H. L. DOHERTY.

METHOD OF ENRICHING GAS FOR ILLUMINATING PURPOSES.

APPLICATION FILED JUNE 29, 1905.

992,944. **Patented May 23, 1911.**

Fig.4

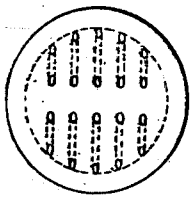


Fig.5

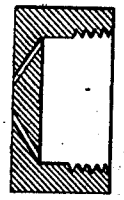


Fig.7

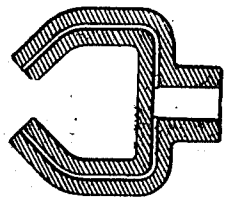


Fig.3

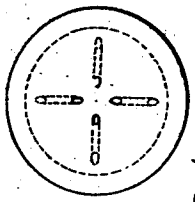


Fig.6

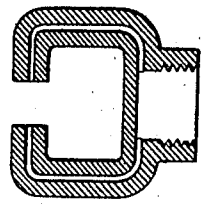
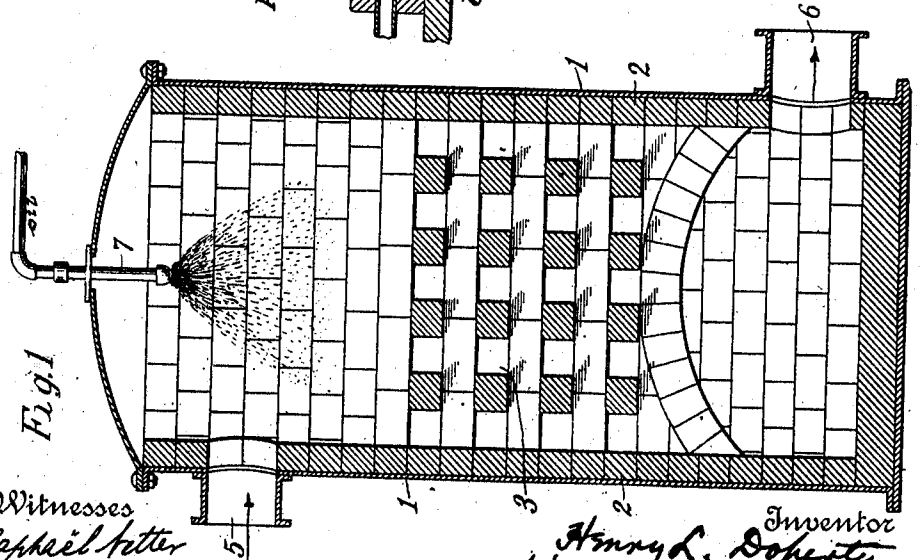


Fig.2

Fig.1



Witnesses
Raphael Netter
S. S. Dunham

Inventor
Henry L. Doherty,
By his Attorneys
Kerr, Page & Cooper

UNITED STATES PATENT OFFICE.

HENRY L. DOHERTY, OF MADISON, WISCONSIN.

METHOD OF ENRICHING GAS FOR ILLUMINATING PURPOSES.

992,944. Specification of Letters Patent. Patented May 23, 1911.

Application filed June 29, 1905. Serial No. 267,503.

To all whom it may concern:

Be it known that I, HENRY L. DOHERTY, a citizen of the United States, residing at Madison, in the county of Dane and State of Wisconsin, have invented a certain new and useful Method of Enriching Gas for Illuminating Purposes, of which the following is a specification, reference being had to the drawing accompanying and forming part of the same.

My invention relates to the enrichment of combustible gas of any kind, more particularly the so-called "water gas" or "producer gas".

In the manufacture of gas by the decomposition of water the combustible gas collected and saved for subsequent use is composed chiefly of hydrogen and carbon monoxid which, burning in the air, give a blue or non-luminous flame. It is therefore necessary to artificially supply this gas with carbon in a form in which it becomes incandescent in the hydrogen and carbon monoxid flame and so produces the desired illumination. The carbon is supplied in the form of hydrocarbon gas or vapor, usually produced by the vaporization or gasification of a hydrocarbon oil. The gas, flowing through the carbureter, takes up the hydro-carbon gas or vapor and is then delivered to the superheater and finally to the washing, cooling and purifying apparatus, after which it is stored for distribution through the mains. In the enrichment method just described, as heretofore practiced, a considerable part of the hydrocarbon oil is actually decomposed or broken down to hydrocarbon of low illuminating value, and the carbon thereof, which is intended to furnish the incandescence in the flame, is deposited in the carbureter as lamp-black, or in the tarry residue composed of the less-volatile part of the oil. The carbon thus liberated from the vapor is wasted, so far as enrichment of the water gas is concerned, and consequently the deficiency must be made up by a larger supply of the hydrocarbon oil. This adds a considerable item to the cost of the product, and it has long been desired to obviate the same. I have therefore been led to devise my present invention, by which the breaking up of the hydrocarbon in the enrichment process, and the consequent liberation of carbon, are eliminated or at least reduced to a practically negligible minimum.

I have discovered that under normal conditions of temperature in the carbureter, the decomposition of the hydrocarbon is caused in some way by the unvaporized oil coming in contact with a solid body notably the lining of the apparatus or the "checker work" therein. I therefore prevent the oil from striking any solid body, and do this by dissipating the oil in the form of a very fine spray or mist, the particles of which have insufficient velocity to carry them against the lining or checker brick before they are completely volatilized. In other words the oil is volatilized entirely in the stream of gas which is flowing through the carbureter and by the heat of the gas itself. I have found that by this method practically none of the volatile constituents of the oil are decomposed, so that they all remain in the gas, such residue as is left in the carbureter being composed almost, if not entirely, of the constituents which do not volatilize at the temperature therein.

My invention therefore consists, broadly stated, in admitting the oil in the form of a fine mist and vaporizing the same in the gas itself without permitting the unvaporized particles to come in contact with a highly heated solid body.

In practicing my method any suitable apparatus for spraying the oil may be used, but I prefer that described and claimed in my co-pending application filed January 11th, 1905, Ser. No. 240,540. Such an apparatus in connection with a carbureter is shown in the accompanying drawings, in which—

Figure 1 is a vertical section of the carbureter, showing the preferred arrangement of the spray device. Fig. 2 is a longitudinal section of the spray apparatus, and Figs. 3 to 7 inclusive, show various forms of nozzles for use therewith.

The carbureter may be of any suitable kind, that herein shown being merely one convenient form. The outer casing of the same is indicated by 1. It is lined with refractory material, usually in the form of bricks, as indicated at 2, and contains a quantity of refractory material 3, so arranged as to have numerous interstices or passages through its mass, as shown. This

is generally known as "checker work", and the amount thereof used in the carbureter may vary considerably.

When the carbureter is to be used a hot blast is blown through by way of the inlet 5 and outlet 6. The checker work and lining are thereby soon brought to the proper temperature, whereupon the supply of air is cut off and the gas to be enriched is delivered through the inlet. At the same time the oil is injected into the space above the checker work by means of the spray device 7. The gas, passing through the hot checker work is itself highly heated.

The process just described is merely that of a well-known type of water gas apparatus, and will be readily understood by those skilled in the art.

In accordance with my invention the spray from the nozzle 7 is so fine and the velocity of the liquid particles composing the spray is comparatively so low that they are vaporized by the heat of the gas before they can strike the hot checker work or lining. The result is that the volatile hydrocarbons are not broken up, but are merely vaporized, and in the form of vapor they are mingled with the gas and pass out therewith through the outlet 6.

Any suitable apparatus may be used for producing the oil spray, but as before stated, I prefer that shown in Fig. 2, which is described and claimed broadly in my copending application before mentioned.

F is an apertured member secured over an opening in the cover of the carbureter and provided with a yoke, indicated by Y, spanning the opening. The top surface of the member F is dressed to provide a seat for the plate P, removably held thereon by a screw y working in the yoke. From the plate P the nozzle N extends through the opening, into the interior of the carbureter. Extending through the nozzle N is a pipe n, and at the end of the nozzle is a spray cap C. The cap has two or more small orifices, o, o', arranged at an angle to each other, so that the fine streams of liquid issuing therefrom will impinge on each other and be thereby broken up into a fine mist or spray. At the upper end the pipe n is in communication with the oil-supply pipe n'. It is desirable that the oil should be under considerable pressure, so that the streams from the orifices in the cap will strike each other with great force. The kinetic energy of the streams, represented by velocity, is thereby dissipated in breaking up the streams into a very fine mist or spray. Consequently the particles composing the spray, which particles are of course liquid, have only slight velocity, so that they are not carried far from the nozzle before they are vaporized by the heat of the gas into which they are discharged and hence do not come into contact with the walls of the chamber or the checker work. In general, the finer the streams and the greater their impact, the finer will be the spray. Where a considerable quantity of oil is needed to give the desired degree of enrichment, the orifices, and consequently the impinging streams, may have to be made so large that the spray will not be fine enough for the best results. In such case the number of the orifices may be increased instead of their size. Also, instead of focusing them all at a common point, they may be focused in pairs, or threes, etc. Fig. 3 shows in plan a cap with four orifices, all focused on the same point. Fig. 4 shows a cap with five pairs of orifices, each pair having its own focus. The angle at which the streams strike also has an important effect on the spray, both on its fineness and the space occupied by it. For example, the more nearly parallel are the streams, the coarser will be the spray, and it will be projected farther from the nozzle. On the other hand, if the angle of impingement be very obtuse, as in Fig. 5, the spray will be very fine and will be more or less diffused around the nozzle instead of being thrown a considerable distance therefrom. By properly proportioning the size, number and angle of the orifices any desired effect may be secured, as will be readily understood. Instead of a cap, with orifices drilled or otherwise formed therein, a spraying device having inwardly discharging tubes may be used, as for example like those shown in Figs. 6 and 7. It will be understood, of course, that any type of spray device may be used, those shown being merely convenient forms.

The nozzle, extending as it does into the carbureter, will become very hot unless suitably protected. It is for this purpose that there is a space left around the oil pipe n in the tubular member N. Extending through this space, well toward the lower end, is a liquid supply-pipe l, communicating at its upper end with a passage l' in the plate P, which passage registers with an inlet passage l'' in the supporting member F. An outlet l^3 is provided in the plate P, registering with a passage l^4 in the member F. By means of the pipe and passages just described a cooling liquid may be circulated through the interior of the tubular member N, around the oil-pipe n, thereby preventing the spray apparatus from becoming hot enough to break up any of the hydrocarbons within the same. Otherwise the deposit of carbon within the device would soon choke the fine discharge orifices. Also, by preventing breaking up of the oil in the spray apparatus the volatile constituents of the oil are all discharged into the gas which is to be enriched.

The method herein described has been used by myself in the manufacture of water and

oil gas and the saving effected thereby has been found to be very considerable, thus demonstrating its practical utility.

What I claim is:

The herein described method of enriching combustible gas, which consists in discharging minute streams of liquid hydrocarbon at high velocity directly into a chamber containing heated gas, and directing the bodies of said streams toward and against each other whereby the bodies of the stream strike each other and are broken up or nebulized into a fine spray, the liquid particles of which have low velocity and are so minute as to be vaporized, substantially coincident with their formation.

HENRY L. DOHERTY.

Witnesses:

CHAS. A. FRUEAUFF,

H. C. ABELL.