C. E. LUCKE.

BURNING OF EXPLOSIVE GASEOUS MIXTURES.

APPLICATION FILED JULY 10, 1915.

**1,302,819.** Patented May 6, 1919.

2 SHEETS—SHEET 1.

*Fig. 1.*

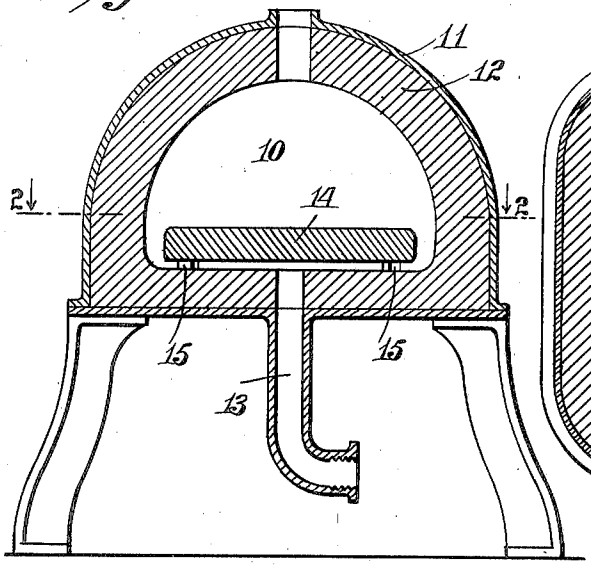



*Fig. 2.*

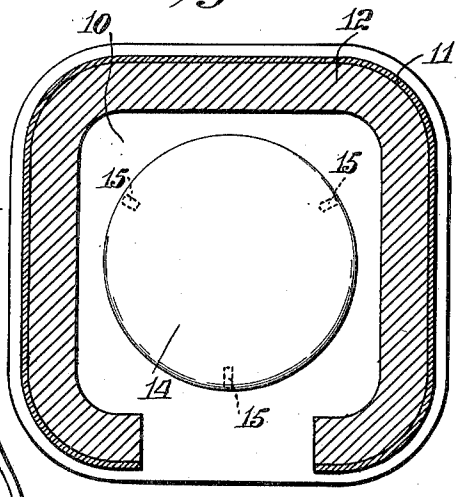



*Fig. 3.*

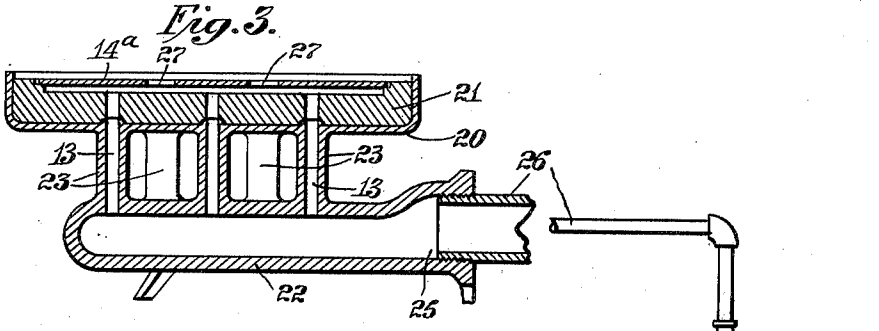
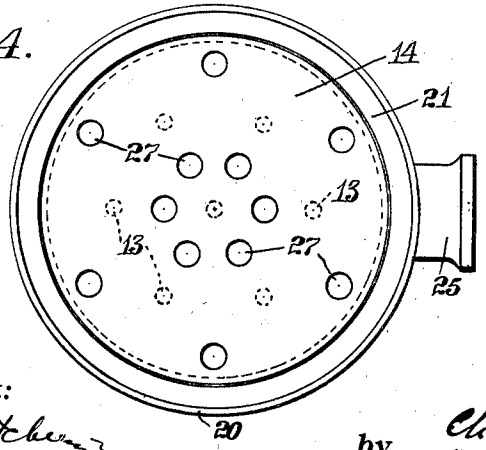



*Fig. 4.*




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2 SHEETS—SHEET 2.

Fig. 5.

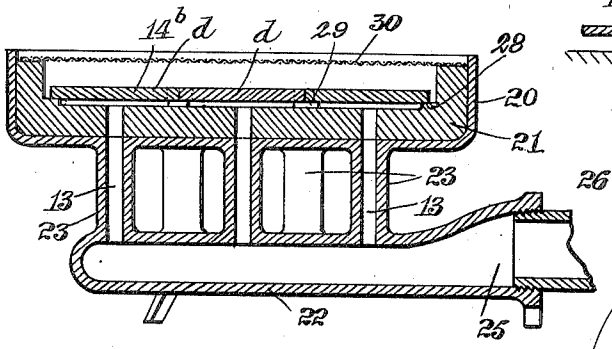



Fig. 7.

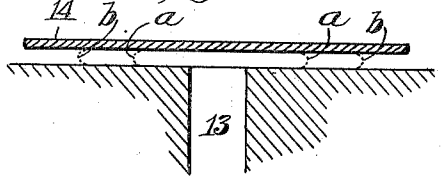



Fig. 8.

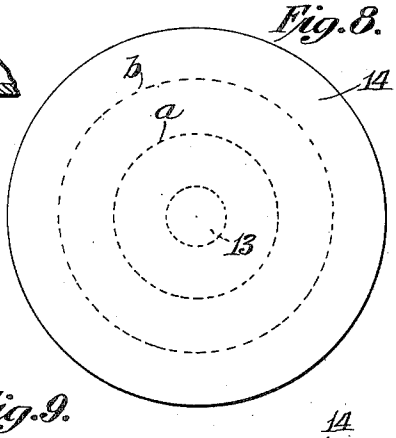



Fig. 6.

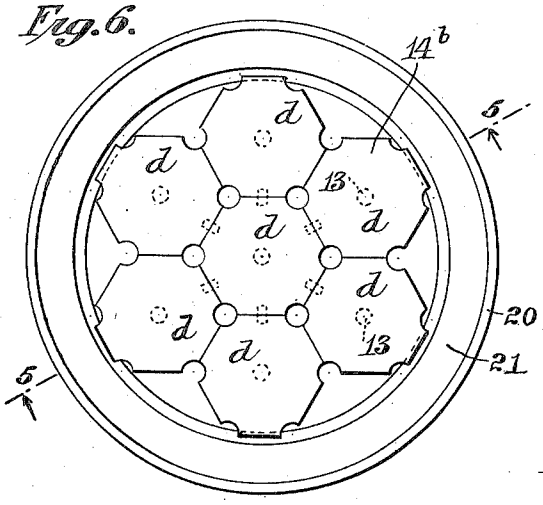



Fig. 9.

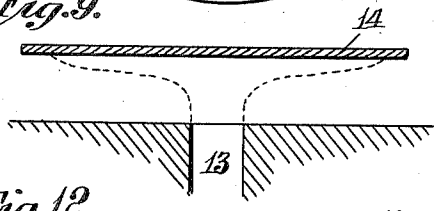



Fig. 12.

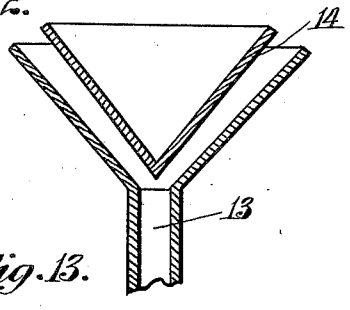



Fig. 10.

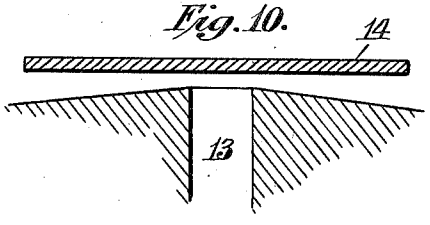



Fig. 13.

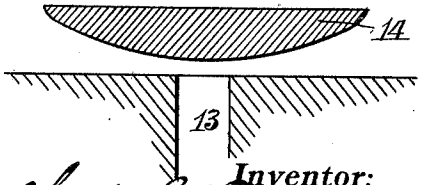
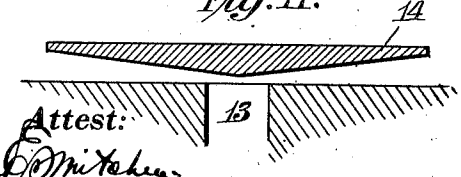



Fig. 11.




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# UNITED STATES PATENT OFFICE.

CHARLES E. LUCKE, OF NEW YORK, N. Y., ASSIGNOR TO GAS AND OIL COMBUSTION COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

## BURNING OF EXPLOSIVE GASEOUS MIXTURES.

1,302,819. Specification of Letters Patent. Patented May 6, 1919.

Application filed July 10, 1915. Serial No. 39,069.

*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, in the county of New York and State of New York, have invented certain new and useful Improvements in the Burning of Explosive Gaseous Mixtures, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to the development of heat by the burning of explosive gaseous mixtures continuously, or non-explosively, as distinguished from non-continuous or intermittent combustion of such mixtures. The invention comprises a method wherein a stream of explosive mixture is supplied at a velocity greater than the rate of propagation of inflammation of the mixture, has its flow velocity reduced by being baffled and caused to spread out against a directing and confining surface, and is burned where its reduced velocity is equal to the rate of propagation of inflammation of the mixture; and the invention comprises also apparatus for practising the method, including means for supplying the mixture flowing with the necessary excess velocity, and baffling means for causing the desired controlled reduction of flow velocity of the mixture; all as hereinafter more fully described and as claimed.

Continuous and localized combustion of explosive gaseous mixtures is accomplished in two ways: first, by feeding the mixture through a flame-interrupting coooling passageway or screen at a rate low enough to cause its exit velocity to be less than the rate of propagation of inflammation of the mixture and then burning the mixture at the exit side of the screen; and second, by causing the mixture to flow with a velocity greater than the rate of propagation of inflammation of the mixture in order to prevent back-flashing, and then, to prevent blow-off or the carrying away of the flame, reducing the velocity to the rate of propagation of inflammation while preventing dissipation of the mixture or diffusion with other gas, and burning the mixture at the surface at which the velocity becomes equal to the rate of propagation of inflammation. The present invention relates to the second way of securing continuous and localized combustion of explosive gaseous mixtures, which is the most efficient way, and for most purposes the most advantageous.

The object of the invention is to provide an improved method and apparatus for developing heat by burning explosive gaseous mixtures which shall be simple and shall be generally adaptable for use under widely varying conditions and shall meet the requirements for maintaining continuous combustion localized within narrow limits of explosive mixtures of varying rates of inflammation and supplied under varying pressures or at varying velocities. Among the special objects of the invention may be mentioned that of securing the required reduction of velocity of the inflowing mixture with a minimum of resistance, thereby minimizing the required supply pressure, securing the localization of the combustion in, or approximately in a desired plane under varying pressures, securing the quick attainment of normal operation with a large amount of the developed heat supplied in the form of radiant heat, the reduction in the thickness of that part of the burner structure which lies beyond the discharge openings of the mixture supply passages, and the provision of a burner which is well adapted for use in any desired position. Other objects and advantages of the invention will appear from the following description.

In burning explosive gaseous mixture in accordance with the present invention, the mixture is caused to flow, in one or a number of suitably spaced streams, with a velocity greater than the rate of propagation of inflammation of the mixture, and the flow velocity is then reduced by baffling the stream of mixture and causing it to spread out with increasing cross-section and with rapidly decreasing velocity against the baffling surface and, most desirably, between it and a closely adjacent coacting wall. The reduction of the flow velocity to the rate of propagation of inflammation so that combustion may take place at the surface where equality between the flow velocity of the mixture and the rate of propagation of inflammation of the mixture is attained is thus secured within a comparatively short distance from the place where the mixture strikes the baffling surface or from the place where spreading begins, and with comparatively little resistance to the flow of the mixture. The baffling surface will usually be a comparatively thin plate of impermeable and highly refractory material, so that, the

plate becoming highly heated, its outer surface may serve efficiently as a source of radiant heat. Such plate should be made of material substantially permanent and not too fragile, such as non-oxidizable or slowly oxidizable metal like nickel, nickel steel, chrome nickel, etc., for the more moderate temperature operations, or suitable porcelain, silica, clay, alundum, etc., for the higher temperature operations. By using an impermeable baffling plate or wall, that is, one which will not permit passage into and through it of any substantial part of the gaseous mixture flowing against it, the spreading out and reduction of flow velocity of the mixture to the required degree against the face of the plate or wall and the localized action of the combustion adjacent to the surface of the baffling plate or wall may be secured under wide variations in the supply velocity of the mixture and under velocities very greatly in excess of the rate of propagation of inflammation. The baffling wall may therefore be made in the form of a very thin plate, the limitation of thinness being only that imposed by the necessary strength of the plate. The thinner the baffling plate, the quicker it will become heated to the maximum degree after combustion is started. If the mixture is supplied in a single stream, the combustion gases may escape beyond the edges of the baffling plate or through openings therein beyond the limit of spreading of the mixture required to secure the necessary reduction of velocity. If the mixture is supplied in a plurality of streams, such streams should be suitably spaced, and the baffling plate, which may be a single integral plate or may be formed by a plurality of parts suitably joined or relatively positioned, may be formed with openings of suitable capacity suitably located between the portions of the plate against which the streams of mixture spread out.

The co-acting wall which is preferably provided closely adjacent to the baffling surface may also be a thin plate adapted to serve as a source of radiant heat, but will usually be a suitable impermeable wall of low heat conductivity so that heat received by it from the combustion space will be deflected back toward the baffling plate, the heat generated being thus substantially all supplied in the direction away from the outer or far side of the baffling plate. I have found that best results are secured by having the co-acting faces of the baffling plate or wall and such adjacent wall approximately parallel and so close together that the mixture will completely fill, or extend all the way across, the space between them as it advances with decreasing velocity. Access of the atmosphere or other gases to the spreading mixture is thus entirely prevented, and the mixture is positively directed and confined by the coacting faces as it advances with decreasing velocity between them so that successive surfaces of uniform velocity will be in the form of narrow bands extending about the place where expanding begins. It is not necessary, however, that the co-acting wall shall be located so close to the baffling face that the advancing mixture shall completely fill the space between them, but the wall may be set farther off from the baffling face and still serve to prevent escape of heat from the combustion space in the direction away from the baffling surface and also to some extent to prevent or limit the access of the atmosphere to the spreading mixture, or the wall might even be entirely removed.

It will be understood that by the term "explosive gaseous mixture" as used herein is meant a mixture of a suitable combustion supporting gas, either oxygen alone or air or other oxygen-containing gas, with combustible matter in a gaseous or other finely divided state in proper proportions, that is, in proportions such that the mixture will have the property of self-propagation of inflammation. For producing the highest temperature, the oxygen should be undiluted and the mixture should contain oxygen and combustible matter in chemical combining proportions at the time of combustion; but there may be an excess of either the combustible matter or the combustion supporting gas within the limits which determines the property of self-propagation. The mixture may be varied in this respect according to the desired character of the products of combustion, that is, whether it is desired that the products shall be neutral, oxidizing or reducing. Also, the mixture may of course contain neutral gas such as nitrogen, carbon dioxid or water vapor, so long as the amount of such neutral gas is not sufficient to make the mixture non-explosive.

The accompanying drawings show simple forms of apparatus whereby the method may be practised and which embody the apparatus features of the invention. In said drawings:

Figure 1 is a sectional view of a small furnace of simple form heated by the combustion of mixture supplied through a single supply passage;

Fig. 2 is a section taken on line 2—2 of Fig. 1;

Fig. 3 is a sectional view of a burner having a plurality of mixture supply passages;

Fig. 4 is a plan view of the burner shown in Fig. 3;

Fig. 5 is a sectional view of a burner similar to that shown in Fig. 3, but having a modified form of baffling plate and having a heat-equalizing and radiating screen beyond the plate;

Fig. 6 is a plan view of the burner shown

in Fig. 5 with the heat-equalizing and radiating screen removed;

Fig. 7 is a diagrammatic sectional view of a single jet burner similar to that of the furnace shown in Fig. 1, but on a larger scale;

Fig. 8 is a plan view of the burner shown in Fig. 7;

Fig. 9 is a view similar to Fig. 7 but showing the baffling plate set farther from the hearth; and

Figs. 10, 11, 12 and 13 are diagrammatic sectional views of other modified forms of burners.

Referring first to Figs. 1 and 2, the walls of the furnace chamber 10 are shown as formed by a metal outer wall or casing 11 and a lining 12 of highly refractory material of low heat conductivity, the bottom wall, or hearth, being flat and having a central mixture supply opening which communicates with and forms a continuation or part of a mixture supply passage 13 through which the explosive gaseous mixture is supplied under a pressure sufficient to cause it to flow through the passage with the desired excess velocity from any suitable source or by any suitable means, as for example by the means shown in Fig. 3 for supplying a mixture of fuel gas and air. Mounted adjacent the hearth within the furnace chamber and extending over the mixture inlet opening and spaced slightly away from the face of the hearth is a baffling plate 14 of suitable highly refractory material such as alundum. The baffling plate, unless otherwise formed to provide for escape of the combustion gases from beneath it, should be of such size as to leave an opening around its edge. It may be supported in any suitable manner, as by supporting and positioning lugs 15 as shown.

The mixture supplied through the passage 13 moving with a velocity greater than the rate of propagation of inflammation of the mixture strikes the under side of the plate 14 and is thereby caused to spread out and to advance with increasing cross-section and with decreasing velocity in the space between the plate and the hearth. The flow velocity of the mixture is thus rapidly reduced, and reduction of velocity to the rate of propagation of inflammation of the mixture being attained before the mixture passes beyond the edges of the plate, combustion will take place adjacent the plate and in the space between it and the hearth. The portions of the plate adjacent to which combustion of the mixture takes place become quickly heated to a high state of incandescence, and the extremely hot combustion gases pass out from beneath the plate into the furnace chamber, heating to a high state of incandescence all the interior surfaces of the furnace chamber swept by these hot gases.

The plate should be spaced off from the hearth a sufficient distance to permit the mixture to flow outward from the baffling point as fast as it can be supplied through the passage 13, and it is most desirably set close enough to the hearth so that the advancing mixture will fill, or extend all the way across, the space between the plate and the hearth. I consider it best to have the plate set off from the hearth a distance about equal to one-quarter of the diameter of the supply passage, assuming the supply passage to be a round passage. When so set the flow capacity of the space immediately adjacent the edges of the passage will be equal to that of the passage. When the plate is set so closely adjacent to the hearth that the advancing mixture fills the intervening space, successive surfaces of uniform velocity of the mixture as it advances between the plates will be in the form of narrow bands extending about the point of impact of the stream against the baffling plate, as indicated by the dotted lines *a* and *b* in Figs 7 and 8, and the combustion of the mixture will be complete at such surface of uniform velocity at which the velocity is equal to the rate of propagation of inflammation of the mixture. As the plate becomes highly heated some combustion of the mixture probably occurs against the surface of the plate within the line or zone where equality between the flow velocity and the rate of propagation of inflammation is attained, but the combustion will principally occur at such band or surface where the flow velocity equals the rate of propagation of inflammation. When the plate is set parellel to the hearth and to extend at right angles to the direction in which the stream of mixture strikes against it, the spreading of the mixture between the plate and hearth will, in the absence of other disturbing conditions, be substantially uniform in all directions and the successive surfaces of uniform velocity will be in the form of annular bands. As the plate and hearth become highly heated, the rate of combustion and capacity of the burner is increased by the heating of the advancing mixture and also, it is believed, by the presence of the incandescent solid matter.

Figs. 3 and 4 illustrate a burner or apparatus for burning an explosive gaseous mixture in which the mixture is supplied in a plurality of suitably spaced streams. This burner as shown comprises a burner head comprising a cup shaped casing 30 and a filling 21 of suitable highly refractory material of low heat conductivity, a casing or header 22 providing a supply chamber, and a plurality of connecting members 23 extending between the burner body and the header 22 and through which the supply passages 13 extend from the supply chamber

to and through the hearth or refractory filling 21. The casing or header 22 is provided with an inlet 25 through which the explosive mixture is supplied to maintain the mixture in the supply chamber under a pressure sufficient to cause the mixture to flow through the supply passages 13 with the desired excess velocity. The mixture supplying means shown comprises a tank G for fuel gas and a tank A for air or oxygen or other combustion supporting gas. The fuel gas and combustion supporting gas may be supplied to these tanks by any suitable means adapted to maintain the desired pressures therein. Outlet pipes controlled by valves *a* and *g* lead from the tanks and connect with a supply pipe 26 which leads to the inlet 25 of the supply chamber. The valves *a* and *g* serve to control the proportions of fuel gas and combustion supporting gas in the mixture, and the pressure maintained in the supply chamber and the velocity of flow through the supply passages 13 may also be controlled by these valves. The proper proportions of fuel gas and combustion supporting gas, that is, proportions such according to the nature of the constituent gases that the mixture shall have the property of self-propagation of inflammation, may be readily determined by experiment. The means shown and above described for supplying an explosive mixture under the required pressure is, of course, only illustrative, and various other suitable means might be employed. So also, explosive mixtures other than mixtures of fuel gas and air or other combustion supporting gas may be used in practising my method, such, for example, as explosive gaseous mixtures of air and coal dust or charcoal dust or fine oil spray, mist or fog.

The baffling plate $14^a$ extends adjacent the hearth past the discharge openings of the several supply passages 13, being supported by a peripheral support or shoulder formed on the hearth or otherwise. The portions of the plate opposite the supply passages are impermeable, but between such impermeable baffling portions, which should be of sufficient extent to effect the desired reduction of the flow velocity of the streams of mixture striking against them, the plate has openings 27 for the escape of the combustion gases. The plate is most desirably spaced off from the face of the hearth a distance such that the spreading mixture will fill or extend clear across the space between the plate and the hearth as explained in connection with Figs. 1 and 2. In order to increase the proportionate amount of heat supplied in the form of radiant heat, the baffling plate is made as thin as the necessary strength will permit and of a suitable refractory material of high heat conductivity such as chrome nickel or other suitable metal.

In operation, the mixture being supplied through the pipe 26 and a suitable pressure being maintained within the supply chamber, the mixture flows through the supply passages 13 with a velocity in excess of the rate of propagation of inflammation of the mixture and each stream of mixture leaving its supply passage is baffled and caused to spread out against the baffling plate and between it and the hearth with reduction of flow velocity in the same manner as in the case of the single stream burner shown in Figs. 1, 2 and 7. The baffling plate becomes highly heated by the combustion adjacent its under face, and because of its high heat conductivity it will, if the burner is suitably proportioned, become highly incandescent throughout its whole or substantially its whole extent, serving as a highly efficient source of radiant heat.

Figs. 5 and 6 illustrate a form of burner similar to that shown in Figs. 3 and 4 except that instead of a single integral baffling plate formed with openings for the escape of the combustion gases, the plate $14^b$ is formed of a plurality of parts or sections *d* shaped to fit together to form a complete plate, each section providing the baffling surface for a single stream of mixture in the particular form shown and the sections being formed so that when assembled the plate will have the necessary openings for the escape of the combustion gases. The several plate sections may be supported when in position in any suitable manner, as by the peripheral shoulder 28 and intermediate supporting studs 29 formed on the hearth as shown. With such a plate the possibility of warping under the intense heat to which the plate is subjected is practically avoided. Such plate sections will usually be molded from a suitable refractory cementitious material.

When the plate is formed, either in sections or as a single integral plate, from material which is not a good conductor of heat, the plate will not become uniformly heated by the combustion taking place beneath it, and it is desirable in some cases to provide a heat equalizing and radiating screen spaced off somewhat from the baffling plate so as to be heated by radiant heat from the baffling plate and by the hot combustion gases. The screen should be formed so as to allow the passage through it of the combustion gases and may be of any suitable character, such as a plate of suitable metal formed with multiplicity of small openings or perforations or a screen woven from suitable wire. Such a screen is shown at 30 in Fig. 5.

Fig. 9 illustrates a burner in which the

baffling plate is so set with relation to the discharge opening from which the stream of mixture issues that the stream will be baffled and spread out against the face of the plate without being confined between the plate and a co-acting wall. Figs. 10, 11, 12 and 13 show several illustrative variations in the forms of baffling means and co-acting non-heat-conducting walls.

What is claimed is:

1. The method of burning explosive gaseous mixtures which consists in supplying the mixture with a velocity greater than the rate of propagation of inflammation of the mixture, reducing the flow velocity of the mixture by baffling the stream of mixture and causing it to spread out and to advance with increasing cross-section and with decreasing velocity in an open space between directing and confining walls, and burning the mixture where the reduced velocity is equal to the rate of propagation of inflammation of the mixture.

2. The method of burning explosive gaseous mixtures which consists in driving a stream of the mixture at a velocity greater than the rate of propagation of inflammation of the mixture against a baffling surface, and causing the baffled stream to spread out against the baffling surface and to advance with increasing cross-section and with decreasing velocity in an open space between closely adjacent facing surfaces, whereby the velocity of the mixture is reduced to the rate of propagation of inflammation in a narrow zone or surface extending about the baffling point, and burning the mixture at such zone where the velocity of flow equals the rate of propagation of inflammation.

3. The method of burning explosive gaseous mixtures which consists in supplying the mixture with a velocity greater than the rate of propagation of inflammation of the mixture, reducing the flow velocity of the mixture by baffling the stream of mixture against an impermeable directing and confining wall and thereby causing it to spread out against the baffling surface and to advance with increasing cross-section and with decreasing velocity, and burning the mixture where the reduced velocity is equal to the rate of propagation of inflammation of the mixture.

4. The method of burning explosive gaseous mixtures which consists in supplying the mixture with a velocity greater than the rate of propagation of inflammation of the mixture, reducing the flow velocity of the mixture by baffling the stream of mixture against an impermeable directing and confining wall and thereby causing it to spread out against the baffling surface and to advance with increasing cross-section and with decreasing velocity, preventing access of the atmosphere to the spreading mixture, and burning the mixture where the velocity is equal to the rate of propagation of inflammation of the mixture.

5. The method of burning explosive gaseous mixtures which consists in supplying the mixture with a velocity greater than the rate of propagation of inflammation of the mixture, reducing the flow velocity of the mixture by baffling the stream of mixture against an impermeable directing and confining wall and thereby causing it to spread out laterally and to advance with increasing cross-section and with decreasing velocity, burning the mixture where the velocity is equal to the rate of propagation of inflammation of the mixture, and preventing escape of heat from the space where combustion takes place in the direction away from the baffling surface of the directing and confining wall.

6. The method of producing heat which consists in mixing a fuel in a finely divided state with a combustion supporting gas in proportions to form an explosive gaseous mixture, driving the explosive mixture thus formed at a velocity greater than the rate of propagation of inflammation of the mixture against the surface of an impermeable baffling plate, whereby the stream of mixture is caused to spread out laterally and to advance with increasing cross-section and with decreasing velocity between the baffling plate and a coacting directing and confining wall extending closely adjacent thereto, and burning the mixture where the velocity is equal to the rate of propagation of inflammation of the mixture.

7. The method of producing heat which consists in mixing a fuel in a finely divided state with a combustion supporting gas in proportions to form an explosive gaseous mixture, driving the explosive mixture thus formed at a velocity greater than the rate of propagation of inflammation of the mixture against the surface of an impermeable baffling plate heated to a state of incandescence, whereby the mixture is caused to spread out laterally and to advance with increasing cross-section and with decreasing velocity against the baffling plate, and burning the mixture adjacent the surface of the baffling plate and thereby maintaining the plate in a state of incandescence to serve as a source of radiant heat.

8. Apparatus for burning explosive gaseous mixtures, comprising means for supplying a stream of the mixture moving with a velocity greater than the rate of propagation of inflammation of the mixture, means providing a baffling surface adapted to cause the stream of mixture to spread out against the baffling surface, and means providing a

surface facing the baffling surface and closely adjacent thereto to co-act therewith to direct and confine the advancing mixture, whereby the mixture is caused to advance between said surfaces with increasing cross-section and with decreasing velocity, the width of the space between said surfaces being such that the mixture will fill said space as it advances with decreasing velocity.

9. Apparatus for burning explosive gaseous mixtures, comprising means for supplying a stream of the mixture moving with a velocity greater than the rate of propagation of inflammation of the mixture, means providing a baffling surface adapted to cause the stream of mixture to spread out against the baffling surface, said baffling surface lying in a plane perpendicular to the direction in which the stream of mixture moves against it, and means providing a surface facing the baffling surface and substantially parallel thereto and closely adjacent thereto to co-act with the baffling surface to direct and confine the advancing mixture, whereby the mixture is caused to advance between said surfaces with increasing cross-section and with decreasing velocity, the width of the space between said surfaces being such that the mixture will fill said space as it advances with decreasing velocity.

10. Apparatus for burning explosive gaseous mixtures, comprising means for supplying a stream of the mixture moving with a velocity greater than the rate of propagation of inflammation of the mixture, a baffling plate against which said stream impinges and by which it is caused to spread out and to advance with increasing cross-section and with decreasing velocity against the plate, and a wall of low heat conductivity extending opposite the baffling surface of the baffling plate and closely adjacent thereto to co-act therewith to direct and confine the advancing mixture and prevent access of the atmosphere thereto.

11. Apparatus for burning explosive gaseous mixtures, comprising means for supplying a stream of the mixture moving with a velocity greater than the rate of propagation of inflammation of the mixture, a thin baffling plate against which said stream impinges and by which it is caused to spread out and to advance with increasing cross-section and with decreasing velocity against the surface of said plate, and a wall of low heat conductivity extending opposite the baffling surface of said plate to prevent escape of heat from the space in which combustion takes place in the direction away from the baffling surface.

12. Apparatus for burning explosive gaseous mixtures, comprising means for supplying a stream of the mixture moving with a velocity greater than the rate of propagation of inflammation of the mixture, means providing an impermeable baffling surface against which said stream impinges and by which it is caused to spread out laterally and to advance with increasing cross-section and with decreasing velocity against said baffling surface.

13. Apparatus for burning explosive gaseous mixtures, comprising means for supplying a stream of the mixture moving with a velocity greater than the rate of propagation of inflammation of the mixture, means providing an impermeable baffling surface against which said stream impinges and by which it is caused to spread out and to advance with increasing cross-section and with decreasing velocity against said baffling surface, and means for preventing access of air to the spreading mixture.

14. Apparatus for burning explosive gaseous mixtures, comprising means for supplying a stream of the mixture moving with a velocity greater than the rate of propagation of inflammation of the mixture, a baffling plate against which said stream impinges and by which it is caused to spread out and to advance with increasing cross-section and with decreasing velocity against said baffling plate, and means for preventing escape of heat from the space in which combustion takes place in the direction away from the baffling surface.

15. Apparatus for burning explosive gaseous mixtures, comprising means for supplying a plurality of separate streams of the mixture moving with a velocity greater than the rate of propagation of inflammation of the mixture, a baffling plate against which said streams impinge and by which they are caused to spread out and to advance with increasing cross-section and with decreasing velocity against said plate, said baffling plate having perforations therein out of register with the impinging streams of mixture, and means providing a surface facing the baffling surface of the baffling plate and closely adjacent thereto to co-act therewith to direct and confine the advancing mixture.

16. Apparatus for burning explosive gaseous mixtures, comprising a hearth having a mixture supply opening therethrough, means for supplying the mixture to be burned under pressure sufficient to cause it to move through the supply opening with a velocity greater than the rate of propagation of inflammation of the mixture, and a baffling plate set close to but spaced slightly away from the hearth opposite the supply opening and adjacent portions of the hearth, said baffling plate serving to baffle a stream of mixture issuing from said orifice and co-acting with the hearth to direct and confine the baffled stream of mixture as it advances

between the hearth and said plate with increasing cross-section and with decreasing velocity

17. Apparatus for burning explosive gaseous mixtures, comprising a burner body or head of refractory material and of low heat conductivity, a mixture supply passage extending through the burner head, means for supplying the mixture to be burned under pressure sufficient to cause it to move through the supply passage with a velocity greater than the rate of propagation of inflammation of the mixture, and a baffling and heat-radiating plate set opposite the discharge end of said passage to baffle a stream of mixture issuing from said passage and to cause the mixture to spread out against the plate and to advance with increasing cross-section and with decreasing velocity.

18. Apparatus for burning explosive gaseous mixtures, comprising a burner body or head of refractory material and of low heat conductivity, a mixture supply chamber adjacent to but spaced off from the burner head, connecting means between the supply chamber and the burner head formed with a plurality of supply passages extending therethrough and through the burner head for the flow of the explosive mixture from the supply chamber to and through the burner head and said connecting means being formed to prevent the backward conduction of heat therethrough to such extent as would result in the walls of the supply passages adjacent the supply chamber being raised to the ignition temperature of the mixture, and a baffling and heat-radiating plate set close to but spaced slightly away from the burner head opposite the discharge ends of said passages, said baffling plate serving to baffle the streams of mixture issuing from said passages and co-acting with the burner head to direct and confine the mixture flowing between them, said plate having openings therein out of register with the ends of the passages.

19. A hearth comprising a receptacle; firebrick placed therein; a series of conduits passing through said receptacle and through said firebrick; a mixture supply chamber with which said conduits register; and a perforated plate in said hearth above the openings of said conduits.

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

CHARLES E. LUCKE.

Witnesses:
A. L. KENT,
PAUL H. FRANKE.