Jan. 24, 1967 P. LAFFITTE ETAL 3,299,675

FLINTLESS GAS-FUELED LIGHTER

Filed July 22, 1964 2 Sheets-Sheet 1

Fig. 2.

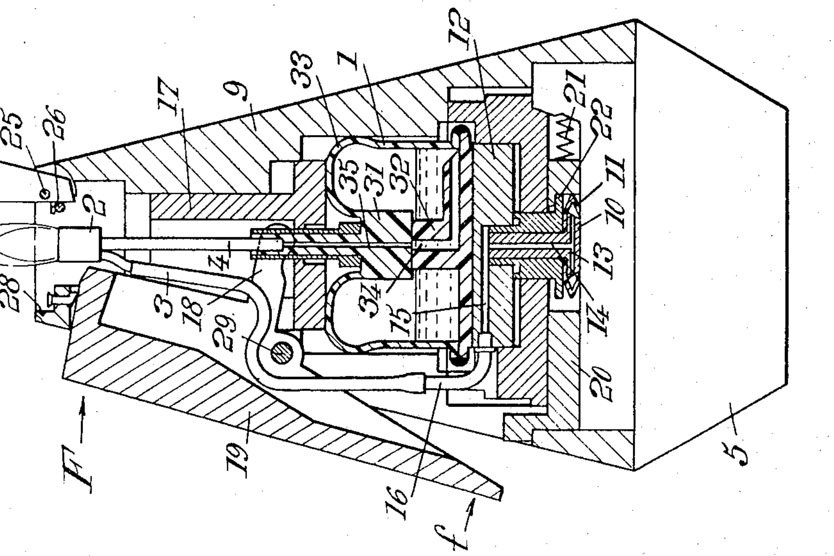

Fig. 1.

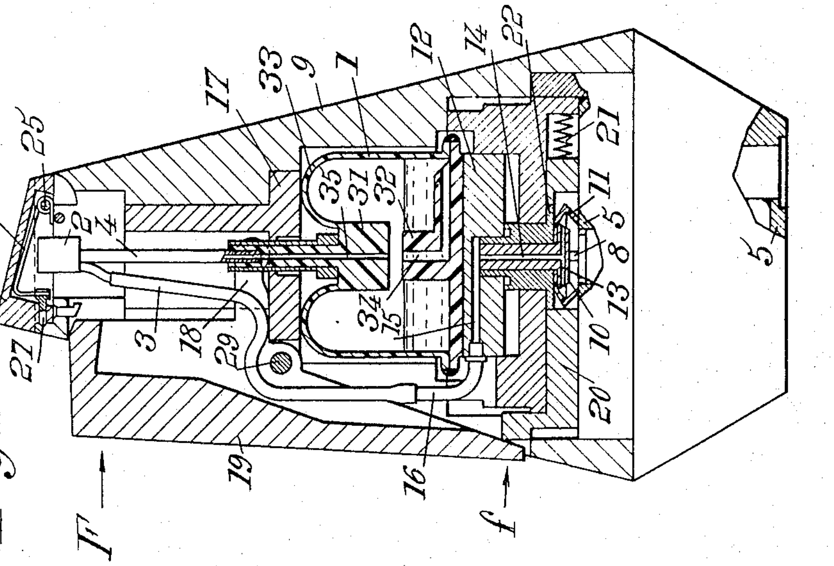

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Fig.3.

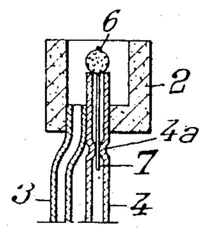


Fig.4.

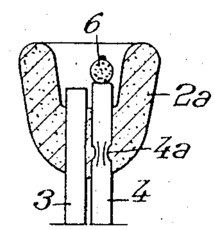


Fig.5.

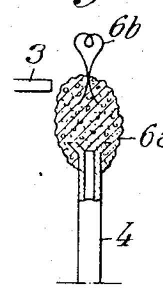


Fig.6.

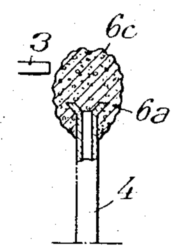


Fig.7.

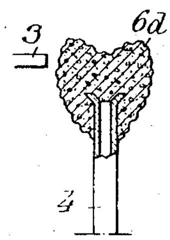


Fig.8.

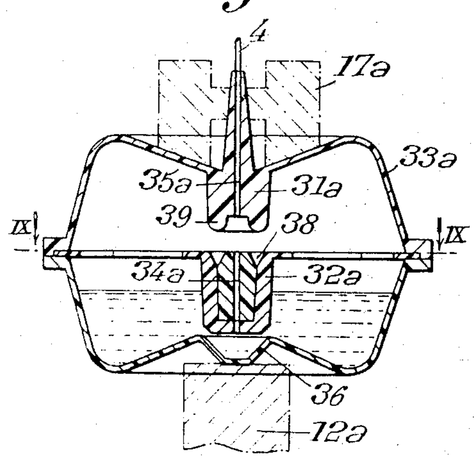
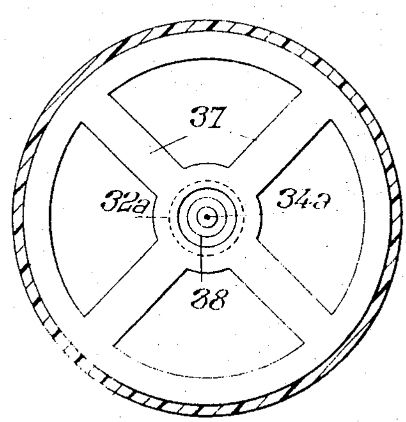


Fig.9.



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FLINTLESS GAS-FUELED LIGHTER

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14 Claims. (Cl. 67—7)

This invention relates to the field of lighters and more particularly to lighters of the gas-fueled type.

Workers in the field of gaseous fuel are known to have attempted to induce combustion in certain types of gas, such as the types normally supplied by municipal gas companies, which types have a large percentage of hydrogen, by simply putting them in the presence of a platinum-based catalyst. However, most combustible gases, in particular methane, butane, propane, etc., if they oxidize at all in the presence of such a catalyst, lead to slow combustion and cannot reach a temperature sufficient to generate a flame.

The present invention is mainly concerned with eliminating this shortcoming by the provision of a gas-fueled lighter in combination with a supply of a peroxide and a catalyst capable of decomposing exothermly the peroxide and of igniting the gaseous fuel, as well as with means for conducting to the catalyst both a flow of said gaseous fuel and a sufficient quantity of the peroxide to assure the ignition of the gas.

It is another object of this invention to eliminate the need for spark producing means in a cigarette lighter.

A further object of this invention is to produce a lighter which functions uniquely through chemical action.

Ignition is thus assured, according to the principles of this invention, by the exothermic decomposition of the peroxide on the catalyst and by the favourable presence of monatomic oxygen produced by this decomposition. This procedure has been found to be able to ignite gaseous fuels, with each ignition requiring only a small quantity of peroxide.

The peroxide used in the embodiments of the present invention is preferably hydrogen peroxide in a sufficiently pure state to be stable and in a concentration greater than 65%, preferably superior to 90% and even more preferably in the vicinity of 100%.

For the catalyst it has been found preferable to use a mass of platinum or of palladium, alone or in combination, or one or both of them in association with silver, the catalytic mass being preferably used in its activated form.

These and other useful embodiments of the present invention will be pointed out in the following description and in the annexed claims, and illustrated in the accompanying drawings.

FIG. 1 shows a longitudinal cross sectional view of a first embodiment of a gas fueled lighter of the present invention in its closed position;

FIG. 2 shows the same view of the lighter in its operating condition;

FIGS. 3 and 4 show longitudinal, cross sectional views of two forms of burner heads usable with the lighter of FIGS. 1 and 2;

FIGS. 5, 6 and 7 show longitudinal, cross sectional views of various forms, possible for the catalytic mass used with the present invention;

FIG. 8 shows a longitudinal, cross sectional view of a variation of the hydrogen peroxide reservoir of FIGS. 1 and 2; and

FIG. 9 is a plan view taken along the plane IX—IX of FIG. 8.

In accordance with the present invention, the lighter

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system comprises, as is shown in FIGS. 1 and 2: a supply of hydrogen peroxide contained, for example, in a reservoir **1**; a supply of gaseous fuel stored under pressure in a reservoir **5**; a catalyst mounted in a burner **2** in such a position as to assure the decomposition of the hydrogen peroxide, the raising of the temperature of the gas, and the ignition of the gaseous fuel; and means for bringing the gaseous fuel from reservoir **5**, through conduit **3**, into the burner, and for bringing a quantity of hydrogen peroxide sufficient to assure the ignition of the gas from reservoir **1**, through conduit **4**, into the burner, so that both fluids will come in contact with the catalyst.

The catalyst is preferably constituted by platinum in an activated form, i.e., prepared so as to present a large surface area for a given volume. This catalyst could thus be, as is shown in FIG. 3, in the form of a bead of spongy platinum **6** attached to a platinum wire **7**.

Still referring to FIG. 3, the wire **7** could be disposed in the upper portion of conduit **4**, this portion being constituted by a metallic tube which is crimped against the wire at *4a* so as to grip the wire and thus maintain the catalyst in position on top of conduit **4**. The crimp *4a* does not close off conduit **4** and therefore does not impede the passage of the hydrogen peroxide to bead **6**.

The outlet ends of conduits **3** and **4** are disposed within a small cup which serves as the burner **2**. This small cup is preferably made of a material which, on the one hand, is capable of absorbing any small excesses of liquid which might form at the time of the decomposition of the peroxide and, on the other hand, has heat insulating properties in order to reduce the heat dissipation from the catalyst to a minimum. The catalyst bead is made as small as possible so as to reduce its thermal inertia. To these ends, burner **2** is preferably made of a porous ceramic material.

FIG. 4 shows a structure identical with that of FIG. 3, with the exception that burner *2a* is given a slightly different configuration which tends to improve its heat insulating characteristics.

The catalyst **6** could also be made, in accordance with the present invention, of a combination of two appropriate catalysts, as has been discussed earlier.

FIG. 5 shows one such variation comprising a porous catalyst mass *6a*, having silver as a base, disposed around the outlet of conduit **4** and having a platinum wire *6b* extending from its upper portion, and sealed therein.

In the modification shown in FIG. 6, the silver-based porous mass *6a*, which surrounds the outlet of conduit **4**, is surmounted by a porous platinum-based mass *6c*.

According to still another modification, as shown in FIG. 7, a porous catalytical mass *6d* composed of several materials could be made in the form of a single mass covering the outlet end of conduit **4** and composed of more or less uniformly distributed, fine particules of, for example, platinum, palladium and silver.

It should be noted that in FIGS. 5 to 7, the outlet end of gas conduit **3** is shown at right angles to conduit **4** and directed towards the catalytical mass. This represents one possible modification of the arrangement shown in FIGS. 3 and 4 for improving the contact between the gaseous fuel and the catalyst.

Returning now to FIGS. 1 and 2, the lighter system which has a generally tubular shape, comprises means for causing the delivery of hydrogen peroxide, from reservoir **1** through conduit 4, and of gaseous fuel, from reservoir **5** through conduit **3**, to burner **2**, where they will come in contact with catalyst **6**. Peroxide reservoir **1** is made of a supple material, such as polyethylene, or of another material which will not interfere with the stability of the peroxide, such as polytetrofluoroethylene, sold under the trade name of Teflon.

Gas reservoir **5** is furnished with an outlet valve which will open when its pin **8** is pressed downward, so as to permit the escape of gas through an opening surrounding pin **8**. Gaseous fuel reservoirs functioning in this manner are well known in the art and in fact represent the most common type of refill element sold for gas cigarette lighters. Therefore, neither the structure of the reservoir nor of its outlet valve will be treated in detail here.

In order to effect a depression of pin **8**, there is disposed within lighter housing **9** a movable assembly which is mounted so as to be able to move vertically in the housing. This assembly comprises a head **10** which bears against the upper surface of pin **8** and which has channelings **13, 14** extending therethrough, for the passage of gas. Passages **13, 14** are connected to flexible conduit **3** by the intermediary of a canal **15**, arranged in movable support **12**, and pipe **16**. Head **10** is joined to an annular, resilient, flexible seal **11** which has its lower edge bearing against the upper surface of reservoir **5** in the region around pin **8** and the reservoir outlet opening so as to ensure that all of the gas leaving reservoir **5** will be directed into channeling **13**. Head **10** supports, and is affixed to, member **12**.

The movable assembly comprises, in addition to plate **12** and head **10**, reservoir **1** and a piston **17** which rests on reservoir **1** and which has a central opening through which conduit **4** communicates with reservoir **1**. Piston **17** is arranged to slide in housing **9** so as to compress reservoir **1**. The downward movement of piston **17** is produced by the pressure exerted on the upper surface thereof by a pair of forks **18** (only one of which appears in FIGS. 1 and 2, the other fork being in front of the plane of these figs.) located on opposite sides of the central opening thereof, these forks being rigidly joined, and preferably integral with, a lever **19** pivoted to housing **9** by pivot **29** which is situated just below the forks **18**.

When a force similar to that indicated by arrow F is applied to lever **19**, the lever is rotated, causing forks **18** to urge piston **17** downward. This movement of piston **17** urges reservoir **1**, plate **12** and head **10** in a downward direction.

The downward movement which units **17, 1, 12** and **10** experience together, i.e., that distance over which all of the elements move as one solid piece, is determined by the movement required to fully depress pin **8**, after which depression head **10** and support **12** will be restrained from descending further.

If, after this point is reached, lever **19** continues to cause forks **18** to move piston **17** downward, reservoir **1** will be compressed against the now stationary support **12**. This compression causes hydrogen peroxide to be forced upward through conduit **4** into burner **2**. This action will be described in detail at a later point herein.

When a sufficient quantity of peroxide has reached catalyst **6** to cause the ignition of the gaseous fuel, it is desirable to be able to stop the flow of peroxide while maintaining the flow of gas.

In order to achieve this result, means are provided for retaining head **10** in its depressed position, even after the force F has been removed from lever **19**. This arrangement thus permits pin **8** to be maintained in the position wherein it maintains the valve of reservoir **5** open.

One embodiment of such means is shown in the figures as comprising a horizontally movable bolt **20** loaded by a compressed spring **21** and furnished with a projection which, when head **10** reaches its lowest position, slides over a horizontal rim **22** of the head so as to maintain head **10** in this position even after the force F has been removed from lever **19** and the compression of reservoir **1** has ceased. This movement of bolt **20** is produced by a suitably calibrated spring **21**. When the compression force on reservoir **1** is removed, peroxide ceases to flow to burner **2**.

Thus, when lever **19** is released, head **10**, support **12** and the bottom of reservoir **1** remain in the position shown in FIG. 2, assuring the continued flow of gas from reservoir **5**, through conduit **3**, to burner **2**. At the same time, piston **17** will move slightly upward, under the reaction force created by the resilient material of reservoir **1**, until this reservoir has resumed the normal configuration shown in FIG. 1, breaking the contact between passages **34** and **35**, removing the pressure on the liquid in reservoir **1**, and thus terminating the flow of liquid through conduit **4**.

The flame **23** will continue to burn until the bolt **20** has been pushed back to its original position, as shown in FIG. 1, at which time rim **22** will be cleared and head **10**, support **12**, reservoir **1** and piston **17** will be urged back into their FIG. 1 positions by the reaction force of resilient, flexible seal **11**, thereby permitting pin **8** to also return to the position shown in FIG. 1, thus closing the outlet of reservoir **5** and terminating the flow of gaseous fuel to burner **2**.

One simple and effective means for urging bolt **20** back to its retracted position, as is shown in FIGS. 1 and 2, is constituted by forming the lower extremity of lever **19** so that it will abut against one end of bolt **20** in order that a force applied to the lever in the direction of the arrow *f* will urge bolt **20** back into its retracted position.

The top of the housing and the burner are preferably closed, for example, by a cap **24** pivotally mounted on housing **9** by means of a pivot **25** around which is mounted a hinge spring **26** which tends to urge the cap into the open position shown in FIG. 2. Cap **24** is maintained in its closed position by a bolt **27** having a rounded or tapered housing-engaging end which, when cap **24** is in its FIG. 1 position, is lightly, but firmly, held in a mating notch **28** in housing **9** by a suitably shaped end of hinge spring **26**.

In order to permit cap **24** to swing open, means are provided in housing **9** for urging bolt **27** out of seat **28** at the beginning of movement of lever **19** and thus permitting spring **26** to rotate the cap **24** into its open position. These means are constituted by a vertically movable piece mounted in housing **9** at a point just below bolt **27** and having a cammed lower surface which as shaped to slide on a similar camming surface formed on the leading portion of the upper edge of lever **19**. With this arrangement, lever **19**, at the beginning of its travel, will force the movable piece upward, causing bolt **27** to slide laterally out of its notch **28**, and thus permitting cap **24** to swing open. To close cap **24** after a light has been obtained, it is only necessary to manually close cap **24** so that bolt **27** mates with notch **28**, lever **19** and the movable piece having by this time returned to the positions shown in FIG. 1.

Returning now to the structure and operation of reservoir **1**, one embodiment thereof is shown in FIGS. 1 and 2 to have a configuration such that in its uncompressed state, its gaseous contents communicate with the ambient air, preferably through conduit **4**.

The reservoir is constructed so as to have, above its base, two coaxial tubular elements **31, 32** each of which is directed toward the interior of the reservoir, the former element being mounted on the top surface, and the latter being mounted on the bottom surface, of the reservoir. These two elements are normally maintained apart from each other by the resiliency of the supple envelope **33** which forms the reservoir. When the upper portion of this envelope is forced downward by the descent of piston **17**, these two elements are forced together, end-to-end, in such a way as to produce an air-tight seal between their surfaces.

The lower tubular element **32** is furnished with an axial passage **34** having a vertical portion and a lower horizontal portion which communicates between the lower end of the vertical portion and the bottom of the liquid-containing region of reservoir **1**. The upper tubular element **31** contains a vertical passage **35** extending completely therethrough and coaxial with the vertical portion of passage **34** so that when elements **31** and **32** are forced together, passages **34** and **35** are joined together to form a single passage. The upper portion of element **31** is connected to conduit **4** in such a way that the interior of this conduit communicates with passage **35**. Thus, when elements **31** and **32** are forced together, a continuous, relatively narrow passage is created between the liquid in reservoir **1** and the catalytical mass **6** at the top of conduit **4**.

Reservoir **1** is designed so that, even when it contains its maximum quantity of peroxide, this liquid can not pass out of reservoir **1**, even if the device is inverted, when the reservoir is in its normal, uncompressed configuration. This safety feature is obtained by such a limitation of the maximum peroxide contents in reservoir **1** and by such a form of said reservoir **1** that the peroxide can never flow over the lower surface of element **31**, regardless of the position of the assembly. The above-noted limitation of the quantity of liquid requires that, with the apparatus upright, this liquid must not extend above the upper surface of element **32**. One of the advantages of this limitation is that no liquid will be present to impede the formation of a good contact between elements **31** and **32**.

When piston **17** begins to compress the reservoir thus established, element **35** begins to move downward, but passage **35** continues to permit the air in reservoir **1** to communicate with the ambient air until such time as elements **34** and **35** are tightly pressed together to form the above-described single passage (FIG. 2). Thus, no pressure is exerted on the peroxide until this connection has been achieved.

When the connection has been formed, the air in reservoir **1** is sealed off from passage **35**. The continued compression of reservoir **1** then causes the air trapped therein to exert a pressure on the peroxide, causing the latter to be forced upward in the passage composed of passages **34** and **35** and conduit **4**. Because of the small internal diameter of conduit **4**, only a relatively small added compression is required to force a sufficient quantity of liquid up to catalytic mass **6**.

When the release of lever **19** causes the compression force on reservoir **1** to be removed, the resiliency of envelope **33** causes the reservoir to return to its normal position (FIG. 1) in which elements **31** and **32** are once again separated from one another, thus breaking the connection between the peroxide mass and passage **34**. It thus results that the interior of reservoir **1** is once again in communication with the external environment so that all danger of a buildup of pressure in the reservoir due to any unexpected decomposition of the peroxide is eliminated.

The structure of the reservoir of FIG. 1 permits an undetermined quantity of fluid to flow because a flow will continue as long as the envelope **33** continues to experience a decreasing volume. While such a structure functions satisfactorily, it has been found more desirable to utilize a reservoir structure which permits a predetermined quantity of peroxide to be delivered to the catalyst each time the lighter is used.

One variation of such a structure is shown in FIGS. 8 and 9 and may be substituted directly in the assembly of FIGS. 1 and 2, or may be used in a modified lighter from which locking mechanism **20** has been eliminated. This simplification is made possible because, due to the fact that each manipulation of the lighter will cause only a predetermined quantity of liquid to flow, the flow of gas may be maintained by a continued pressure on the lighter actuating means and the flame will be extinguished only by the release of these actuating means. Such actuating means may be constituted by lever **19**, or by any appropriately arranged lever, button, or handle.

The modified peroxide reservoir of FIG. 8 has a resilient, flexible envelope **33*a*** having at the center of its lower surface a small cavity **36** which forms a basin for holding a fixed quantity of liquid. Above basin **36** is disposed a tubular element **32*a*** containing an axially disposed vertical passage **34*a***. Element **32*a*** is suspended in the reservoir by means of a series of spokes **37** which are fastened to a ring which is, in turn, held between the two hermetically sealed halves making up envelope **33*a***.

The position and preferred shapes of a modified piston **17*a*** and support **12*a*** are shown in dotted lines in FIG. 8.

A second tubular element **31*a***, aligned with element **32*a*** and having a vertical passage **35*a*** in alignment with passages **34*a*** is arranged in the upper surface of envelope **33*a***. Passage **35*a*** is arranged to pass out of the envelope, thus placing the interior of reservoir **1** in communication with the external environment, through the intermediary of passage **4**. The lower end of element **31*a*** is furnished with a downwardly extending, annular sealing lip **39** which is shaped and positioned to fit into an upwardly opening annular notch **38** cut in the upper surface of element **32*a***, this latter surface being disposed approximately midway between the top and bottom of envelope **33*a***.

When such a structure is compressed by the downward movement of piston **17*a***, the upper tubular element descends until lip **39** rests in notch **38** and element **32*a*** moves downward, causing a deformation of spokes **37**, until contacting the walls of basin **36**.

After the lower edge of element **32*a*** makes contact with the walls of basin **36** and the lip **39** makes contact with notch **38**, all in an impermeable manner, the continued movement of piston **17*a*** forces element **32*a*** further down into basin **36**. The liquid in this basin, having nowhere else to go, is forced upward through passages **34*a*, 35*a*** and **4** to catalyst mass **6**. This flow continues until element **32*a*** reaches the end of its travel, at which time it has flattened basin **36** and the surface thereof is flat against the bottom-surface of element **32*a***. Elements **31*a*** and **32*a*** now form a solid, semi-rigid column so that the downward force of piston **17*a*** may be maintained in order to cause support **12*a*** and head **10** to maintain the valve of reservoir **5** open. Since no further peroxide can flow, this downward force may be maintained as long as desired without creating the possibility of an undue loss of peroxide.

When the downward pressure on piston **17*a*** is released, the envelope **33*a*** returns to its original shape with elements **31*a*** and **32*a*** separated, element **32*a*** separated from basin **36**, basin **36** in its original shape and filled with a new charge of liquid, and the interior of envelope **33*a*** in contact with the exterior through passage **35*a***. This release of pressure also permits members **10** and **12*a*** to rise, causing the outlet of reservoir **5** to be closed.

In a non-illustrated variation of the structure of FIG. 8, the lower surface of envelope **33*a*** is made flat and the lower surface of element **32*a*** is equipped with a downwardly opening, flexible, annular seal similar in structure to the seal **11** of FIGS. 1 and 2. With this arrangement, the device would function by pressing down on the top of envelope **33*a*** so as to cause the seal to come in contact with the envelope base, with the result that a given mass of liquid will be trapped within the seal. The continued compression of the envelope causes this seal to be collapsed, forcing this mass of liquid upwardly through passages **34*a*, 35*a*** and **4**.

Whichever form is used for reservoir **1**, it is preferred that the reservoir be filled with a quantity of peroxide which will last about as long as the gas in reservoir **5** so that both supplies can be refilled or replaced at the same time.

While a few illustrative embodiments have been shown and described herein, it should be understood that many variations could occur to us without departing from the spirit of the present invention and that the coverage thereof should therefore be limited only by the scope of the appended claims.

What we claim is:

1. A lighting device for use with a source of combustible gas, comprising:

(a) casing means having an interior cavity;
(b) a source of peroxide disposed in said cavity;
(c) a catalytical mass for exothermically decomposing said peroxide, said mass being supported in a position where it can be in communication with the region outside said casing;
(d) conduit means connected between said source and said catalytical mass for conducting said peroxide into contact with said mass; and
(e) actuating means mounted on said casing for inducing a flow of peroxide through said conduit means.

2. A lighting device as recited in claim 1 wherein said catalytical mass comprises a body of spongy platinum in its activated state.

3. A lighting device as recited in claim 1 wherein said source of peroxide contains stable hydrogen peroxide in a concentration of greater than 65%.

4. A device as recited in claim 1 further comprising a burner element fastened to said casing, said burner element being in the form of a cup and being made of a material which is porous, heat-insulating and fire-resistant, wherein said catalytical mass is disposed within the cup formed by said burner.

5. A device as recited in claim 4 wherein said conduit means deliver said peroxide into the cup formed by said burner element.

6. A device as recited in claim 1, further comprising a source of combustible gas, and wherein said conduit means comprises: a first tubing having an inlet end connected to said source of peroxide and an outlet end in contact with said catalytical mass; and a second tubing having an inlet end connected to said source of combustible gas and an outlet end located in the vicinity of said catalytical mass.

7. A device as recited in claim 6 wherein said actuating means comprises a force applying element, and wherein said source of peroxide and said source of gas are positioned so that a single movement of said force applying element will simultaneously permit the flow of gas through said second tubing and force a quantity of peroxide through said first tubing.

8. A device as recited in claim 7 wherein said source of peroxide comprises means which permit only a predetermined quantity of peroxide to be forced out of said source for each movement of said force applying element.

9. A device as recited in claim 6 wherein said outlet end of said first tubing consists of a rigid pipe in the outlet end of which said catalytical mass is fastened.

10. A device as recited in claim 6 wherein said source of peroxide comprises an envelope of flexible, resilient material and a quantity of peroxide partially filling the region enclosed by said envelope.

11. A device as recited in claim 10, wherein said envelope comprises a first protrusion extending from the upper surface of said envelope towards the interior of the region enclosed thereby, said protrusion having an axial passage therethrough and being connected to said first tubing so that said axial passage forms a continuous channel with said first tubing and forms a means of communication between said first tubing and the region enclosed by said envelope.

12. A device as recited in claim 11, wherein said envelope further comprises a second protrusion extending from the bottom of said envelope towards said first protrusion and having at least one axial passage in alignment with said passage in said first protrusion and in communication with said quantity of peroxide.

13. A device as recited in claim 12, wherein said actuating means comprises means for compressing said flexible envelope so as to first move said two protrusions into contact with one another in such a way that an impermeable joint will be formed therebetween and their respective axial passages will be in communication with one another, and so as to then force peroxide through said passages, into said first tubing and into contact with said catalytical mass.

14. A source of peroxide for a gas lighting device, comprising: a peroxide storing envelope made of a flexible, resilient material and having an opening therein for the outlet of said peroxide; a tubular protrusion disposed in said envelope and having an axial passage aligned with said opening; and a cavity disposed within said envelope in communication with the peroxide containing region thereof and in alignment with said passage of said protrusion, said cavity being dimensioned to hold a predetermined quantity of peroxide, whereby when said envelope is compressed in a direction parallel to said axial passage, the peroxide in said cavity will be isolated from the rest of the peroxide in said envelope and will be subjected to a pressure urging it through said axial passage and through said opening in said envelope.

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