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T. H. FISHER

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PORTABLE LIGHTING DEVICE AND FUEL THEREFOR

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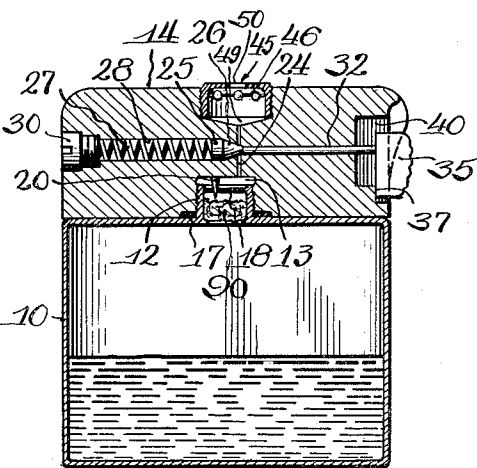


Fig. 1

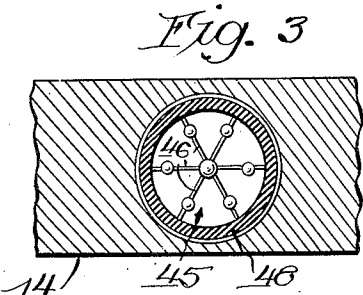
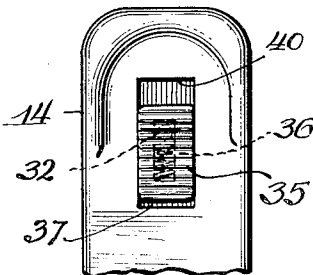
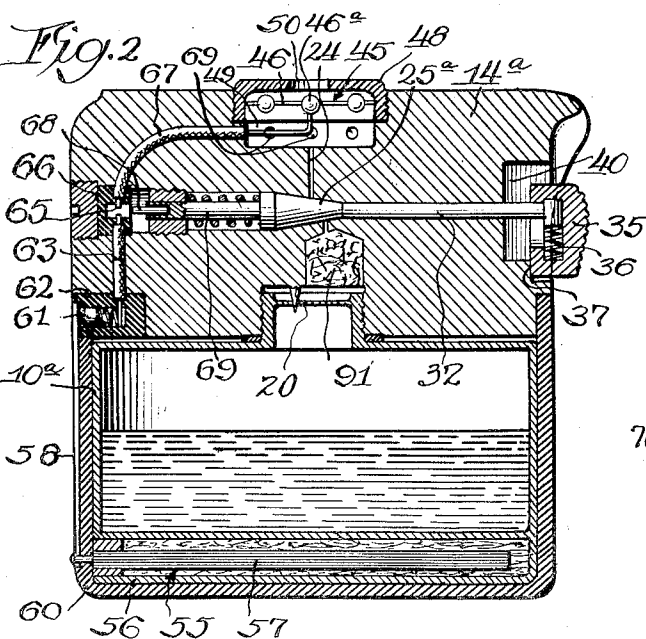


Fig. 5

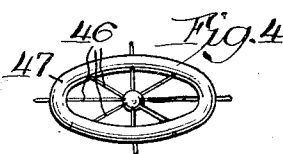
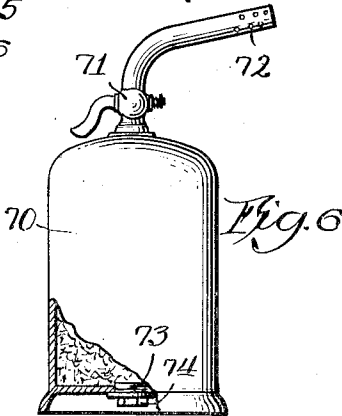


Fig. 6

Witness:

Chas. P. Toursh.

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UNITED STATES PATENT OFFICE

THOMAS H. FISHER, OF CHICAGO, ILLINOIS

PORTABLE LIGHTING DEVICE AND FUEL THEREFOR

Application filed January 24, 1927. Serial No. 163,116.

This invention relates to improvements in portable lighting devices, and fuel for the same.

The principal object of the invention is to provide a new and improved form of lighting device including a fuel which may be readily handled under pressure in suitable containers of relatively small volume and which may be released under pressure so as to be ignited either by catalytic agents, heated wire, or other well known forms of ignition devices.

My invention is especially applicable to lighting devices of the cigarette lighter type commonly carried in the pocket, although as will hereinafter appear, it is capable of much wider application in other forms of lighters.

Among the principal requirements of cigarette lighters and similar portable devices is a suitable fuel of sufficient quantity to last a reasonable time without requiring refilling. Most of the lighters of this type now in use are of the wick type using alcohol or similar liquid fuel, and ignited by spark from a cerium lighter, or in some cases by means of a catalyzer. These lighters, however, are more or less uncertain in operation, require frequent refilling, the flame is limited in size and is easily extinguishable. It has also been proposed to utilize certain inflammable gases under pressure especially gases such as hydrogen which may be ignited by catalyzers, but the advantage in ease of ignition and superior burning qualities is offset by the enormous pressures required in providing a sufficient quantity of fuel in a relatively small volume, and making it difficult to control the greatly varying pressures as the fuel is gradually exhausted. The use of such inflammable gases has therefore been considered impractical for portable lighters of this character.

I have discovered that there is a certain class of inflammable gases which combines the advantages of a readily ignitable gas flame and the capability of being compressed into liquid form and maintained therein under low pressures and at ordinary temperatures, whereby a single filling of fuel will last much longer than any of the heretofore mentioned fuels. Such low boiling liquids

of which ethylene oxide is an example may therefore be utilized in liquid form in a container of relatively small dimensions and may be released under relatively low pressures, maintained substantially constant as long as the supply of fuel lasts. I have found, further, that certain preferred materials of the class described, function better when mixed with a volatile liquid such as methyl alcohol, in which case the vapor of the latter is found to pass off with the vapor from the low-boiling liquid to produce a gaseous mixture which may be ignited by ordinary platinum or palladium catalyzers.

The class of low-boiling inflammable liquids, including ethylene oxide, as above described, are also readily ignited by a cerium lighter, electric spark or heated wire, and furthermore, when the catalyzer is used, the action is rendered more positive by passing a small current through the catalyzing agent while the latter is exposed to the flow of gas. Accordingly, I have devised certain forms of containers especially suited for use with the class of low-boiling inflammable liquids above described, as will hereinafter more fully appear in connection with the accompanying drawing.

In the drawing:

Figure 1 is a view in vertical cross section of one form of lighter constructed in accordance with my invention.

Figure 2 is a view in vertical cross section of a modified form of lighter including an auxiliary electric cell and circuit, but drawn to a somewhat larger scale than Figure 1.

Figure 3 is a detail view in horizontal cross section showing the arrangement of the catalyzer wires shown in Figures 1 and 2.

Figure 4 is a view in perspective of a modified arrangement of catalyzer wires.

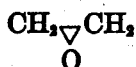
Figure 5 is a fragmentary side view of the lighter in Figures 1 or 2, showing details of the valve locking mechanism.

Figure 6 is a view of a modified form of lighting device consisting of a torch, drawn to a smaller scale than the preceding figures.

Referring first to the novel type of fuels for which the several forms of lighting devices illustrated in the drawing are especially

designed, it has been suggested at the outset that superior flame and ignition qualities might be expected from inflammable gases of which hydrogen is an outstanding example, were it not for the very large pressures necessary for compressing any considerable amount of gas in a relatively small volume. With reference to hydrogen, I have demonstrated that 90 cubic centimeters of hydrogen under a pressure of 150 pounds per square inch, burns with a small flame for only two minutes. Obviously to obtain sufficient hydrogen in a pocket-size lighter of much smaller capacity, considerably higher pressures would be necessary. Commercial acetylene (C_2H_2) dissolved in acetone has also been widely used for portable lamps, giving better results than compressed acetylene itself. Even this form of fuel, however, is not satisfactory for cigarette lighters on account of the limited amount of fuel which may be thus provided, and furthermore on account of the nature of the products of combustion thereof, which include the well-known disagreeable odor.

I find that there is a certain restricted class of combustible organic compounds which when properly prepared and controlled overcome the several disadvantages above mentioned. A preferred form is ethylene oxide,



of the alkylene oxide series which at ordinary temperature is a gas, but which is capable of being liquefied by moderate pressure (approximately one atmosphere) and boiling at approximately 54° F. (below ordinary room temperatures), and which may be readily ignited by a spark from a cerium lighter or other means of generating heat.

The superiority of ethylene oxide as a fuel for purposes contemplated, may be seen by comparison with compressed hydrogen above mentioned, in which 90 cubic centimeters under pressure of 150 pounds per square inch burns with a small flame for only two minutes. Four cubic centimeters of ethylene oxide will burn with a flame one-fourth to one-half inch long for forty minutes. The flame is luminous, difficult to blow out, and has no detectable odor nor toxic products of combustion. Furthermore, ethylene oxide is stable and has practically no deleterious effect on ordinary metals, such as copper, iron, zinc or the like, which may ordinarily be used for containers. It is easily prepared in large quantities as a by-product of petroleum, but heretofore its uses have been so limited that it has been generally considered as a laboratory curiosity.

Other organic compounds having substantially the same desirable properties comprises

the low-boiling liquids falling in the following series:

Cyclane (of which cyclopropane is the best example).

Ethylene (of which propylene is the best example).

Methane (of which butane is the best example).

Ether (of which methyl ether is the best example).

Acetylene.

There are also certain members of other series having substantially similar characteristics, but which are not so well suited for use in a lighter on account of the difficulty in preparing or handling them:

Alkyl nitrites (including ethyl nitrite).

Aldehydes, (including acetaldehyde).

Amines, (including methylamine, dimethylamine, trimethylamine and ethylamine).

By the term "moderate pressures," as applied to liquefying the above compounds, I mean pressures varying from approximately 15 pounds or less per square inch (as required for ethylene oxide) up to approximately 150 pounds per square inch, which pressures can be conveniently handled and controlled in portable lighters, or even as high as 500 pounds per square inch, where special containers may be provided.

I have found further, that the fuel properties of ethylene oxide and like compounds controlled under moderate pressures as above described, may be improved by mixing methanol (CH_3OH), or methyl alcohol therewith. It is found that methanol mixes readily with ethylene oxide in liquid form in wide proportions, but that a mixture of approximately five parts ethylene oxide and one part methanol provides a preferred fuel for the purpose herein contemplated, the vapor from methanol passing off with the ethylene oxide, to form a readily combustible gas. Excessive amount of methanol up to equal proportions of ethylene oxide may also be utilized without greatly affecting the passing off of the ethylene oxide, but in this case, large proportions of the methanol will remain as a residue.

This gaseous mixture of methanol and ethylene oxide is readily ignited by a platinum catalyzer of commercial form, including platinum sponge and wires, when the catalyzer is reasonably active. Action of the catalytic agent, however, may be assured by heating, as by an electric current. The mixture also readily ignites by ordinary cerium lighter, electrically heated wire or electric spark and burns with an intense flame, the size of which may be controlled by any suitable valve means. The pressure within the container is quite low, probably not exceeding 15 pounds per square inch and is maintained uniformly, regardless of the amount

of fuel in the container, on account of the fact that the ethylene oxide is maintained in liquid form by this relatively low pressure generated in the container.

Referring now to details shown in the drawing, a preferred form of container and igniting means consists of a separable metallic shell 10, in the form shown, this shell being relatively flat to conform to the usual shape of pocket lighters, and provided with a threaded neck 12 at its upper end detachably connected by screwing into a socket 13 formed in the valve head or holder 14. Suitable gas-tight packing means are provided, herein consisting of a washer 17 interposed between the base of the threaded neck and the support, as shown.

It will be understood that the class of gases herein contemplated for fuel, are preferably maintained under pressure in a sealed container. Accordingly, I provide sealing means for the container 10, herein consisting of a frangible partition 18 extending across the neck of the container. In order to release the gas when it is initially inserted in the holder, I provide a suitable puncturing device, herein shown in the form of a projection 20 at the upper end of the threaded socket in which the container is screwed and in position to puncture the frangible partition when the container is screwed into position.

It will thus be seen that when the container is punctured, the gas is allowed to escape into the upper end of the socket and from thence through suitable valve means provided for controlling the flow of gas. A preferred form of valve means for the above purpose, is shown in Figure 1 in which a duct 24 leading from the socket 13 extends upwardly and is controlled by a valve member 25 of conical shape disposed for movement transversely of the duct and fitting in a correspondingly shaped valve seat 26. The valve member 25 is normally maintained in closed position by spring 27 in bore 28. Said bore is closed by screw 30.

The valve member 25 is controlled by plunger 32 extending to one side of the head 14 and preferably in alignment with the bore 28, as shown. Manual control means are provided for depressing the plunger, in the form shown consisting of a safety catch device including a finger piece 35, mounted for lateral sliding movement on the outer end of plunger 32. A spring 36 in said finger piece normally holds the finger piece in a position eccentric of the plunger 32, as shown in Figures 2 and 3, in which position the lower edge of the finger piece is engaged with a locking shoulder 37. Pressure of the finger piece upwardly against tension of spring 36 permits the finger piece to slide out of engagement with shoulder 37, and to register with a depression or socket 40, in which position it may then

be depressed to open the valve 25. The finger piece returns automatically to locked position as soon as pressure is released, since the spring 28 serves to push the finger piece outwardly until the lower edge of the finger piece passes shoulder 37, in which position the spring 36 in said finger piece forces the latter downwardly into the locked position shown in Figures 1, 2 and 5.

In the form of lighter shown in Figures 1, 2 and 3, a catalyzer 45 is provided for lighting the gas as it is released from the container. The catalyzer consists of a plurality of platinum wires 46, 46, extending radially from a central point to form a web, and preferably having balls of platinum sponge carried thereon. In the form shown in Figure 3, one ball is disposed at the center of the web, and others are disposed on each of the wires 46 intermediate their ends. The entire catalyzer web is mounted in a socket 49 at the mouth of the discharge passage 24, said thimble having an opening 50 forming the discharge passage for the ignited gases.

In a modified form of catalyzer shown in Figure 4, the radiating wires 46, 46, are connected to a ring 47 formed of platinum sponge or similar active agent commonly utilized with platinum wire catalyzers, but here forming a support for the web which may be mounted in the thimble 48 and extending across the gas discharge opening in the same manner as shown in Figures 1 and 4.

As heretofore suggested in connection with certain forms of fuels, it may be sometimes desirable to assist the action of the catalyzer by warming it slightly. In the modified form of lighter shown in Figure 2, means are provided for passing a small electric current through the catalyzer each time the gas valve is opened. For this purpose, I provide a small battery 55, herein shown as an integral part, and extending along the bottom of the removable container 10^a, and consisting of a single electric cell of the dry type, including a negative electrode 56 integral with the container bottom, and a positive electrode 57 extending from one end thereof, the space between the electrodes being filled with any suitable electrolytic agent well known to the art.

The positive electrode 57 is connected by contact with a conductor strip 58 formed along the outer side of the non-conducting cover 60. The entire cover 60 is detachably connected to the head 14^a, and when so connected as shown in Figure 2, the upper end of the conductor 59 engages a spring pressed contact 61 carried in the insulator piece 62. A wire 63 leads from the contact 61 to a switch gap 65 in the insulator piece 66, and from thence an insulated wire 67 leads upwardly and is connected to the center 46^a of the catalyzer web 45. The electric circuit is closed each time the valve is opened by move-

ment of an insulated pin 68 carried on the end of a spindle 69 on valve member 25a, said pin serving to close the switch gap 65. The circuit is completed through thimble 48, body 14a and casing 10a.

It will be observed that the cell 55 is of simplest form and being integral with the container casing 10a is renewable with the latter. It is manifest, however, that a separate battery may be provided, if desired. Furthermore the current from the battery may, if desired, be used to heat ordinary resistance wires, or jump a spark gap, disposed in place of the catalyzer, and thus ignite the gas directly.

The thimble 48 containing the catalyzing agent is also preferably detachable from the body of the holder, as shown, so as to permit ready replacement thereof.

In the modified form shown in Figure 2, holes 69, 69 extend from the sides of the support 14a to permit ingress of air beneath the thimble to aid in the combustion of the gases.

The fuel may be supplied either in free-flowing liquid form as shown in Figures 1 and 2, or absorbed in a suitable absorbent as indicated in Figure 6. When used without an absorbent, I find it preferable to provide suitable restraining means to prevent escape of free liquid, especially when the device is inverted. This restraining means consists of any suitable absorbent or unglazed porcelain, and may be disposed either in the neck of the fuel container, as indicated at 90 in Figure 1, or in the discharge passage, as indicated at 91 in Figure 2.

Figure 6 shows a portable lighter which may be of larger dimensions than a cigarette lighter, and consisting of a container 70, provided with a simple valve cock 71 and a nozzle 72 of the blow-torch type. In this case the fuel may be poured or otherwise introduced in the tapped hole 73 and secured therein by plug 74. The particular class of low boiling liquids herein suggested for fuel purposes may, of course, be readily poured at temperatures below their normal boiling points. At higher temperatures the fuel would preferably be inserted in the container under pressure.

I claim:

1. A fuel for lighting devices comprising a mixture of liquefied ethylene oxide and methanol mixed with said liquefied ethylene oxide in less than equal proportions of said methanol.

2. A fuel for lighting devices consisting of a mixture of approximately five parts liquid ethylene oxide and one part methanol.

3. A fuel for lighting devices consisting of a mixture of liquid ethylene oxide and methanol, the latter comprising one sixth or less of the total volume.

4. A lighting device comprising a container, and ethylene oxide maintained in liq-

uid form therein under its own vapor pressure and means for releasing said ethylene oxide therefrom in gaseous form.

Signed at Chicago, Ill., this 19th day of January 1927.

THOMAS H. FISHER.