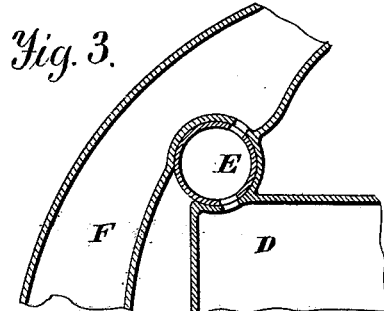
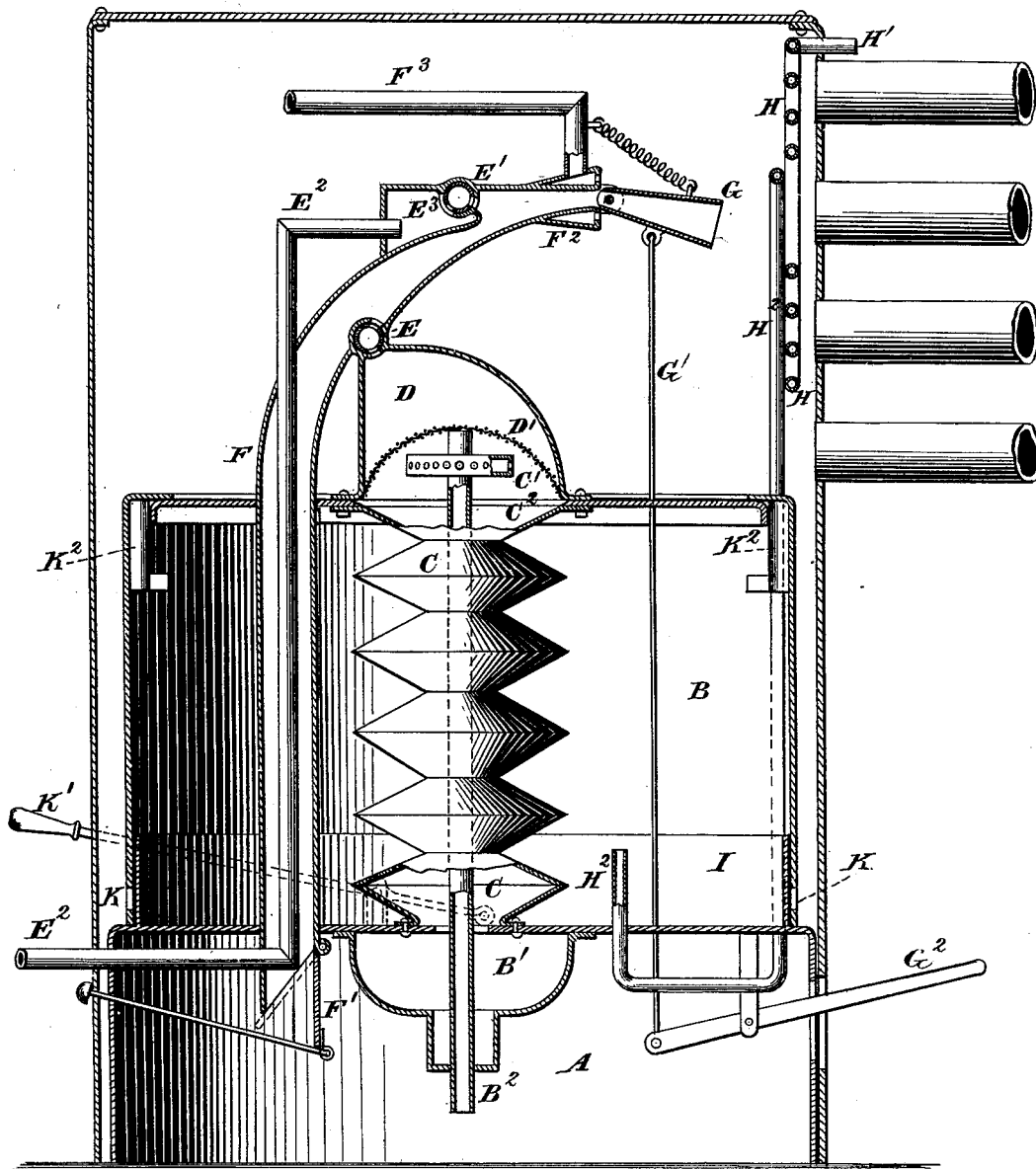


A. E. WATKINS.
Gas Generator and Burner.
No. 220,554. Patented Oct. 14, 1879.

Fig. 1.



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Fig. 2.

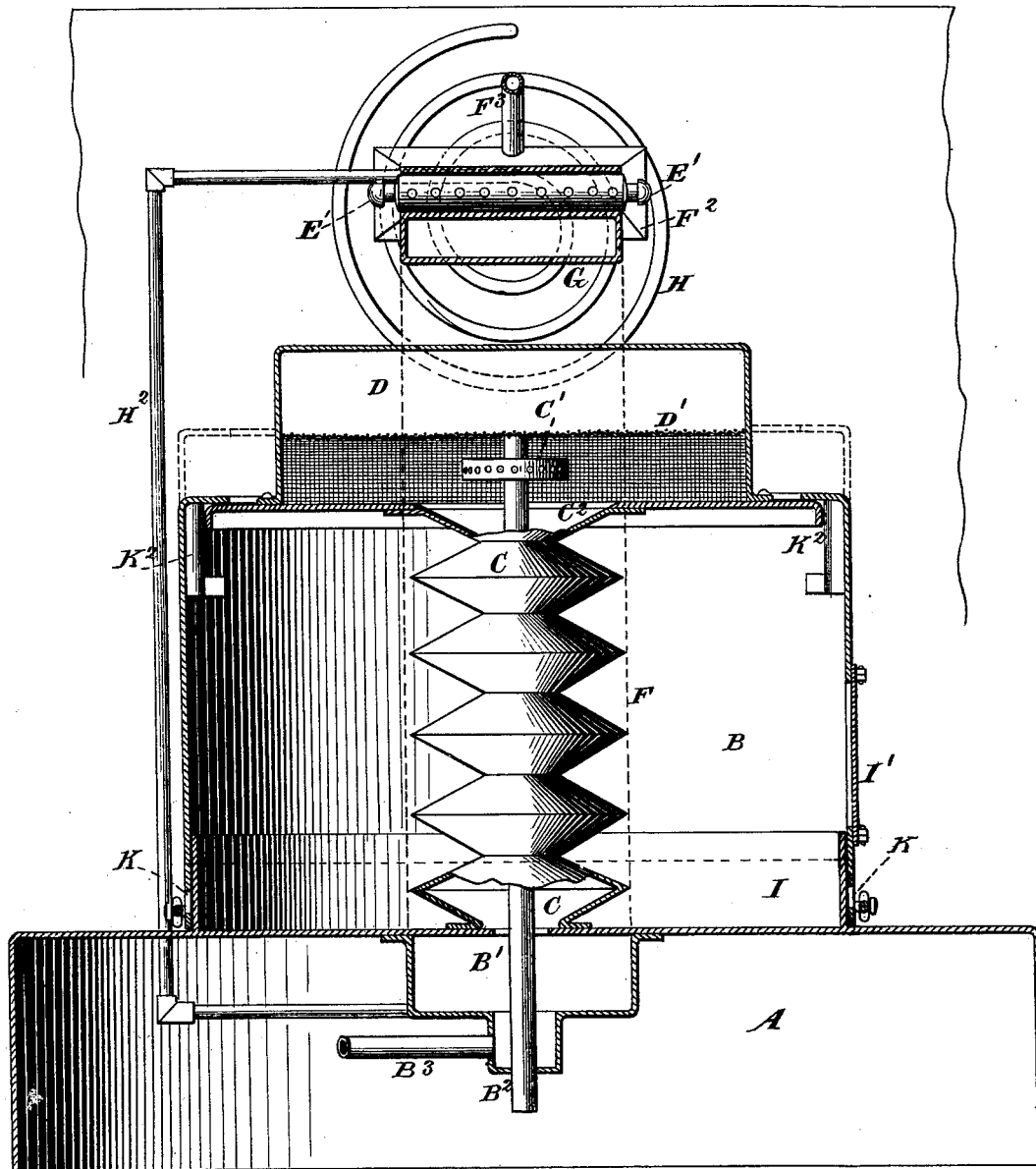
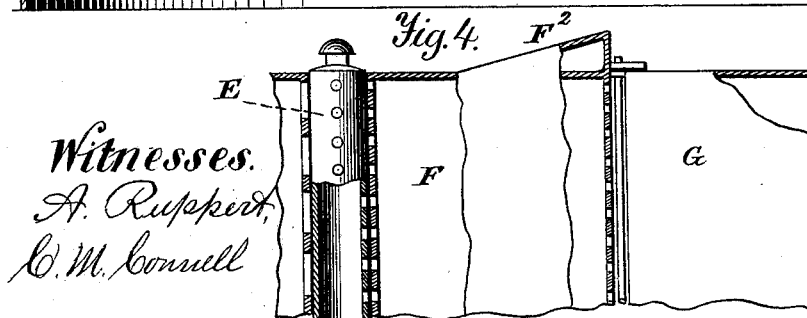


Fig. 4.



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UNITED STATES PATENT OFFICE.

ALFRED E. WATKINS, OF BALTIMORE, MARYLAND, ASSIGNOR OF THREE-EIGHTHS OF HIS RIGHT TO SAMUEL H. ADAMS AND JOHN F. ADAMS, AND ONE-EIGHTH OF HIS RIGHT TO JOHN S. WILLIAMS, ALL OF SAME PLACE.

IMPROVEMENT IN GAS GENERATOR AND BURNER.

Specification forming part of Letters Patent No. **220,554**, dated October 14, 1879; application filed February 3, 1879.

To all whom it may concern:

Be it known that I, ALFRED E. WATKINS, of Baltimore, in the county of Baltimore and State of Maryland, have invented certain new and useful Improvements in Gas Generators and Burners; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification—

Figure 1 being a vertical section, showing the interior of an improved apparatus for generating and burning gas resulting from the vaporization of petroleum and other hydrocarbons. It is represented as placed in the furnace of a steam-generator, said furnace being shown with portions of the flues. Of the gas-generating apparatus there is shown a pan for containing oil to be burned when starting the generation of gas, an inclosed chamber or series of chambers into which the oil to be vaporized is injected, a gas-receiving chamber containing a strainer and an adjustable outlet-valve, a similar valve for admitting steam or water, a passage for air to be mingled with the gas previous to its reaching the escape-nozzle, a pipe for the introduction of water or steam, another for the introduction of water to the outlet-orifice, a water-chamber surrounding the outlet-orifice, a swinging gas-escape orifice for directing the flame upon different parts of the furnace, and a coil of pipe for generating or superheating steam and conducting it from a steam-generator to within the case surrounding the gas-generating chambers.

Fig. 2 is a transverse vertical section, showing the parts of the gas-generator above enumerated, together with a sliding case for confining the steam received from the coil or boiler, to heat the gas-generating chambers when the fire from the oil contained in the pan is not in use. It has a vertical movement to admit air to support the combustion of the oil

in the pan, showing also a chamber below the gas-generating chamber or chambers for receiving any unevaporated oil after it has passed through the gas-generating chambers, and a pipe which is to be connected with a pump for returning such oil to the gas-generating chamber or chambers.

Fig. 3 is a detached sectional view of a portion of the gas-receiving chamber, the air-passage, and a removable regulating-cock for controlling the relative amounts of air and gas which are to be delivered and burned; and Fig. 4 is a detached longitudinal section through the upper portion of the outlet-passage, showing the perforated and removable spray cock or pipe for controlling the amount of water or steam that shall be allowed to mingle with the air and gas before it is delivered to be burned, a portion of the water-chamber which surrounds the discharge-orifice, and the swinging escape-orifice.

Corresponding letters denote like parts in all of the figures.

My invention relates, first, to an improved method of generating gas from petroleum and other liquid hydrocarbons and burning the same; secondly, to an apparatus for generating gas from such materials and mingling therewith air and steam, or air and water, or air, steam, and water commingled; and it consists, further, in the therein-described method of generating gas from hydrocarbons by passing them over the surface of a steam-heated generator, and continuously collecting the unvaporized portions in a closed chamber, and redistributing them over the steam-heated surface till all the vaporizable matter contained therein is converted into gas; and it further consists in the combination of certain of the parts of which the structure is composed, as specified in the claims forming a part of this specification.

In constructing devices of this character there are formed, by preference, two or more chambers, A and B, of metal, which, when applied to steam-generators, shall be of such form and dimensions as will allow of their being

placed within or convenient to the fire-box thereof, or such as will permit them to be applied to furnaces when said steam-generators have no fire-box within them.

The lower one of these chambers, A, when separated from the upper one, forms the base, and is bolted to plates forming the bottom of fire-box. It contains a receptacle, B¹, for oil which is to be vaporized, and suitable pipes, B² and B³, the former being for the purpose of conducting the material to be vaporized to the gas-generating chambers, and the latter for connecting the chamber B¹ with a pump or other forcing apparatus, by which any oil which passes down through the generating-chambers without being vaporized may be returned thereto, and the operation repeated until all or nearly all the gas-producing matter they contain has been vaporized.

The pipe B² is firmly secured to the lower head of the receptacle B¹, it being supplied with oil or any other liquid hydrocarbon by a pump, or from an elevated reservoir or other forcing device, and provided with a cock or valve by which the quantity of material passing through it may be regulated. This pipe, which may be perforated to more thoroughly distribute the oil upon their interior surfaces, passes up through the gas-generating chamber or series of chambers C C, and is surmounted by a distributing-vessel, C¹, which consists of a chamber having perforations in its periphery, through which the oil or other material is forced, and from which it passes to a concave plate, C², secured to the generating-chambers, the office of which is to collect the material forced from the vessel C¹ and direct it into the chambers C C, down upon the interior of which it trickles, and in which the greater portion thereof is vaporized. The balance passes into chamber B¹, to be again returned to chamber C¹, as above described, till the residuum becomes useless for gas-producing purposes, when it is drawn off and a fresh supply added; or the two processes of supply and discharge may go on simultaneously.

The vapor or gas generated in the chambers C C passes out at the upper end thereof into a chamber, D, where it comes in contact with and is made to pass through a strainer, D', of fine wire-cloth or other suitable material, by which said vapor or gas is prevented from carrying with it any solid substance, and by which oil is prevented from being carried into the duct or pipe which leads the gas to the burner.

From the chamber D the vapor or gas passes through a perforated cock, which is constructed substantially as shown in Fig. 4, it being readily removable from its seat in the air-induction pipe or duct, in order that it may at any time be taken out to be cleaned or repaired.

Owing to the fact that this cock has in it two or more rows of apertures or perforations, it can be used to at all times control the amount of gas or vapor which shall pass it, and the direction of the flame or gas within the duct be changed at will. Through this adjustable cock

the vapor passes into an air duct or pipe, F, the lower end of which opens into the space A, it being there supplied with a suitable valve, F¹, by which the amount of air allowed to enter can be regulated by means of a rod leading therefrom to the outside of the structure. This air-duct extends from the space A upward through the heating-chamber B, and hence the air in passing through it is, to some extent, warmed previous to its being united with the vapor, and thus all danger of condensation of the vapor is avoided. After leaving the chamber B the duct extends upward in a curved form if the flame is to be directed at right angles to the gas-generators, or vertically upward if the flame is to be directed in line therewith, it being, as before stated, supplied with the cock E, through which the gas or vapor enters, and the current of air is mingled therewith, and the mingled current passes on a short distance to a point where another cock, E¹, constructed in all respects like the one above described, is placed, it being for the purpose of admitting a suitable quantity of water or steam to be mingled with the current of air and vapor at this point, such water or steam being conducted to a chamber, E³, formed in the duct, by a pipe, E².

Owing to the fact that perforations in the cock E¹ are in line, or about in line, with the discharge-orifice of the duct F, and to the further fact that the water or steam may be discharged from the chamber E³ under any desired pressure, it follows that any required impetus may be given to the gases under combustion and the flame carried to a considerable distance beyond the orifice.

In order that the combustion of the gas may be as thorough as possible, I propose, in some cases, to omit the steam, and to use in place thereof—or I may use in connection therewith—jets or a spray of water injected into the outgoing current of gas at a point outside of that at which ignition takes place. I prefer that this water be passed through or mingled with some substance that will add an oxide to it previous to its entering the gas or flame; but water not so treated will be found to produce a beneficial result.

In arranging for the use of water as a promoter of combustion, there may also be provided a chamber, F², which is made to entirely or partly surround the outlet-orifice of the passage F, that portion thereof which is immediately above and below said orifice being perforated with a series of small holes, so arranged that as the water passes from them it shall be directed into contact with the flame. This chamber is also designed to serve the purpose of cooling the discharge-nozzle and preventing the collection thereon of solid carbon or other foreign substances, it being supplied by a pipe, F³, with water from a pump or other suitable source that will give the required pressure.

In the use of hydrocarbon-burners as heretofore constructed a very serious difficulty has

been encountered, owing to the fact that the flame issuing therefrom impinged against a single point or portion of the material to be heated, thereby causing such material to become irregularly heated, if not injured or worn away. With the view of avoiding this difficulty, there is hinged to the outlet-orifice a swinging escape-nozzle, G, and to this are attached a rod, G¹, and a lever, G², or any other suitable mechanism whereby the nozzle G may be constantly or intermittently oscillated for the purpose of sweeping the outgoing flames over a broad surface, and thereby more evenly heating the same.

For the purpose of showing how this device may be applied to a locomotive-boiler, there is shown in Fig. 1 a portion of a tube-sheet with some of the tubes inserted; and in order that this method of heating the gas-generating chamber or chambers may be accomplished, there is placed directly in the rear of the tube-sheet a coil-pipe, H, one end of which enters the steam-generator at H¹, and the other end is secured to the pipe H², which passes down and enters the heating-chamber B, where it discharges common or superheated steam around the gas-generating chambers C, and the heat thereof is made to vaporize the oil contained within said chambers, the supply to the coil being regulated by suitable cocks or valves. When it is desired to use common steam in this coil, that portion of the pipe which enters the steam-generator is placed below the water-line in said generator, so that water enters the pipe, and, being converted into steam, is delivered at the opposite end of said pipe into the chamber B; but when it is preferred to use superheated steam, the pipe is made to enter the steam-generator at a point above the water-line, so that steam will enter the coil, which, in passing toward the chamber B, will be superheated and delivered therein in that condition.

For the purpose of facilitating the starting of the operation of this apparatus, there is placed in chamber B a pan, I, into which is placed a quantity of hydrocarbon and cotton-waste, fibrous asbestos, or other suitable material, sufficient to heat the gas-generating chambers and vaporize any oil there may be injected into them. While this material is still under combustion the oil-forcing apparatus is set in operation and the oil injected into the generators. The resultant gases, passing from the nozzle, take fire from the flames passing out at the top of the case and impinge upon the coil-pipe H, and water being let therein by pressure or gravity, it is speedily converted into steam and passed into the chamber B, where it escapes till the gas is given off freely at the nozzle. The fire in said pan I is then extinguished by lowering the case upon its seat, and the steam from coil continuing to enter chamber B, the vaporization of the oils contained within the gas-generators is continued till sufficient heat has been generated to form steam of any required pressure within a steam-

generator, if the apparatus be used for that purpose, after which the further addition of either steam or water to the coil may be omitted, as the radiant heat from the furnace within which it may be placed will be sufficient to keep up the generation of the gases and their resultant flames.

The lower part of case may be cast with openings therein, as at K K, to supply the oil contained in the pan I with sufficient air to support combustion, and also with proper guides K², that when it lifts off its seat the annular space at top permits the escape of the smoke and flames.

The operation of raising and lowering the case is performed by the lever K¹, which is pivoted thereto and to a fulcrum outside thereof, or in any other manner deemed desirable.

During the operation above described the cock E may be closed, and the gases resulting from the vaporization of the hydrocarbons be confined within the generating and gas-receiving chambers till a desirable pressure has been obtained, when, by turning said cock, the pressure is relieved and the gas emitted with force through the openings therein into the passage or duct F, within which a current will be induced toward the escape-nozzle. The gas and air commingling will take fire within the passage if the same be not too much contracted, and the heat will add much toward the efficiency of the apparatus. The addition of air to the gas is regulated by the valve F¹.

As the mingled gases under combustion flow toward the nozzle they are further accelerated in their motion, and their burning qualities enhanced by the addition of a spray of water or steam thrown from the cock E¹, whose apertures are in or about in line with the escape-nozzle, said cock being fed by the pipe E² and chamber E³.

I am aware that gas has been generated from hydrocarbons by passing them through retorts surrounded by fire heat, and afterward collecting the residuum in an open vessel and returning it to said retort. Such a method of generation I do not claim; but,

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

1. The herein-described method of generating gas, it consisting in distributing liquid hydrocarbons over the surface of a steam-heated generator, and continuously collecting the unvaporized portions in a closed chamber, and redistributing them over the steam-heated surface till all the vaporizable matter contained therein is converted into gas, substantially as set forth.

2. The combination of the water or steam supply pipe F³, the chamber F², placed upon the end of the gas-discharge pipe, and having in its outer end a series of perforations for comminuting the steam or water passing through them, and the swinging nozzle G, for directing the flame upon different parts of the heating-coil H, substantially as set forth.

3. In combination with the eduction-pipe of an apparatus for generating and burning gas from hydrocarbon oils, the removable perforated regulating-cocks E and E¹, inclosed within correspondingly-perforated cases, whereby the quantity of gas is regulated, and it is minutely divided and mixed with the inflowing air and steam, and whereby they may be readily removed for cleaning, substantially as shown and described.

4. The combination of the air-duct F, damper or valve F¹, water or steam pipe E², perforated water-chamber F², and water-pipe F³, the parts being arranged substantially as shown, and for the purpose specified.

5. The combination of the oil-receiving chamber B¹, the pipe B³, for connecting it with the oil-forcing apparatus, the pipe B², and the concave plate C², for collecting the oil not evaporated in its passage through the gas-generating chambers and directing it toward or into chamber B¹, as set forth.

6. The combination of the vertically-adjust-

able casing of chamber B, for permitting the ingress of air for supporting combustion in commencing the operation of the apparatus, and the pan I, for the reception of oil, substantially as set forth.

7. The combination of the heating-coil H, the steam-generator, the chamber B, surrounding the gas-generator, and the swinging or flame-directing nozzle G, whereby the flame may be directed upon different parts of the coil, substantially as and for the purpose set forth.

8. The combination of the gas-receiving chamber D, the removable perforated regulating-cock E, and the air duct or pipe F, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

ALFRED E. WATKINS.

Witnesses:

SAML. H. ADAMS,
C. M. CONNELL.