(No Model.)

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APPARATUS FOR AND METHOD OF MAKING FUEL GAS.

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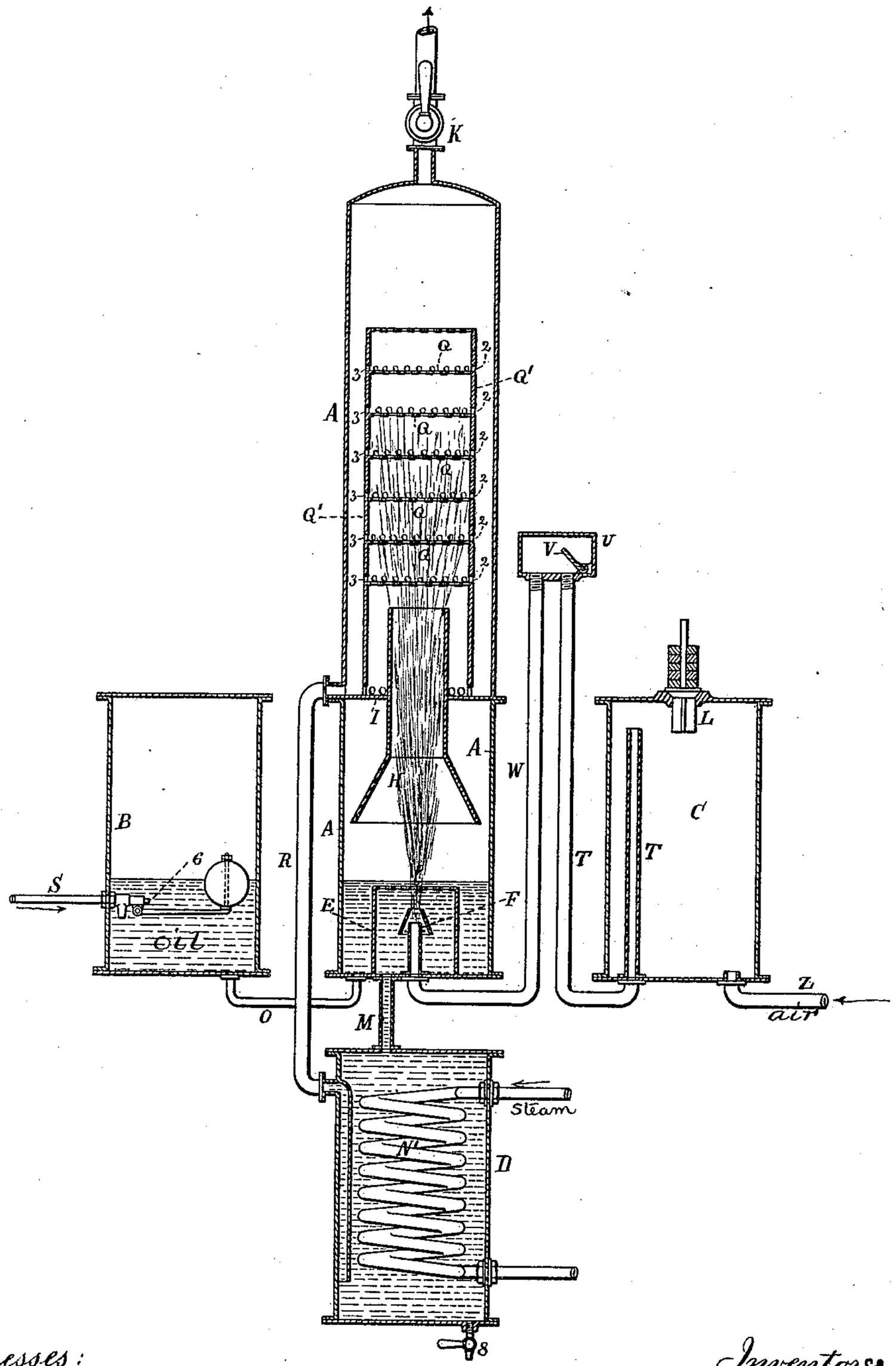

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR AND METHOD OF MAKING FUEL-GAS.

SPECIFICATION forming part of Letters Patent No. 464,779, dated December 8, 1891.

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To all whom it may concern:

Be it known that we, EDWARD P. REICHHELM, of Jersey City, in the county of Hudson, and GEORGE MACHLET, Jr., of Elizabeth, in the county of Union and State of New Jersey, both citizens of the United States, have invented an Improvement in Apparatus for and Methods of Making Fuel-Gas, of which the following is a specification.

The object of this invention is to produce a heating-gas that is especially adapted to use in manufacturing purposes, such as the melting and annealing of metals, the welding and tempering of tools, &c., and for the heating of incandescent lamps for illuminating purposes.

In apparatus heretofore devised, in which air is driven through a holder containing liquid hydrocarbon, such liquid hydrocarbon is liable to obstruct the passage of the air, and in many instances the more volatile portions of the liquid are first driven off and the less volatile liquid does not supply the proper proportion of combustible vapors to the atmospheric air. Hence the combustion is not uniform, and the temperature varies and waste oil has to be removed from the apparatus at intervals. In the present invention the liquid hydrocarbon is caused to circulate around through the apparatus with rapidity by the action of an atomizing jet of air at a low temperature, and in so doing the air becomes impregnated with the hydrocarbon vapors and forms a combustible gas that is not liable to condensation in the gas-holder or in the pipes, and the carbonaceous liquid is circulated continuously until consumed and a uniform volume of hydrocarbon liquid is maintained by the addition of gasoline or similar liquid as fast as the vaporization takes place, and the liquid hydrocarbon is vaporized without the formation of residuum. It is preferable to employ gasoline or similar liquid that is free from tar and foreign substances.

This invention relates to the peculiarities of the devices as hereinafter set forth and claimed.

In the drawing we have represented this apparatus by a vertical diagrammatic section.

The principal vessel made use of by us is a vertical carburetor A, through the bottom of which rises an air-pipe with an atomizing-nozzle F, and surrounding this nozzle is a stationary cylinder E, forming an oil-well and having an upper end of wire-gauze or fine perforated metal. Above this is an inverted funnel H, the tubular portion of which passes through a diaphragm I in the carburetor A, and above this inverted funnel there are two or more screens Q, one above the other, supported, preferably, by a case Q′, in which there are openings at 2 3 for the free passage of the carbonaceous liquid from above each screen, which liquid passes back to the oil-well E through any suitable pipe or pipes. We have shown a space between the case Q′ and the interior of the carburetor A, and also a pipe K leading to a suitable gas-holder or to the forge, furnace, or other apparatus in which the gases are to be burned.

Below the carburetor A we have represented a return-tank D with a pipe R leading from the carburetor A above the diaphragm I, and between the top of the holder D and the bottom of the carburetor A is a rising pipe M, opening at its upper end within the oil-well E.

Gasoline or similar hydrocarbon is supplied to the feeding-tank B by a pipe S and it is maintained at the proper level by a float or ball valve 6, and there is a pipe O leading from the bottom of the feeding-tank B to the bottom of the carburetor A, but such pipe opens outside of the oil-well E, and the level of the liquid in the feeding-tank B is to be such that the liquid in the carburetor A will rise a little above the top edge of the oil-well E, the return-tank D at this time being full, and it will now be understood that atmospheric air under a suitable pressure is supplied through the pipe W and issues by the atomizer F and a column of spray is sent forcibly up through the inverted funnel H and through the screens Q and the liquid runs from the upper surfaces of the screens Q through the openings 2 3 and pipe R to the bottom of the tank D, and thence rises into the oil-well E, and the circulation of the liquid is maintained with a rapidity proportionate to the pressure of atmosphere passing through the atomizer F,

and it will be apparent that the diaphragm I prevents the direct return of any liquid to the bottom of the carburetor A and causes the same to run by the pipe R preferably into the tank D, so as to rise from such holder into the oil-well E, and there will not be any circulation through the feeding-tank B; but whenever the level of liquid in the apparatus descends sufficiently to open the float-valve 6 the gasoline or similar liquid hydrocarbon runs into the apparatus sufficiently to maintain a nearly uniform level of the liquid. The pipe R might be connected directly to the pipe M, but it is preferable to use the holder D; and the return pipes or passages might be within the carburetor A instead of passing outside the same.

We have found that in cases where there was not a free delivery of the liquid that is blown through the screens Q such liquid accumulating upon the screens interferes with the circulation or flow of the atmospheric air; but when the liquid is allowed to run freely from the upper surfaces of such screens by the return-passages these screens obstruct the movement of the air but little, and the screens being constantly wet with the liquid hydrocarbon the atmosphere becomes fully saturated with the gaseous vapors before passing off by the pipe K, and we have also discovered that the atmosphere issuing under a pressure from the atomizer F expands and the apparatus becomes cold. Hence the saturation of the air with the hydrocarbon vapors is almost always at a lower temperature than the gas in the holder or in the pipes, and there is little or no risk of the hydrocarbon vapors condensing into liquid after passing out of the apparatus, and to such an extent is the cold developed by the expansion of the atmosphere and the vaporizing of the gasoline that moisture in the atmosphere becomes frozen and sometimes obstructs the screens where the apparatus as a whole is allowed to become too cold. To prevent this difficulty we introduce into the return-tank D a coil of pipe N′, through which is caused to circulate steam or hot air sufficient to melt any particles of vapor that may be condensed from the atmosphere and cause such moisture to subside into the bottom of the return-tank D, and the same is drawn off by a cock or valve 8 from time to time; but it is advantageous not to apply by the coil N′ more heat than is necessary to prevent the formation of particles of ice.

In consequence of the rapid circulation of the liquid hydrocarbon within the vessel the whole of such liquid is exposed equally to the action of the atmosphere, and such hydrocarbon is converted into vapor with uniformity, and the burning gas produced can be depended upon for uniformity in its heating properties, and we remark that the air and vapors passing upwardly through the screens tend to raise up and cause to flow away the liquid that rests upon such screens. Hence there is but little resistance to the air and atomized vapor, and the upper screens in the range are comparatively free from the liquid hydrocarbon, such liquid being deposited on the lower screens. After passing the top screen the air expands slightly because the pressure is less. Hence its capacity for holding the hydrocarbon vapors is augmented and a practically permanent gas is formed, especially under the subsequent increase in the temperature of such gas.

Any suitable blowing apparatus may be made use of for furnishing the atmospheric air under the proper pressure; but we prefer to introduce a reservoir C, to which the atmosphere is supplied by a pipe Z, and this reservoir C has an escape-valve L, which is weighted to maintain the proper pressure, and it opens to allow the free escape of atmosphere after a given pressure has been obtained or when the gas-making has been stopped, and from this vessel C a pipe T passes downwardly and then upwardly into the chamber U, in which is a valve V, to the upper end of the pipe T, and the pipe W descends from this reservoir U and passes to the atomizer F. The object of this valve V is to close the pipe T and prevent gaseous vapors passing backwardly into the atmosphere when the blower is stopped accidentally or otherwise.

It will be apparent that the gaseous vapors, mixed with atmospheric air, can be passed directly from the pipe K to the forge, furnace, or other heating apparatus, and if the discharge of gas is shut off at such apparatus the valve V will close and the air will escape from the valve L, and as soon as the discharge of the burning gases is open at the forge or furnace the apparatus will commence automatically and supply the burning gas with uniformity to the flame of the furnace or other apparatus, and we also find that this gas is of great purity and is well adapted for illuminating purposes when applied to render incandescent a net-work of refractory material, such as in the Welsbach incandescent lamp.

In operating the apparatus, as hereinbefore described, the moisture of the atmosphere is entirely removed by the cold developed, and hence such moisture does not pass into the pipes.

In making use of this apparatus it appears that the liquid hydrocarbon, being atomized by the jet of air, is driven upwardly through the series of screens, and these screens promote the subdivision and atomizing of the liquid hydrocarbon by the air, because larger atoms of liquid that lodge upon the screens are broken up and atomized by the air passing through the interstices. Hence the mixture of air and gas is principally dependent upon the atomizing action rather than upon the vaporization of the hydrocarbon by heat, and on the contrary the expansion of the atmosphere lessens the temperature, the atmosphere is thereby deprived of watery vapors, which become either frozen or suffi-

ciently condensed to be returned with the liquid hydrocarbon in the vessel D, and such watery materials subside in this vessel and do not pass into the oil-well, because the oil rises up into that well, and the atmosphere passing on with the hydrocarbon, being in a very dry condition, no watery vapors can be condensed in the pipes or apparatus through which the combustible gases pass.

It is usually advantageous to provide a gasoline-holder under ground, to which water is admitted with a pressure sufficient to displace the gasoline and cause it to pass by the pipe S and cock 6 to the feeding-tank B, and such water is to be displaced or removed whenever a fresh supply of gasoline is introduced into such holder.

This invention is to be distinguished from the ordinary carbureting apparatus in which the hydrocarbon liquid is volatilized by the action of the air and passes to the holder along with the moisture that is usually found in the atmosphere. By our present invention the hydrocarbon liquid is atomized progressively, and in the atomizing action the moisture in the atmosphere is removed, so that the atomized liquid is held by the dry atmosphere without the risk of condensation in the pipes or apparatus to which the fuel-gas passes previous to its combustion.

We claim as our invention—

1. The combination, in a carburetor, of an atomizer through which atmospheric air under pressure is caused to issue, an oil-well in the lower part of the carbureting-chamber and surrounding such atomizer, an inverted funnel above the atomizer, through which the gasoline or other hydrocarbon vapors are sprayed, screens or sieves over the inverted funnel and within the carburetor, and return-passages for the hydrocarbon liquids leading from the sides of the screens to the oil-well, substantially as set forth.

2. The carburetor A, having a diaphragm I, in combination with an inverted-funnel opening through such diaphragm, screens above the opening of the inverted funnel, a case surrounding and supporting such screens and having openings for the free passage of the liquid hydrocarbon from above such screens, an oil-well and atomizer at the lower part of the carburetor A and below the funnel, a supply-pipe for liquid hydrocarbon, and a return-pipe connecting the upper part of the carburetor above the diaphragm with the oil-well for circulating the hydrocarbon liquids, substantially as set forth.

3. The combination, with the carburetor A and the atomizer F, of the oil-well E in the lower part of the carbureting-chamber and surrounding such atomizer, an inverted funnel over the atomizer and through which the liquid is sprayed by the air, screens above the inverted funnel and supports for the same that allow the liquid to freely run off such screens, a tank D below the carburetor, a pipe for returing the liquid from the upper part of the carburetor to the tank D, and a pipe for leading the liquid from the tank into the oil-well E, substantially as set forth.

4. The combination, in a carburetor, of the atomizer F and the oil-well surrounding the same in the lower part of the carburetor, an inverted funnel H over the atomizer and a diaphragm I through which the funnel opens, screens above the funnel, a tank D below the carburetors and a return-pipe thereto from the carbureting-chamber below the screens and a pipe M leading up to the oil-well, and a coil within the tank D for regulating the temperature thereof by steam or hot air, substantially as set forth.

5. The combination, with the carburetor A, the diaphragm I, and the inverted funnel H, opening through such diaphragm, of an oil-well and atomizer in the lower part of the carburetor and below the funnel, ranges of screens above the funnel, a return circulating-pipe for the liquid from above the funnel to the oil-well, an air-reservoir C and supply-pipe and escape-valve, a pipe from the same leading to the atomizer within the carburetor A, and a valve for preventing the backward escape of liquid or vapors when the air-supply is shut off, substantially as set forth.

6. The combination, in an apparatus for making fuel-gas, of a carbureting-chamber and an oil-well below the same and communicating therewith, a jet within the oil-well and supply-pipes for air under pressure for atomizing the oil from the well, a series of screens within the carbureting-chamber above the jet through which the air and atomized liquid are projected by the direct action of the atomizing-jet of air, and a return-pipe connecting the lower portion of the carbureting-chamber with the oil-well for returning liquid that is not retained by the air to the oil-well, substantially as specified.

7. The combination, in an apparatus for making fuel-gas, of a carbureting-chamber and an oil-well below the same and communicating therewith, a jet within the oil-well and supply-pipes for air under pressure for atomizing the oil from the well, a funnel for directing the jet and atomized liquid, a series of screens within the carbureting-chamber above the jet through which the air and atomized liquid are projected by the direct action of the atomizing-jet of air, and a return-pipe connecting the lower portion of the carbureting-chamber with the oil-well for returning liquid that is not retained by the air to the oil-well, substantially as specified.

8. The method herein specified of producing a combustible gas and removing watery vapors from the carbureted air, consisting in atomizing a liquid hydrocarbon by a jet of air under sufficient pressure to condense moisture in the same by the low temperature developed by the expansion of the air and passing the liquids that are not sufficiently

atomized into a vessel, whereby the water may separate from the hydrocarbon, substantially as described.

9. The method herein specified of producing a combustible gas and removing watery vapors from the carbureted air, consisting in atomizing a liquid hydrocarbon by a jet of air under sufficient pressure to condense moisture in the same by the low temperature developed by the expansion of the air, driving the atomized materials upwardly and detaining the liquids that are not sufficiently atomized, and further atomizing the same by said jet, substantially as described.

Signed by us this 14th day of February, 1891.

EDWARD P. REICHHELM.
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Witnesses:
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