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METHOD OF TREATING DISTILLATION GASES TO PRODUCE AN ILLUMINATING LIQUEFIED GAS.

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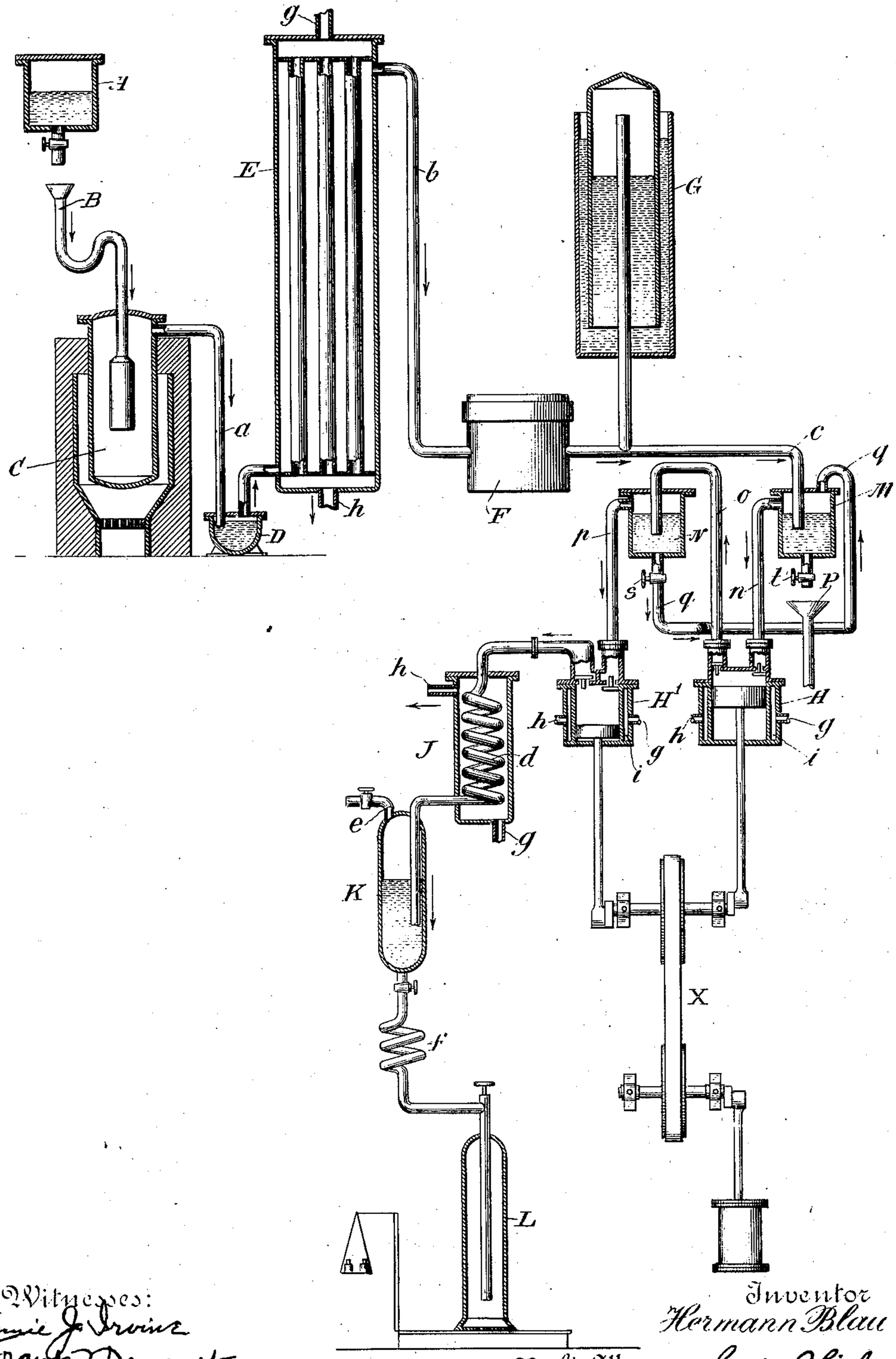
994,369. Patented June 6, 1911.



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METHOD OF TREATING DISTILLATION-GASES TO PRODUCE AN ILLUMINATING LIQUEFIED GAS.

994,369. Specification of Letters Patent. Patented June 6, 1911.

Application filed December 2, 1908. Serial No. 465,710.

To all whom it may concern:

Be it known that I, HERMANN BLAU, a citizen of Germany, and a resident of Augsburg, Bavaria, Germany, have invented a new and useful Improvement in Methods of Treating Distillation-Gases to Produce an Illuminating Liquefied Gas, of which the following is a specification.

This invention relates to methods of treating distillation gases to produce an illuminating liquefied gas and has for its object the production of an illuminating liquefied gas that can be made and used without loss of liquid hydrocarbons and the prevention of the loss of constituents of the gas dissolved in the liquid hydrocarbons and the further advantages hereinafter described and claimed.

In the accompanying drawing forming part of this specification is illustrated apparatus suitable for carrying out the present invention.

In the drawing, which is an elevation partly in vertical section, A is a tank; B an inlet-pipe or conduit; C a retort; D a receptacle; *a* a pipe connecting C and D; E a cooler; F a cleaner; *b* a pipe connecting E and F; G a receptacle; M a vessel; *c* a pipe connecting M with F and G; H a compressor; *n* a pipe connecting M with H; N another vessel; *o* a pipe connecting H with N; H′ a second compressor; *p* a pipe connecting N with H′; *q* a pipe connecting N with M; *s* a stop-cock in the pipe *q*; *t* a stop-cock in the pipe leading from the bottom of M to a point above the funnel P; *i i* channels with which the compressors H and H′ are provided; J a cooler; *d* an outlet-pipe from the compressor H′, which passes in the form of a coil through the cooler J and thence into the vessel K; *e* an outlet-pipe for gases from the vessel K; *f* an outlet-pipe for liquified gases from the vessel K into the container L; *g g* are inlet-pipes for water or other cooling substance and *h h* are outlet-pipes therefor; X is a motor.

The arrows of the drawing indicate the directions in which the gases and liquids flow.

Experience, in the manufacture of liquid illuminating gas according to Letters Patent of the United States No. 862,383 of August 6, 1907, has shown that it is advantageous, with respect to the utility of the by-products of the manufacture, to manage the raw materials in the retorts at very low gas-forming temperatures. While this method of working gives results quite favorable, with respect to the quality of the resulting by-products, it has, on the other hand, a disadvantage in so far as, under it, a relatively large quantity of boiling hydrocarbons arises at 30° to 100° Celsius, which, by carburization, goes over into the distillation gas and is necessarily found, after the compression, in the liquid illuminating gas. After the vaporization of the liquid illuminating gas at atmospherical pressure or at pressures which, as they are mostly employed in the use of the gas, are a little above the atmospherical pressure (two to three atmospheres), these hydrocarbons, for the greater part, separate out again in the fluid form without having the opportunity of afterward going over again into the gas by carburization, so that they are, practically speaking, to be considered as lost. The present invention overcomes this disadvantage in the following manner;—the compression and liquefaction of the distillation gases are not, as usual, undertaken in two or three stages of compression immediately following one another, but, after the first or second stage, the compression is interrupted and the liquid hydrocarbons, which cause the over-carburization, separating out under this stage of compression, are removed, whereupon the compression of the gas is continued, under familiar separation of the surplus permanent gases, up to complete liquefaction. By proper choice of the stage of compression, which, aside from the method of working, is determined by the kind of the gas-making material, the carbureting constituents can be so far removed that subsequent separating out in the use of the gas is surely avoided. Since the carbureting constituents of the gas, while in liquid condition, possess the property of dissolving at once, in considerable quantity, the most valuable constituents of the gas itself, and since, moreover, the solubility, according to Dalton's law of absorption, increases proportionally with the pressure, considerable quantities of gas escape from the compressed, saturated liquid, as soon as the liquid is let off from the dephlegmator into a vessel communicating with the atmosphere,

and are lost. In order to avoid this and to recover these gases in a simple way, the saturated liquid is not, as above mentioned, permitted to escape into a vessel communicating with the atmosphere but, at the pressure of the suction pipe, into a vessel inserted in the suction pipe of the compression apparatus or connected with the suction pipe by a gas-conduit pipe, so that the gases escaping, through the reduction of pressure, from the over-saturated liquid, are mixed with gases newly sucked up by the compressor and are thereby recovered.

In carrying out the present invention satisfactory results are secured by first compressing, after the usual cleaning, the distillation gas used for the purpose at a low stage of compression at normal temperature under water-cooling, then removing the liquid hydrocarbons thereby separated out, then compressing the so treated gas at the higher pressure necessary for its complete liquefaction and finally drawing it off into vessels of suitable material, such as steel. In this manner are avoided over-carburization of the gas and therewith subsequent separating out of fluid hydrocarbons and the loss occasioned thereby in the use of the gas.

In the carrying out of the foregoing process the liquid hydrocarbons separated under pressure and saturated with gases under pressure should, preferably, be permitted to escape, at the pressure of the suction pipe, into a vessel inserted in the suction pipe of the apparatus or connected with the suction pipe by a gas-conduit pipe, in order to recover for the process gases set free from the fluid hydrocarbons through reduction of the pressure.

Illustrated in the drawing forming part of this specification is one form of apparatus or means by the aid of which the above described process of this invention may be carried out. The tank A may contain pure petroleum of any origin which proceeds through the inlet B to the retort C heated from below to the inner temperature of 550° to 600° Celsius and is gasified therein. The gasification products pass out of the retort, by the annexed connecting pipe *a* into the receptacle D and from there into the cooler E in which the gases may be cooled down by any artificial cooling, as by air or water, in order to separate highly boiling constituents and difficultly volatile constituent parts of tar. The cooler E is, preferably, to be employed in carrying out the process of this invention, but, as will be understood by those skilled in the art to which this invention appertains, the cooler E, like some other details of the apparatus, is not necessary. From E the gases pass to the cleaner F, where they are liberated by chemicals in the well known way from the detrimental parts (CO_2, H_2S, CO, CN, etc.). The receptacle G, connected by pipe *c* with F and M, serves as a balance between the production of gas and the withdrawal thereof by the action of the compressor H, which sucks up the gas through pipe *n* from the vessel M into which it is delivered by the pipe *o* and compresses it in any desired low stage of compression, such as from 5 to 7 atmospheres. The compressor H may be provided with a channel *i* for the passage of water or may stand in water in order to secure the cooling action of the water, as is usual in the use of such compressors. The compression of the gases in the compressor H liquefies and thereby separates out hydrocarbons which are the cause of the above mentioned over-carburization and which have not been previously separated out by action such as that of the cooler E. From the compressor H the liquefied constituents of the gases and the remaining non-liquefied constituents thereof pass through pipe *o* into the vessel N, whence the said remaining non-liquefied or gaseous constituents are sucked up through pipe *p* by the compressor H′, in which they are compressed at a higher stage of compression, a pressure of from 100 to 150 atmospheres being sufficient, and whence the said liquefied constituents are, by opening the stop-cock *s*, let off or permitted to escape through pipe *q* into vessel M. The vessel M is, as shown, inserted in or connected with the suction pipe *n* of the compression apparatus and the pressure in the vessel M is substantially that of the pressure in the suction pipe *n* and in pipe *c*. When said liquefied constituents pass from the pressure of the vessel N, which is that of the compressor H, to the lower pressure of the vessel M, the valuable constituents of the gases, which were dissolved by the said liquefied constituents in the compressor H, escape, through the reduction of pressure, from the said liquefied constituents and are mixed in the vessel M with gases newly sucked up by the compressor H through pipe *n*, and are thereby recovered. The remaining liquefied constituents, which cause the above mentioned over-carburization, are removed from time to time from the vessel M through stop-cock *t* and funnel P.

The compressor H′ may be provided with a channel *i* for the passage of water, or may stand in water in order to secure the cooling action thereof, as above stated with reference to the compressor H. Obviously more than two compressors, of varying stages of compression, may, if desired, be employed in the carrying out of the process of this invention.

The heat liberated by the compression in the compressor H′ may be taken off, wholly or in part, under the cooling action of water in the cooler J, through which the gas may pass in a tubular coil *d*. Under the contem-

poraneous influence of the pressure of the compressor H′ and the cooling action of water, liquid gas separates and disunites, from the non-liquefied, permanent gases, in the vessel K. The separation goes on in such a way that the remaining, readily volatile hydrocarbons are separated as a liquid and the gaseous hydrocarbons, with a small quantity of the permanent gases, methane and hydrogen, are dissolved in the former, while the principal quantity of the methane and hydrogen is separated in a gaseous form above the liquid. The non-liquefied gases are taken off by the pipe *e* for any use, while the liquefied gases are drawn off, through *f*, into suitable vessels L for transport. The quantity of gaseous constituents absorbed by the liquefied constituents will suffice, on suitable reduction of the pressure, to change the liquefied constituents substantially into their gaseous form.

From the foregoing description of the present invention, it will be clear to those skilled in the art, that variations may be made in details without departing from the main features of the invention.

What I claim is—

1. The method of producing illuminating liquefied gases, consisting in compressing distillation gases at a low stage of compression, removing the liquid constituents thereby separated out, and then compressing the so treated gas to the higher pressure necessary to liquefaction of remaining constituents, substantially as described.

2. The method of producing illuminating liquefied gases, consisting in compressing distillation gases at a low stage of compression, removing the liquid hydrocarbons thereby separated out, and then compressing the so treated gas to the higher pressure necessary to liquefaction of remaining constituents, substantially as described.

3. The method of producing illuminating liquefied gases, consisting in compressing, under cooling action, distillation gases at a low stage of compression, removing the liquid constituents thereby separated out, and then compressing the so treated gas to the higher pressure necessary to liquefaction of remaining constituents, substantially as described.

4. In the production of illuminating liquefied gases, the method of recovering gases set free from separated liquid constituents, consisting in causing the separated liquid constituents to escape into a vessel connected with the suction pipe of the apparatus employed, substantially as described.

5. In the production of illuminating liquefied gases, the method of recovering gases set free from separated liquid hydrocarbons, consisting in causing the separated liquid hydrocarbons to escape into a vessel connected with the suction pipe of the apparatus, substantially as described.

6. In the production of illuminating liquefied gases, the method of recovering gases set free from separated liquid constituents, consisting in causing the separated liquid constituents to escape, at the pressure of the suction pipe, into a vessel connected with the suction pipe of the apparatus employed, substantially as described.

7. In the production of illuminating liquefied gases, the method of recovering gases set free from separated liquid hydrocarbons, consisting in causing the separated liquid hydrocarbons to escape, at the pressure of the suction pipe, into a vessel connected with the suction pipe of the apparatus, substantially as described.

8. The method of producing illuminating liquefied gases, consisting in compressing distillation gases at a low stage of compression, then removing the liquid constituents thereby separated out, then causing the separated liquid constituents to escape into a vessel connected with the suction pipe of the apparatus employed, and then compressing the so treated gas to the higher pressure necessary to liquefaction of remaining constituents, substantially as described.

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