No. 809,200. PATENTED JAN. 2, 1906.

J. LÜHNE.

APPARATUS FOR VAPORIZING LIQUID COMBUSTIBLES.

APPLICATION FILED NOV. 17, 1903.

2 SHEETS—SHEET 1.

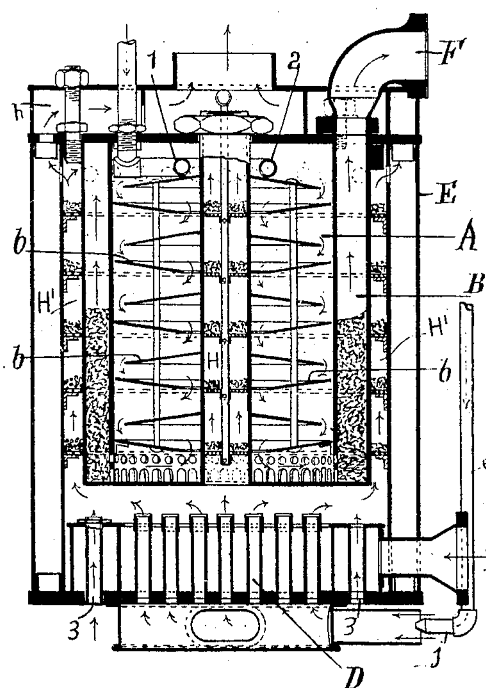

Fig. 1.

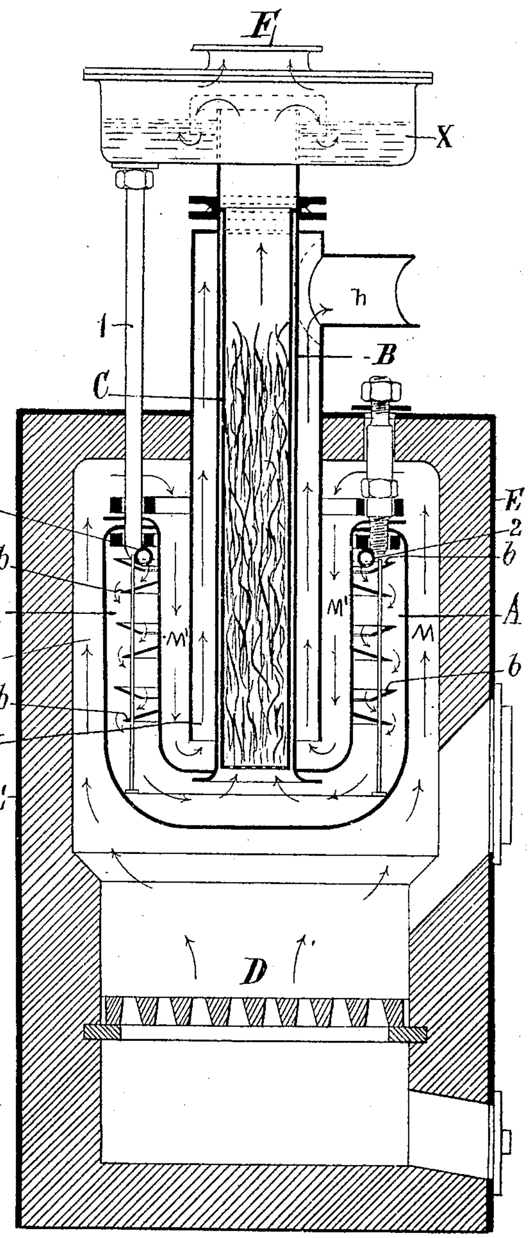

Fig. 3.

WITNESSES

INVENTOR

Johann Lühne

BY

ATTORNEYS

No. 809,200. PATENTED JAN. 2, 1906.

J. LÜHNE.

APPARATUS FOR VAPORIZING LIQUID COMBUSTIBLES.

APPLICATION FILED NOV. 17, 1903.

2 SHEETS—SHEET 2.

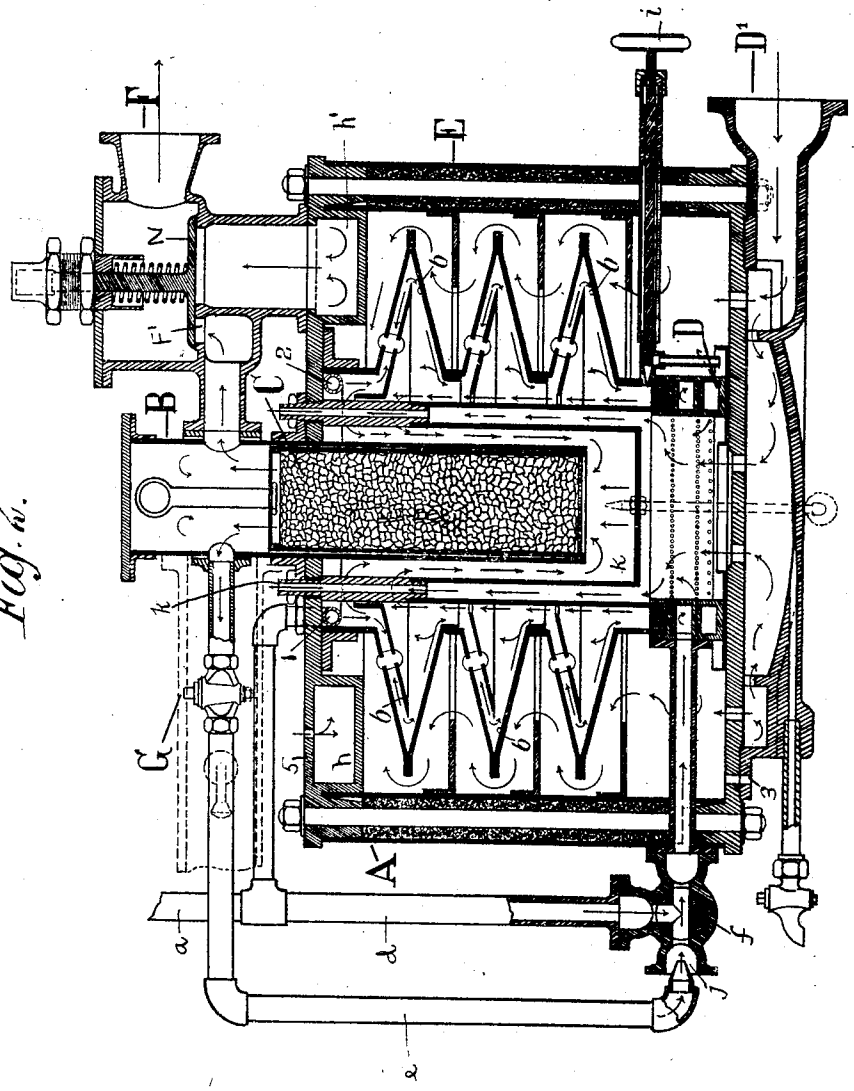

Fig. 2.

WITNESSES

H. M. Kuehne

Helen Louise Kuehne

INVENTOR

Johann Lühne

BY Richards & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

JOHANN LÜHNE, OF AIX-LA-CHAPELLE, GERMANY.

APPARATUS FOR VAPORIZING LIQUID COMBUSTIBLES.

No. 809,200. Specification of Letters Patent. Patented Jan. 2, 1906.

Application filed November 17, 1903. Serial No 181,531.

To all whom it may concern:

Be it known that I, JOHANN LÜHNE, of 10 Maxstrasse, Aix-la-Chapelle, in the Empire of Germany, have invented a certain new and useful Improved Apparatus for Vaporizing Liquid Combustibles for Heating, Power, Lighting, and other Purposes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The invention relates to an apparatus for converting liquid combustibles by completely transforming or decomposing them into gases by employing two generators.

The liquid combustibles are conducted through one generator in thin films over heated distilling-surfaces draining from one to the other, which surfaces may be plain or undulated and gradually sloped, perforated, corrugated, or divided into separate parts, as most convenient to the special circumstances. While traversing these surfaces the liquid undergoes progressive distillation, and the products are preferably required to traverse another generator made in one with the above-mentioned generator or adapted to be separated therefrom. This second generator is filled with material adapted to transform the products of distillation completely into gas. For this purpose nickel-turnings and cobalt are specially suitable. This perfecting-generator simultaneously acts as a filter. It will be distinguished from the first generator by being denoted the "perfector."

The accompanying drawings show by Figures I, II, and III, by way of example, vertical sections of three different forms of construction of apparatus for carrying out the process.

In Fig. I the perfector is arranged outside the generator, whereas in Figs. II and III it is removably fitted inside. The generator A and perfector B are concentrically arranged and heated by the furnace D. The combustible is supplied to the generator A through the perforated circular tube 1 2, the supply being effected and varied according to their nature. It traverses the generator by draining successively from the several surfaces *b*. These can be arranged in suitable numbers beneath, above, and alongside each other as well as vertically. They may be secured by angle-irons in contact with the generator-casing or may stand free with suitable clearance, so that the external and internal heat may operate for decomposing purposes. The draining-surfaces *b* are interrupted. They may consist of porous or penetrable material—for instance, perforated sheet metal, sieves, gauze, and the like—being preferably of compressed metallic wire fabric for the purpose of presenting extensive surface and effecting a better decomposition of the combustible. The combustible passed over the various draining-surfaces is subjected to a progressive distillation, the most volatile separating out first. The separated gases are conducted in the direction of the arrow to the perfector B for the completion of the decomposition and fixing. The spreading and draining surfaces may be arranged at close intervals in a generator-casing with plain surfaces or in one with an undulating formation, as shown in Fig. II.

In Figs. II and III the perfector B is removable from above, and in the portion C it is provided with a charge for decomposing, reducing, and fixing the gases produced in the generator. The whole is inclosed in an isolating-casing E for allowing the necessary heating and can have the construction either of that of Figs. I, II, or III.

The heat for effecting the gasification of the combustible liquids may be derived from the combustion of some of the liquid itself, from the combustion of a portion of the manufactured gas, from a mixture of liquid and gas, or by the combustion of solid fuel on a grate, and when the installation is for power purposes and the gas is employed in working internal-combustion engines then the waste heat of the exhaust-gases can be utilized for the same purpose.

The drawings show means for deriving heat in each of the above-enumerated ways. In Fig. II the pipe *a*, which supplies to the generator A the liquid to be vaporized, has a branch *d*, commanded by a three-way cock *f*, whereby some of the liquid can flow into the furnace D to be burned. In another position of the plug of the cock *f* the flow from *d* can be shut off and a passage through the cock be provided for a mixture of air drawn from the atmosphere and combustible gas delivered through the nozzle *j*, which gas is derived from the gasifying apparatus on the opening of a turn-cock G and conducted by the pipe *e*. In Fig. I also this method of heating is shown and is correspondingly lettered. If the plug of the turn-cock *f* is placed

in yet another position, as shown in Fig. II, a mixture of liquid gas and air will be delivered to the furnace D for combustion.

When heated waste gases are available, they are conducted to the furnace, as shown by the arrows in Figs. I and II, after they have first been led to the mouthpiece D′. The heat thus available may be supplemented by heat derivable from the other sources when requisite.

In Fig. III a grate is shown whereon solid fuel, coal, or coke can be burned to provide the heat requisite for the gasification.

In Figs. I and II additional air for combustion is admitted by the apertures marked 3.

The products of combustion flow over the bounding-surfaces of both the generator A and the perfector B. In Fig. I they divide into two streams, a portion flowing through a central tube H and the remainder through the annular passage H′, the two streams meeting in the flue-passage *h*, from which they are conducted to the chimney. In H and H′ shelves are provided on which porous incombustible material is placed, which will serve to retard the stream, render the combustion more perfect, and be a medium for conducting heat to the generator and perfector. In Fig. II the inner stream flows through an annular passage K and emerges by a number of tubes *k* and the outer stream flows by a devious path over the outside sloping surfaces of the generator A and escapes through a lateral passage or passages in casing E. (Not shown in the drawings.) In Fig. III the products of combustion first pass upward through M, then downward through M′, and again upward through M^2 to the flue-passage *h*.

In Fig. II is shown a valve *i*, which on being opened will allow excess of liquid which has not become vaporized to be withdrawn from the generator A.

If gas is being produced for use in gas-engines, it will be advantageous to mix with it some heated air as it flows away from the vaporizer. A contrivance for effecting this object is shown in Fig. II. The gas escaping from C will on lifting a valve N find a passage F′ leading to the delivery-pipe F, and the lift of the same valve N will open a way for air to flow from an annular chamber *h′* and mix immediately with the gas, such air finding admission to *h′* through small apertures formed in the cover-plate 5 and being raised in temperature by the waste heat of the generator.

By means of this apparatus maintained at a sufficiently high temperature there will occur a complete decomposition of the combustible into gas. Substances carried over from the generator and not yet vaporized will be decomposed on traversing the perfector. The perfector acts also as a filter and prevents entrance of the exterior atmosphere and effects a more uniform vaporization. The gases on leaving the perfector enter a receiver X, which acts as a cooler and at the same time can serve to contain the combustibles destined to be gasified. The gases are hereby directly cooled, and those condensed are deposited and pass once more through the apparatus to be again vaporized.

The apparatus may be made with the generator inside and the perfector outside, as in Fig. I, or vice versa, as in Figs. II and III, the same effects being obtained in each. When employed for power purposes, the heat of the exhaust-gases from the motors can be utilized for effecting the distillation by allowing them to enter at the opening D′. The prepared gases are led away at F and, according to their intended purpose, may or may not be mixed with air. The remaining devices shown are well-known auxiliary apparatus universally in use.

The mode of operation is the same in all three examples. That shown in Fig. III is the simplest and is specially suitable for making oil-gas, distilling, &c., as by the arrangement of the receiver X, which is used to directly contain the material to be vaporized and by means of which the gases coming from the converter can be cooled, the portion liable to condense can be collected and utilized directly again for the vaporizing process, also the material to be vaporized is hereby preheated, which is very advantageous for certain substances, and the gases already distilled can be conducted away. By directly introducing air or gas in the direct process the most efficient utilization of the combustible or gas mixture is attained.

When producing mixed gas consisting, for instance, of water-gas and oil-gas, preferably the water-gas to be mixed is directly introduced and allowed to traverse the apparatus, as hereby an intimate mixture, and especially a fixing of the gas, results.

By means of a charge of nickel or similar material, besides perfecting the gasification, an increase in volume and a formation of gases for special purposes can be effected. For instance, spirit is preferably reduced by nickel into methane and hydrogen and petroleum into heavy hydrocarbons and methane.

The individual stages of decomposition and vaporization process cannot be sufficiently separated to exactly determine the changes that occur. It is, however, essential that by means of the arrangement of the diffusing-surfaces where the easily-volatile substances immediately separate the substances more difficult to decompose gradually approach the region of higher temperature and the decomposition is gradually advanced and a much greater efficiency is attained.

I claim—

1. An apparatus for converting liquid combustibles into gases consisting of a combina-

tion of a generator, means for supplying liquid thereto, said generator being fitted with a succession of downward-shelving surfaces over which the liquid is spread and from which it drains to the next lower surface, means for heating said surfaces, and a perfector charged with loose permeable material in communication with said generator, means for heating the perfector and through which perfector the product of the partial distillation in the generator is required to pass and be therein filtered and entirely gasified.

2. An apparatus for converting liquid combustibles into gases consisting of a combination of a generator, means for supplying liquid thereto, said generator being fitted with a succession of downward-shelving surfaces of undulating form and penetrable character over and through which the liquid is spread and from which it drains to the next lower surface, means for heating said surfaces, and a perfector charged with loose permeable material in communication with said generator, means for heating the perfector and through which perfector the product of the partial distillation in the generator is required to pass and be therein filtered and entirely gasified.

3. An apparatus for converting liquid combustibles into gases consisting of a combination of a generator, means for supplying liquid thereto, said generator being fitted with a succession of downward-shelving surfaces over which the liquid is spread and from which it drains to the next lower surface, means for heating said surfaces, a perfector charged with loose permeable material in communication with said generator, means for heating the perfector and through which perfector the product of the partial distillation in the generator is required to pass and be therein filtered and entirely gasified, and a cooling-receiver into which the products of distillation are led such receiver being charged with the liquid destined to be converted into gas.

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

JOHANN LÜHNE.

Witnesses:
JOSEPH TANSEN,
HENRY QUADFLIEG.