pass through said tank.

The refrigerating material may be water, ammonia, or other common refrigerant.

F is the outlet-pipe for the gases, communicating with tank D, and may lead to a fixing-chamber, a gasometer, or directly to the point of consumption, as may be desired.

G is a pipe connected to the oil-tank and communicating with an atomizer, H, located within the retort B, as shown, said pipe being located in a flue, *g'*, built in the furnace-wall, whereby the oil may be heated and vaporized on its passage from the tank to the atomizer. It is obvious that should such heating of the oil not be desired the coil need not necessarily be located within the flue, but may be placed entirely on the outside of the furnace, and instead of a coil a single pipe may be used. A pump (not shown) may be located between the coil and the tank and communicating therewith, whereby the oil may be forced through the coil to the atomizer.

M designates a well-known form of tubular boiler having a dampered stack and communicating with the combustion-chamber of the furnace by means of a dampered flue, L.

N is an auxiliary dampered flue communicating with the combustion-chambers of the furnace and the stack of the boiler for purposes hereinafter explained.

m designates a pipe connected to the steam-

space of the boiler M and the atomizer H, said pipe in its extent forming a superheating-coil, located in flues m', communicating with the combustion-chamber of the furnace, whereby the steam may be superheated on its passage from the boiler M to the atomizer H. Suitable doors are provided whereby entrance may be had to flues g' m' for repairs, cleaning, &c.

O′ indicates a superheating-flue constructed in the walls A of the furnace and communicating with the retorts and with a pipe, O, leading from the stack of the boiler M, establishing a means whereby the products of combustion may be diverted from going to waste and intensely heated and delivered to retort B.

O^2 designates a pipe which may be in communication with the open atmosphere or any suitable gas or vapor reservoir, and is connected with flue O.

g indicates a pipe communicating with the tank D and atomizer H′.

In order to operate the apparatus an ordinary coal-fire is started on the grate-bars, the combustion of which heats the interior of the furnace, passing around the retorts, transmitting heat thereto and to the oil-heating pipes and the steam-superheating coil in its passage to the flue L, whence it passes through the tubes of the boiler M to the stack. When the furnace shall have become thoroughly heated, the waste heat passing through the tubes of the boiler will have generated steam therein, and, the steam and oil valves being opened, the steam from the boiler will pass through the pipe m, becoming highly superheated on its passage to the atomizer H. The oil will pass or be pumped from the tank D through the pipe G to the atomizer H, from whence this mixture will be driven with some energy by the force of the steam through the heated retorts B. This mixture being forced through the retort B produces a partial vacuum at the point o of the flue O, which is in communication with the boiler-stacks, and causes the products of combustion from the furnace to be drawn through the highly-heated flue O to the retort B, where they are commingled with the steam and oil or oil-vapor issuing from the atomizer H. This mixture then passes through the entire length of the highly-heated retort B to the pipe C, through the pipe C beneath the surface of the oil in closed tank D, through which oil the gas rises, and in its passage depositing its tar and heating the oil to a degree sufficient to drive off the lighter hydrocarbon, which escapes through the pipe F together and mingled with the heated gas from the retort. These mixed gases may be then led to any suitable fixing-chamber or elsewhere, as may be desired.

The oil in the tank D may be kept at any desired temperature by means of the refrigerating-tank E, which surrounds it; or in place of tank E a coil, through which the refrigerating material can be passed, may be used, or, if desired, both tank and coil may be employed.

The tar from the retorted gas deposited in the oil, being of greater specific gravity than the oil, naturally sinks to the bottom of the tank D, from whence it may be drawn by the pipe g to the atomizer H′, which is fastened on swinging joints in the door above the grate-bars, or be drawn off and used for lubricating and other purposes.

The atomizer H′ is connected by means of a valved branch pipe, h, to the steam-coil m. Oil may be continuously or automatically fed to the tank by any well-known means.

The steam and oil valves being opened, the steam from the superheating-coil m and the tar from the pipe g enter the atomizer H′ and are injected into the furnace to be burned, to continue the heat of the charge of coal on the grate-bars when it shall have become exhausted.

Should the steam-pressure in the boiler M at any time become too great, the damper in the flue L may be closed or partially closed and the damper in the flue N, leading directly to the stack, correspondingly opened. Thus the steam-pressure may be maintained at any desired point. When desired, the valve on the pipe O may be closed and the valve on the pipe O^2 opened, and atmospheric oxygen or any other convenient gas or vapor may be substituted for the products of combustion from the furnace.

The tar at the bottom of tank D may be supplied to atomizer H, if desired. In this case either the gas produced by the apparatus would be used to heat the furnace or the coal would be continued as fuel.

It is not designed that the arrangement of retort or retorts should be necessarily limited to that shown in the drawings hereto—as, for example, there may be two rows or sets of two retorts each, or three rows or sets of two retorts each, or one retort or five retorts, straight or curved.

Having thus fully described my invention, I wish to state that I do not herein claim the process described, as such is the subject-matter of another application, Serial No. 274,680, filed May 22, 1888.

What I claim is—

1. In an apparatus for making gas, the combination of a furnace and a suitable number of retorts, an injector for introducing commingled superheated steam, hot air, or gas and oil into the retorts, a closed tank containing hydrocarbon oil at a temperature of from about 180° to below that of the gas emitted from the retorts, a pipe leading from the outlet end of the retorts into said closed tank and delivering the gas of the retorts into the oil in the said tank, and another pipe leading from the bottom of the closed tank back to the injectors to supply oil thereto, and a refrigerating apparatus surrounding the said tank, substantially as set forth.

2. In an apparatus for making gas, a furnace, and retorts in suitable number and arrangement therein, and an injector opening into the retorts and feeding commingled superheated steam, hot air, or gas and oil thereinto, a steam-boiler heated from the furnace, an auxiliary flue separately connecting the boiler-stack and retorts of the furnace, and valves for controlling communication between the retorts and such flue for utilizing the products of combustion or not, combined with a closed oil-tank, a pipe connecting the said tank and the gas-outlet of the retorts, and a refrigerating-chamber surrounding the oil-tank and maintaining the oil at from 180° Fahrenheit to a point below that of the incoming gas, substantially as described.

3. In an apparatus for making gas, the combination of a furnace and a suitable number of retorts, suitable means for introducing commingled steam, air, or gas and oil into the retorts, a closed tank containing hydrocarbon at a temperature of from about 180° to below that of the gas emitted from the retorts, a pipe leading from the outlet end of the retorts into said closed tank and delivering the gas of the retorts into the said tank, and another pipe for supplying the retorts with oil from the bottom of the said tank for mixture with the steam or like fluid, and a refrigerating apparatus surrounding the oil-tank, substantially as and for the purposes described.

GEORGE K. CUMMINGS.

Witnesses:
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JOSHUA MATLACK, JR.