No. 755,376. PATENTED MAR. 22, 1904.

C. E. LUCKE.

METHOD OF COMBUSTION.

APPLICATION FILED JUNE 7, 1901.

NO MODEL.

Fig. 1.

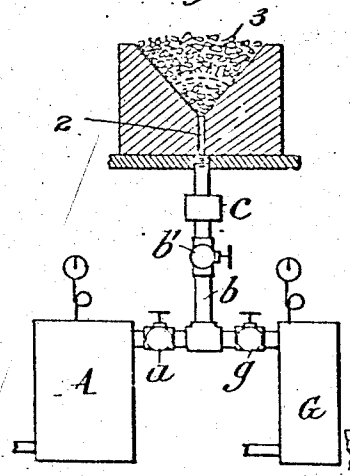


Fig. 2.

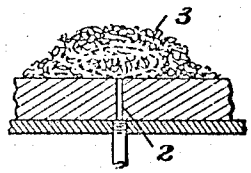


Fig. 3.

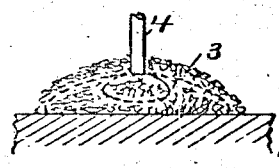


Fig. 4.

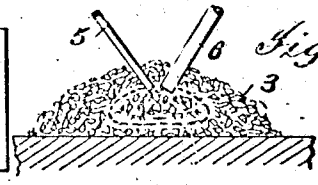
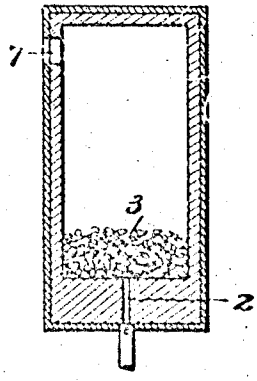


Fig. 5.



Attest:
J. F. Geddes
Geo. H. Bolte

Inventor:
Charles E. Lucke
By Philipp Langner Rust & Kennedy
Attys

No. 755,376. Patented March 22, 1904.

UNITED STATES PATENT OFFICE.

CHARLES E. LUCKE, OF NEW YORK, N. Y.

METHOD OF COMBUSTION.

SPECIFICATION forming part of Letters Patent No. 755,376, dated March 22, 1904.

Application filed June 7, 1901. Serial No. 63,542. (No specimens.)

To all whom it may concern:

Be it known that I, CHARLES E. LUCKE, a citizen of the United States, residing at New York city, county of New York, and State of New York, have invented certain new and useful Improvements in Methods of Combustion, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to the non-explosive combustion of explosive gaseous mixtures.

The object of the invention is to provide a practical method of burning such mixtures non-explosively and continuously.

The uses to which such a method of combustion may be put are very numerous, and the desirability of such a method has been long felt; but no satisfactory practical method of burning explosive gaseous mixtures non-explosively and continuously has to my knowledge been known prior to my invention.

The difficulty which has heretofore been met with in the combustion of explosive gaseous mixtures has been due to the fact that combustion started at any point tends to propagate itself throughout the mixture with great rapidity. If the mixture be at rest, the surface of combustion changes its position, moving through the mass. If the mixture be in motion, the surface of combustion may be at rest or in motion, but will be at rest only when the mixture moves with a velocity equal to the rate of propagation of inflammation through the mixture. No practically successful method has heretofore been known whereby the flame-cap or surface of combustion could be localized or maintained at a desired point under the varying conditions of actual practice.

By my method of combustion I am enabled to confine the movements of the surface of combustion within narrow limits, so that the combustion is practically localized and maintained at a desired point. I secure this result by causing the mixture to flow with a velocity greater than the rate of propagation of inflammation through the mixture and then causing it to spread out or expand and its velocity to be thus reduced until its velocity is as low at least as the rate of propagation of inflammation of the mixture. Then if combustion be started it will maintain itself in a surface at which the velocity of translation of the mixture equals the rate of propagation of inflammation. This combustion-surface, the surface of constant velocity, will advance or recede as the initial velocity of the mixture increases or decreases; but by causing the spreading or expansion of the mixture to be sufficiently abrupt, with a consequent rapid decrease in velocity of translation, this movement of the combustion-surface may be reduced and combustion maintained within limits entirely suited to the requirements of practical use of the method even with large variations in the velocity at which the mixture is supplied. Furthermore, this expansion and reduction of velocity of the mixture should be accomplished in such a manner as to cause an even flow of the gaseous mixture and to prevent its diffusion with the surrounding medium before reaching the surface of constant velocity at which the combustion takes place.

The expansion and reduction of velocity of the mixture within the desired limits and the prevention of diffusion with other gas may be accomplished in any suitable manner and with the aid of any suitable apparatus or means. I prefer, however, to cause the mixture to flow into a space which is subdivided, so that as the mixture flows therethrough its direct advance will be prevented and it will be caused to spread out through the subdivisions of the space, and thus to advance in increasing volume and with diminishing velocity and without diffusion with other gas. For thus subdividing the space within which the combustion-surface is to be secured I preferably employ small pieces of a suitable refractory material placed loosely about the opening or the point or place from which the mixture flows with or has an initial velocity greater than the rate of propagation of inflammation.

The accompanying drawings illustrate several ways in which my method may be carried out by causing the mixture to flow through a space filled with small pieces of refractory material. It is to be understood, though, that while I prefer to carry out my method of combustion by causing the mixture to flow through

a suitably-subdivided space, this in itself forming a feature of the invention, and prefer to form such a subdivided space by means of loose pieces of refractory material, yet the invention is not to be limited thereto, the means shown for carrying the invention into practice being shown merely by way of example.

In said drawings, Figure 1 illustrates a preferred form of burner for burning combustible gaseous mixtures in accordance with my invention and a simple form of apparatus for supplying a gaseous mixture to the burner. Figs. 2, 3, and 4 show modified forms thereof. Fig. 5 shows a burner having a closed combustion-chamber.

Referring to Fig. 1, the gaseous mixture is admitted to the combustion-space through a comparatively small inlet-opening 2, and above the inlet-opening the walls of the burner spread apart, so as to form a space of gradually-increasing transverse area, and the space between these spreading walls is filled with small pieces of suitable refractory material 3, placed loosely therein. The mixture is supplied to the inlet-opening 2 by any suitable means—as, for example, the means shown—and caused to flow therethrough with a velocity greater than the rate of propagation of inflammation through the mixture, and rising through the mass of fragments or pieces of refractory material 3 it will be caused to spread out and to advance with diminishing velocity and without diffusion with other gas. The combustion-surface will be at a greater or less distance from the inlet-opening, according to the initial velocity of the mixture as it flows from the opening, rising toward or even to the surface of the refractory material as the initial velocity increases and retreating toward the inlet-opening as the initial velocity diminishes.

In the apparatus shown for supplying the gaseous mixture to the burner, G represents a tank for the fuel-gas, and A a tank for air or other combustion-supporting gas, the gas and air being supplied to these tanks by any suitable means adapted to maintain a desired pressure therein. From each tank there extends an outlet controlled by valves g and a, respectively, and these outlets lead to a pipe b, which leads through a safety or gauze chamber c to the inlet-opening 2, this pipe b being also provided with a valve b'. By means of the valves g and a the proportions of gas and air in the mixture and the velocity with which the mixture flows through the opening 2 may be controlled, and the velocity of the flow of the mixture may also be controlled by the valve b'. The proper proportions—that is, proportions such, according to the nature of the constituents, that the mixture will have the property of self-propagation of inflammation and the necessary velocity of flow of the mixture through the opening 2—may be readily determined by experiment.

In Fig. 2 the mixture enters through an inlet-opening 2, as in Fig. 1; but the pieces of refractory material 3 are merely placed in a heap on a flat surface.

In Fig. 3 the mixture is introduced into a heap of pieces of refractory material through a downwardly-pointing nozzle 4.

In Fig. 4 the constituents of the gaseous mixture, as a suitable gas or oil and air, are fed in proper proportions through separate nozzles 5 and 6 and mixed within the heap of pieces of refractory material to form the explosive mixture. When oil is fed through the nozzle 5, it will be vaporized by the heat, and the vapor will mix with the air or other gas from the nozzle 6 to form the explosive gaseous mixture.

In Fig. 5 a burner is shown having a closed combustion-chamber, from which the products of combustion may pass under pressure through an exit-passage 7.

It will be understood that by the use of the term "explosive gaseous mixture" herein is meant a mixture of a suitable gas, as air, containing oxygen, with combustible matter in a gaseous or finely-divided state in proper proportions—that is, in proportions such that the mixture will have the property of self-propagation of inflammation.

What I claim is—

1. The method of burning explosive gaseous mixtures which consists in causing the mixture to move with a velocity greater than the rate of propagation of inflammation through the mixture, and then reducing the velocity to the rate of propagation of inflammation and preventing diffusion with other gas, by causing the mixture to spread out so that the successive surfaces of uniform velocity shall have adjacent points in any such surface at substantially the same distance from the place where spreading begins, and burning the mixture at the surface at which the velocity is equal to the rate of propagation of inflammation, substantially as described.

2. The method of burning explosive gaseous mixtures which consists in causing the mixture to flow through an opening with a velocity greater than the rate of propagation of inflammation through the mixture, and then reducing the velocity to the rate of propagation of inflammation and preventing diffusion with other gas, by causing the mixture to spread out so that the successive surfaces of uniform velocity shall have adjacent points in any such surface at substantially the same distance from the opening or place where spreading begins, and burning the mixture at the surface at which the velocity is equal to the rate of propagation of inflammation, substantially as described.

3. The method of burning explosive gaseous mixtures which consists in causing the mixture to flow with a velocity greater than the rate of propagation of inflammation through the mixture into a space subdivided so as to

cause the mixture as it advances to spread out so that the successive surfaces of uniform velocity shall have adjacent points in any such surface at substantially the same distance from the place where spreading begins, and burning the mixture at the surface at which the velocity is equal to the rate of propagation of inflammation, substantially as described.

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

CHARLES E. LUCKE.

Witnesses:
A. A. V. BOURKE,
G. M. BORST.