ELECTRIC GAS LIGHTER WITH A MANUALLY OPERABLE PIEZOELECTRIC IGNITION DEVICE

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ABSTRACT OF THE DISCLOSURE

A liquefied gas-fueled smoking lighter utilizing piezoelectric elements as high voltage generating means comprising a casing and a liquefied gas fuel reservoir disposed within said casing including a fuel spouting valve and a fuel injection valve which are in a fuel transfer relation to each other. A high voltage generating device disposed outside of the fuel reservoir between the fuel valves and including a pair of piezoelectric elements therein; a pair of electrodes connected to said piezoelectric elements for actuating the device; and an actuating device for said impact device.

BACKGROUND OF THE INVENTION

Smoking lighters utilizing piezoelectric elements as high voltage generating means have been known in the art and some of them have been already on the market. However, one of the prior art piezoelectric element-type smoking lighters uses a plurality of combined levers in order to apply stress on piezoelectric elements and as a result of such an arrangement, this type of prior art piezoelectric element-type smoking lighter has disadvantages that the construction of the lighter is necessarily complicated and the size of the device is also inevitably large.

Another form of prior art piezoelectric element-type smoking lighter is so constructed that an impact device for striking piezoelectric elements or applying stress on the same and an actuating member for operating the impact device may move along their separate paths which require separate spaces for providing such paths in the lighter and as a result, such a construction of a piezoelectric element utilizing smoking lighter is not suitable for small size smoking lighters such as pocket-type smoking lighters.

As an improvement over the second-mentioned prior-art piezoelectric element-type smoking lighter, a quite small size piezoelectric element-type smoking lighter has been proposed and in which an impact device for applying stress on piezoelectric elements and an actuating member for operating the impact device are aligned with each other in a plane within the casing of the lighter.

Although the construction of the last-mentioned improved piezoelectric element-type smoking lighter may be considered suitable for a small size lighter when viewed from a standpoint of construction and arrangement alone, in this type of smoking lighter, the storing of striking energy with which piezoelectric elements struck is solely effected by depressing a spring operatively connected to an actuating member which actuates an impact device in a linear direction and in order to strike the piezoelectric elements with the full of stored energy, the spring has to have a very high elasticity which requires the actuating member to be depressed with a corresponding degree of high force. Therefore, this type of smoking lighter can not be satisfactorily operated by a user who has a weak finger pressure and this has been a great drawback which impedes the popularization of piezoelectric element-type smoking lighters.

The present invention relates to improved smoking lighters, and more particularly to improved smoking lighters which utilize piezoelectric elements as high voltage generating means and the generated high voltage is used to ignite a flow of spouting liquefied gas fuel.

One object of the present invention is to provide a pocket-size smoking lighter utilizing piezoelectric elements as high voltage generating means which is simpler in construction and has a longer service life.

Another object of the present invention is to provide a pocket-size smoking lighter utilizing piezoelectric elements as high voltage generating means in which a piezoelectric element-striking member and an actuating member for operating an impact device including the striking member are adapted to rock in the same direction whereby the space required for these two members to move can be limited to a minimum.

A further object of the present invention is to provide a pocket-size smoking lighter utilizing piezoelectric elements as high voltage generating means in which a piezoelectric element-striking member and an actuating member which operates an impact device including the striking member are coaxially pivoted within the body or casing of the lighter and the striking member and actuating member are adapted to rock in the same direction requiring relatively small spaces for such rocking movement of the striking and actuating members in the casing whereby a pushing force applied upon the actuating member is added to the striking force which the striking member applies on the piezoelectric elements.

A still further object of the present invention is to provide a smoking lighter utilizing piezoelectric elements in which as high voltage generating means a force required for operating an actuating member which is adapted to operate an impact device may be reduced to a minimum value by making the distance between the impact device and the pivot point of the actuating member smaller than that between the above-mentioned pivot point and the pushing portion of the actuating member.

A still further object of the present invention is to provide a pocket-size smoking lighter utilizing piezoelectric elements as high voltage generating means which has a simplified construction and in which a pivotal actuating member adapted to pivot in the same direction as that of a piezoelectric element striking member is provided with a valve opening and closing portion and with a portion which is adapted to engage a striking energy storing spring.

A still further object of the present invention is to provide a pocket-size smoking lighter utilizing piezoelectric elements as high voltage generating means in which a piezoelectric element impact device and its associated devices are disposed within a chassis whilst a fuel reservoir and the above-mentioned chassis are integrally and positively secured to the body or casing of the lighter whereby a high and stable ignition efficiency can be maintained throughout its long service life.

A still further object of the present invention is to provide a smoking lighter utilizing piezoelectric elements as high voltage generating means which can attain the above-mentioned objects by extending the duration of spark discharge obtainable by piezoelectric elements which are subject to an impact force or energy by a striking member and by improving a discharge gap to be provided by electrodes.

The above and other objects and attendant advantages of the present invention will be more readily apparent to those skilled in the art from the following description when read in connection with the accompanying drawings.
3 BRIEF DESCRIPTION OF THE INVENTION

FIG. 1 is a vertical sectional view of a preferred form of liquefied gas-fueled smoking lighter utilizing piezo-electric elements as high voltage generating means according to the present invention; FIG. 3 is an enlarged fragmentary cross sectional view taken substantially along the line III—III of FIG. 2 and as seen in the arrow direction therein;

FIG. 4 is a vertical sectional view of a modified form of liquefied gas-fueled smoking lighter utilizing piezo-electric elements as high voltage generating means according to the present invention; and FIG. 5 is an enlarged fragmentary sectional view showing the relationship between an actuating member and a fuel spouting nozzle suitably employed in the smoking lighter shown in FIG. 4.

PREFERRED EMBODIMENTS OF THE INVENTION

The present invention will now be described referring to the accompanying drawings and especially to FIG. 1 thereof in which a first or preferred embodiment of the present invention is illustrated. As shown in FIG. 1, the smoking lighter generally comprises a vertical extending casing 1 in which a liquefied gas fuel reservoir or tank 2 is fixedly mounted. The fuel reservoir 2 has a first chamber 2' in which a liquefied gas fuel spouting valve device 3 having a nozzle 3a extending upwardly at the top of the valve device and communicating with the interior of the device is housed and a second chamber 2" in which a liquefied gas fuel injecting valve 4 is housed. The first and second chamber 2' and 2" are communicatively connected with each other in a fuel transfer relation therebetween by means of an intermediate connector member 5 having a through axially extending bore 6 extending between the two chambers 2' and 2" within the fuel reservoir 2. A valve manipulating member 7 is provided for opening and closing the fuel spouting valve device 3 and the valve manipulating member has one end portion provided with a bore (not shown) through which the nozzle 3a extends. The above-mentioned end portion of the valve manipulating member 7 surrounds the nozzle 3a, with the bore 3b of the nozzle 3a which is larger in diameter than that of the nozzle body 3a and is threaded on the upper end of the nozzle body. The other end of the valve manipulating member 7 extends inwardly to a position to be engaged by an actuating member of which description will be made hereinafter and the manipulating member is rockably supported at an intermediate point between the opposite ends by a transverse shaft 8 which serves as the fulcrum for the valve manipulating member 7 as the latter is moved for opening and closing the fuel valve device 3.

A pair of piezo-electric elements 9 and 10 are stationary mounted in a vertically aligned relation in a vertically extending hollow cylindrical insulative member 11 which is provided on the intermediate connecting member 5 between the chambers 2' and 2" of the fuel reservoir 2 outside of the latter. The pair of piezo-electric elements 9 and 10 are vertically aligned having the adjacent positive ends thereof facing to each other with a conductive metal plate 12 interposed therebetween. One or the left end of the conductive metal plate 12 (as seen in FIG. 1) extends through the adjacent wall of the cylindrical member and upwardly along the outside of the cylindrical member 11. An impact receiving cap 13 is secured to the upper end of the upper element 9 and the cap is adapted to receive an impact from an impact device which will be in detail described hereinafter. A metallic seat member 14 is disposed on the underside of the lower element 10 within the hollow cylindrical mem-

ber 11 and secured to the upper surface of the intermediate connector member 5. An anode 15 is supported by an insulative mounting member 16 which in turn is secured to the interior of the casing 1 by means of adhesive or fitting in the casing 1 at a point above and inwardly spaced from the spouting valve device 3. One of the upper end of the anode 15 extends through a lateral opening of the mounting member 16 into the outside of the member and the other or lower end of the anode extends downwardly to be connected to the upward extension of the above-mentioned conductive metal plate 12 by means of a resistor 17 disposed between the anode and metal plate. The portion of the anode 15 except for the exposed upper end portion is shielded by an insulative tube 18 which extends down from within the insulative cylindrical mounting member 16 into a position outside and below the mounting member and is adapted to electrically shield the above-mentioned portion of the anode 15 from other parts. Similarly, an insulative tube 19 electrically surrounds the extension of the conductive metal plate 12 and shields the same from other parts.

A cathode 20 is secured to and inwardly extends from the inside of one end wall of the casing 1 (the left-hand end wall as seen in FIG. 1) in a position confronting to the anode 15 and the cathode is electrically connected to the piezo-electric element 9. The anode 15 and the anode 15 are adapted to cooperate with each other to provide a discharge gap therebetween. A hollow spring-loaded sector-shaped actuating member 21 is provided in an opening at one end wall of the casing 1 (the right-hand end wall as seen in FIG. 1) and rotatably supported on a transverse shaft 22 passing through the opposite side walls of the casing 1 and secured at the opposite ends to the interior of the casing. A spring 23 is disposed on a transverse shaft 23' with one end anchored to the shaft 23' and the other end abutting against the underside of the actuating member 21 so as to normally urge the actuating member outwardly and outwardly through the end opening in the casing 1. Thus, portion of the actuating member 21 is normally disposed outside of the casing 1. A striking member 24 is pivotally supported on the transverse shaft 22 extending between the opposite side walls of the casing 1 and secured at the opposite ends to the interior of the casing. A spring 25 is disposed on the transverse shaft 22 with one end abutting against a laterally extending pin (not shown) on the striking member 24 and the other end secured to the interior of the hollow sector-shape actuating member 21. Therefore, the striking member 24 is adapted to pivot about the transverse shaft 22 toward and away from the above-mentioned impact receiving member 13 as the actuating member 21 is pushed or released. A downwardly extending stop piece 26 having a nose 26' at the lower end is pivotally supported on a transverse shaft 26' extending between the opposite side walls of the casing 1 and secured at its opposite ends to the interior of the casing and the stop piece is normally urged in the counter-clock direction as seen in FIG. 1 by the force of a spring 27 which is disposed on the transverse shaft 26' with one end anchored to the inside of the top wall of the casing 1 and the other end abutting against a laterally extending pin (not shown) on the stop piece 26. The engaging notch 24a at the tip end of the striking member 24 is adapted to abut against the nose 26' at the lower end of the stop piece 26 so the movement of the striking member 24 in the counter-clock direction is limited by the engagement between the engaging notches with the nose 26'. A flame spouting opening 29 is provided in the top wall of the casing 1 right above the valve device 3. Reference numeral 30 designates a bottom closure plate of the casing 1 and since the bottom plate has the conventional construction and does not constitute part of the present invention, detailed description thereof will not be made herein.

In operation, when the hollow sector-shape actuating member 21 is first manually pushed in the arrow direc-
tion (FIG. 1) against the force of the spring 23, the spring 25 having one end anchored to the inside of the actuating member 21 and the other end thereof engaging the striking member 24 is compressed so as to store the moving or pushing energy of the actuating member 21 in the spring 25. Thereafter, as the actuating member 21 is further pushed in the above arrow direction, the upper inner edge of the actuating member 21 engages and forces the stop piece 26 to pivot about the transverse pins 26a against the force of the spring 27 so as to disengage the nose 28 of the stop piece 26 from the now engaging notch 24a of the striking member 24. The striking member 24 is allowed to rapidly rock or descend in the counter-clock direction to strike against the impact receiving member 13 with a sharp blow. When the impact receiving member 13 is struck by the striking member 24 in the above manner, the piezo-electric elements 9 and 10 are distorted to generate a high voltage between the confronting positive ends of these elements. The thus generated high voltage is transmitted through the conductive metal plate 12 and resistor or insulating coupling 17 to the anode 18 which in turn cooperates with the opposing cathode 20 secured to the interior of the casing 1 and electrically connected to the piezo-electric elements 9 and 10 to provide sparks in the discharge gap therebetween. As the actuating member 21 is continuously pushed in the arrow direction until the striking member 24 disengages from the stop piece 26 as mentioned above, the lower portion of the actuating member is caused to abut against and depress the rear or other end of the valve manipulating member 7 in opposition to the force of the spring 23 in such a manner that the rear end of the manipulating member engaging the valve nozzle 3a may be raised up to open the valve 3 which in turn allows the liquefied fuel therein to spout under pressure through the nozzle 3a into the space including the discharge gap. The spouting fuel is ignited by the spark generated across the discharge gap in the manner mentioned above. The generation of the sparks and spouting of the fuel will be allowed to continue until the pushing force acting on the actuating member 21 is released and the parts are returned to their initial position, respectively. As the actuating member 21 moves back in the manner as mentioned above, the striking member 24 is also allowed to pivot about the transverse shaft 22 in the clockwise direction to the normal position in which the engaging notch 24a of the impact member 24 engages and is held in position by the nose 26 of the stop piece 26 and the valve manipulating member 7 is also released from the lower portion of the actuating member 21 to return to the normal position so as to cause the nozzle 3a to drop to close the valve device 3 whereby the spouting of the fuel and generation of the sparks will be discontinued.

Referring now to FIGS. 2 and 3 of the accompanying drawings, a modified second embodiment of the present invention is illustrated. As shown in these figures, the modified form of smoking lighter generally comprises a longitudinally extending casing 101. The interior of the casing 101 is divided into two chambers having different sizes by a bored vertical partition wall 134 and one or the smaller size chamber connected (the right-hand side as seen in FIG. 2) houses a liquefied gas fuel reservoir 102 having a fuel injecting valve 104 at one end or the right-hand end as seen in FIG. 2 and a fuel spouting valve 103 at the other or left-hand end extending into a bore or opening in the partition wall 134. The other or larger size chamber houses a chassis including a number of devices which will be described hereinafter. A fuel spouting valve 103 has a nozzle 103a connected to the extended tip end and the nozzle extends laterally in the horizontal direction within the larger size casing chamber. A valve manipulating member 107 is connected to the nozzle 103a and pivotally supported at 108 on the nozzle. The valve manipulating member 107 is adapted to be operated by an operating plate 107a which is pivoted on a transverse pin 108 and which is adapted to cooperate with an actuating member of which description will be made hereinafter. A high voltage generating device generally comprises a laterally extending insulative hollow cylindrical member 111 in which a pair of piezo-electric elements 109 and 110 are stationarily laterally aligned relation with the adjacent positive ends facing to each other with a conductive metal plate 112 interposed therebetween. An impact receiving cap 113 is secured to the outer or exposed end of the piezo-electric element 109 and a metallic seat member 114 is secured to the end of the other piezo-electric element 110 remote from the positive end thereof. The thus formed high voltage generating device is secured to the chassis 135. An anode 115 is supported by an insulative mounting member 116 which is in turn attached to or fit in the chassis 135 at the end of the larger size chamber remote from the end where the high voltage generating device is provided. The anode 115 is electrically connected through a resistor 117 to the above-mentioned conductive metal plate 112. The conductive metal plate 112 and anode 115 are electrically shielded by insulative tubes 118 and 119, respectively, from other parts. A cathode 120 is secured to the chassis 135 and electrically connected to the piezo-electric elements in a configuration relating to the transverse shaft 122 to provide a discharge gap therebetween. A heat-resisting and insulative nozzle rotating disc 133 is vertically supported at the end of the chassis by the anode and cathode 115 and 120 where the anode and cathode 115 and 120 having a substantial thickness are disposed in any suitable conventional means. The nozzle rotating disc 133 has a center opening (not shown) through which the tip end of a nozzle 103b extends upwardly from the lower edge of the disc, and a vertical flame spouting opening 137 having a substantial size of opening communicating at the lower end with the opening of the nozzle 103b. A crescent plate 132 is applied on one surface covering the lower portion of the nozzle rotating disc 133 and has a configuration corresponding to the lower end portion of the disc where the plate 132 is applied and a corresponding opening. A flexible cable 131 communicates between the fuel spouting valve nozzles 103a and 103b for a fuel transfer relation therebetween. A hollow sector shape actuating member 121 similar to the actuating member 21 in the first embodiment is pivoted on a transverse pin 122 which extends transversely and is fixedly secured to the opposite walls of the chassis 135. The sector shape actuating member 121 is received within an opening formed in the top wall of the casing at an intermediate point between the opposite ends thereof and is normally urged outwardly by means of a spring 123 one end of which is anchored to a laterally extending pin on the operating plate 107a while the other spring end is anchored to the transverse pin 122 on which the actuating member is pivoted. A striking member 124 is also pivoted at its upper end on the transverse pin 122 and is adapted to be pivoted about the pin 122 toward and away from the impact receiving cap 113 by the action of a spring 125 which is disposed on the transverse pin 122. One end of the spring 125 abuts against the striking member 124 and the other end abuts against a transverse pin 121a extending laterally and inwardly from the inner side of the actuating member 121. A stop piece 126 extends laterally between the opposite side walls of the chassis 135 and is pivotally supported on the above-mentioned transverse shaft 136. The stop piece 126 is subjected to the action of a spring 127. The stop piece 126 has a pair of arms 126a and 126b one of which or the arm 126a is adapted to engage a transverse pin 121b on the actuating member 121 whilst the other arm 126b is adapted to engage a transverse pin 124a extending from one side of the striking impact member 124. A transverse pin 138 extends between the opposite walls of the chassis 135 and serves as a limit means for the pivotal movement of the stop piece 126. Reference numeral 129 designates a...
flame spouting opening provided at the upper and left corner of the casing 101 (as seen in FIG. 2) and reference numeral 130 designates a bottom cover closure for sealingly closing the open bottom of the casing 101.

In operation, when the actuating member 121 is manually depressed down in the arrow direction as seen in FIG. 2 against the force of the spring 123, the spring 125 one end of which engages the transverse pin 121a is also compressed down while the striking member 124 which is engaged by the other end of the spring 125 and maintained in engagement with the stop piece 126 whereby the movement energy of the actuating member 121 is stored in the spring 125. As the actuating member 121 is further depressed down, the actuating member 121 pivots the arm 126a of the stop piece 126 by the transverse pin 121b and forces the arm 126b of the stop piece 126 from the pin 124a of the striking member 124 whereby the striking member 124 is permitted to rapidly pivot downwardly in the counter-clockwise direction to strike against the impact receiving cap 113. When the impact receiving cap 113 is struck by the striking member 124 in the above-mentioned manner, a high voltage develops between the opposite positive ends of the piezo-electric elements 190 and 110 and the thus developed high voltage is transmitted through the conductive metal plate 112 disposed between the opposing positive ends of the piezo-electric elements and the resistor 117 connected to the metal plate to the anode 115 whereupon sparks fly across the discharge gap defined between the anode 115 and the cathode plate 120 disposed in opposition to the anode and electrically connected to the piezo-electric elements secured to the chassis 135. The sparks flying across the discharge gap ignite the fuel which is spouting through the fuel spouting valve 103, the nozzle 103a, the flexible cable or tube 131 and nozzle 103b as the valve manipulating member 197 pivots in response to the operation of the operating plate 107a which in turn pivots in response to the pivotal movement of the actuating member 121 as the actuating member is further pushed down prior to the pivotal movement of the striking member 124. When it is desired to extinguish the blazing flame in the modified smoking lighter of FIGS. 2 and 3, as mentioned above in connection with the first embodiment of FIG. 1, the depressing force acting on the actuating member 121 is released whereupon the striking member 124 is allowed to return to its normal position. The striking member 124 in its engagement with the arm 126b of the stop piece 126 by the spring 125 various parts of the smoking lighter are ready for a next cycle of lighting operation. And in this modified embodiment of FIGS. 2 and 3, the disc 133 and overlapping plate 132 are adapted to pivot about the anode 115 and cathode 120 as the fulcrum by means of the overlapping member 132 by virtue of the elasticity of the flexible cable 131.

Accordingly, the flame which is to be obtained by the spouting fuel being ignited by the sparks may be optionally directed in either one of the directions indicated by B and B' in FIG. 2 depending upon the position of the disc 133. However, in either case, the distance between the nozzle 103b and the electrodes 115 and 120 will be maintained constant.

Next, a second modified embodiment of the present invention is shown in FIGS. 4 and 5 of the accompanying drawings. As seen in these figures, the modified smoking lighter 200 comprises a vertically extending casing 201 in which a liquefied gas fuel reservoir 202 and a chassis 235 the latter of which includes various devices that will be described hereinafter. The fuel reservoir 202 includes a fuel spouting valve 203 and a fuel injecting valve 204 therein. A valve manipulating plate 205 is pivotally mounted on the end of the nozzle 203a and 203b by the fuel spouting valve 203 and is adapted to rock like a lever upon a transverse shaft 208 as the fulcrum extending between the opposite side walls of the casing 201 and secured to the inner surfaces of the walls so as to open or close the fuel spouting valve 203. In order to prevent the nozzle 203a from rotating as the nozzle is moved upwardly and downwardly, the nozzle is provided at a point where the valve manipulating plate 207 engages it with a notch 208a. The high voltage generating device of this second modified smoking lighter comprises a vertically extending insulative hollow cylindrical member 211 and a pair of piezo-electric elements 209 and 210 vertically aligned within the cylindrical member with the opposite positive ends facing to each other with a conductive metal plate 212 interposed therebetween. An impact receiving member cap 213, which is adapted to receive the impact end of a striking member as will be described hereinafter, is secured to the top of the upper piezo-electric element 209 and a metallic seat plate 214 is positioned under the lower piezo-electric element 210. The thus formed high voltage generating device is secured to the above-mentioned chassis 235 in the conventional manner. The metallic seat plate 214 has an upwardly extending portion 214a surrounding the insulative cylindrical member 211 and the outer surface of the upper part of the upwardly extending portion is provided with a thread 214b and a set screw 241 is threaded onto the thread portion 214c. Referring to the impact receiving member cap 213 on the piezo-electric element 210, an impact receiving member 215 is held in an insulative electrode mounting member secured to or fit in the chassis 235 at a point adjacent to and above the right side of the fuel spouting valve 203 and electrically connected through a resistor 217 inserted within the insulative electrode mounting member 216 to the conductive metal plate 212. Insulative tubes 218 and 219 are disposed surrounding the intermediate portions of the anode 215 and conductive metal plate 212 so as to electrically shield the anode and conductive metal portions from other parts of the smoking lighter. The above-mentioned nozzle 203a is electrically connected to the piezo-electric elements 209 and 210 and positioned in a confronting relation to the anode 215 so as to provide a discharge gap therebetween. An actuating member 221 is pivotally supported on a transverse pin 222 which extends between the opposite side walls of the casing 201 and is secured to the opposite ends to the inner surfaces of the walls and urged outwardly by the action of a spring 223 which is disposed about a transverse pin 236. A striking member 224 which constitutes an impacting device is pivotally supported on the transverse pin 222 and is adapted to rock to and from the impact receiving member 235 secured to the top of the piezo-electric element 209 by the force of a spring 225 which abuts against the impacting member 224 while the other end abuts against a laterally extending pin 221a on the actuating member 221. A stop piece 226 is pivotally supported on a transverse shaft 236 which extends laterally of the chassis 235 and is subject to the action of a spring 227 which is disposed on the shaft 236. The stop piece 226 has a pair of arms 226a and 226b apart from each other at an angle and the arm 226a is adapted to engage the transverse pin 221b on the actuating member 221 while the other arm 226b is adapted to engage the pin 224a on the striking member 224 and has a L-shaped piece 225 at the thin end. A reference numeral 230 designates a bottom cover closing the open bottom of the casing 201. A threaded shaft 238 is threaded through the bottom cover 230 and a casing supporting plate 239 into the threaded bore 214c in the seat plate 214. The threaded shaft 238 serves to hold the fuel reservoir 202 and chassis 235 in position within the casing 201. A cushion 240 is disposed between the fuel reservoir 202 and chassis 235 and serves to fill up the free space between the fuel reservoir and chassis to prevent them from moving relatively to each other. The cushion 240 also serves to prevent the effects to be exerted upon the piezo-electric elements by the striking member 224 from being transmitted to the fuel reservoir so that the connection to the fuel reservoir may be effectively protected from any damage which will be otherwise inevitable.
In operation, when the actuating member 221 is manually pushed and pivoted in the arrow direction as seen in FIG. 4, the spring 225 one end of which abutting against the lateral pin 221a on the actuating member 221 is compressed and in this case, since the other end which is anchored to the striking member 224 maintains its engagement with the stop piece 226, the movement energy of the actuating member 221 is stored in the spring 225. As the actuating member 221 is further pivoted the actuating member forces the arm 226a on the stop piece 226 to pivot by means of the pin 221a on the actuating member 221 and therefore, the other arm 226b of the stop piece 226 separates from the pin 224a on the striking member 224 whereby the striking member 224 is allowed to rapidly pivot to strike against the impact receiving cap 223. Therefore, a high voltage is developed between the opposite positive ends of the piezo-electric elements 209 and 210 and the thus generated high voltage is transmitted through the conductive metal plate 212 and resistor 217 to the anode 215 whereupon sparks are struck out across the discharge gap between the anode 215 and nozzle 203a to ignite a flow of fuel spouting through the nozzle 203a of the fuel valve 203 and including a pair of the actuating member 221 engages and depresses the inner end of the manipulating plate 207 so as to raise the other or tip one of the manipulating plate prior to the pivotal movement of the impacting member 224.

When it is desired to extinguish the flame on the smoking lighter of FIG. 4 and 5, the manual force acting on the actuating member 221 is released, then the actuating member 221 is returned to the initial position illustrated in FIG. 4 by the action of the spring 223 and as a result the other devices or parts are also returned to their initial position as illustrated with solid lines.

FIG. 5 especially illustrates the relationship between the nozzle 203a and actuating member 221 on an enlarged scale. The fuel spouting valve device illustrated in FIG. 5 is substantially the same as that shown in FIG. 4 except for the elimination of the valve manipulating plate 207 and instead the tip end of the actuating member 221 is bent as shown with reference numeral 221C and the bent tip end is adapted to engage the nozzle 203a so as to close the fuel spouting valve and on the other hand, when the actuating member is separated from the engaging nozzle 203a, the fuel spouting valve is opened to permit the fuel within the valve device to spout through the nozzle 203a.

Although certain preferred embodiments of the present invention have been described and illustrated herein, it is to be understood that these are illustrative in nature and not necessarily limiting upon the scope of these teachings in their broader aspects. Many additional variations within the scope of the appended claims will doubtless occur to those skilled in the art.

What is claimed is:

1. A liquified gas-fueled smoking lighter utilizing piezo-electric elements as high voltage generating means comprising a casing; a liquified gas fuel reservoir disposed within said casing and including a fuel-spouting valve and a fuel-injecting valve; a high voltage generating device disposed outside of said reservoir and including a pair of piezo-electric elements; a pair of electrodes disposed within said casing and connected to said piezo-electric elements, respectively; an impacting device disposed within said casing for striking said piezo-electric elements and including a striking member, an impact forstoring spring and an impact releasing member; an actuating member for operating said high voltage generating device; means mounting said actuating member for pivotal movement; and means mounting said striking member for pivotal movement; said actuating member being so disposed that upon release of the stored impact force in the spring the striking member pivots in the same direction as the actuating member upon operative movement of the latter.

2. A liquified gas-fueled smoking lighter as set forth in claim 1, wherein the actuating member and the striking member are pivotally disposed on a common shaft end.

3. A liquified gas-fueled smoking lighter as set forth in claim 1, wherein the fuel-spouting valve has a fuel-spouting nozzle movable between a first position in which the fuel within said reservoir is allowed to discharge through said fuel-spouting valve and nozzle, and a second position in which said fuel-spouting valve is closed, said nozzle being provided on its periphery with a notch that serves as means for preventing the nozzle from rotating.

4. A liquified gas-fueled smoking lighter as set forth in claim 1, wherein the impacting device includes a stored impact force releasing member which has a first portion adapted to engage and controllably block movement of said striking member, and a second portion adapted to be subject to the action of said actuating member for releasing the striking member.

5. A liquified gas-fueled smoking lighter as set forth in claim 1, wherein a valve manipulating member is provided for actuating the fuel-spouting valve and wherein the pivoted actuating member has a first portion adapted to operate said valve manipulating member and a second portion adapted to operate said impact force releasing member.

6. A liquified gas-fueled smoking lighter as set forth in claim 1, wherein the pivoted actuating member further has a portion adapted to engage the impact force storing spring of the impacting device and a portion adapted to engage another spring for returning said actuating member to its initial position.

7. A liquified gas-fueled smoking lighter as set forth in claim 1, wherein the pivoted actuating member for effectively impact force storing and releasing has a flame-spouting opening closing portion extending to a position covering said fuel-spouting nozzle.

8. A liquified gas-fueled smoking lighter as set forth in claim 1, wherein the pivoted actuating member has an extension disposed to engage with or disengage from the upper end of the fuel-spouting nozzle.

9. A liquified gas-fueled smoking lighter as set forth in claim 1, wherein the high voltage generating device comprises an insulative hollow cylindrical member, a pair of piezo-electric elements end-to-end connected with the adjacent positive ends confronting to each other having a conductive metal plate disposed therebetween, an impact receiving cap secured to the end of one of said piezo-electric elements remote from said confronting end and a seat plate secured to the end of the other piezo-electric element remote from said confronting end and having a threaded extension surrounding said cylindrical member, said threaded extension being adapted to threadably receive a set screw thereon for tightening said impact receiving cap.

10. A liquified gas-fueled smoking lighter as set forth in claim 1, including means to block the pivotal movement of the striking member under the force supplied by the impact force storing spring, said blocking means including a pin on the striking member and a blocking member engaging the pin, said blocking member being shifted away from said pin upon operative movement of the actuating member.

11. A liquified gas-fueled smoking lighter as set forth in claim 1, wherein a chassis is disposed on the upper side of the casing, one end of said chassis being located adjacent the fuel-spouting valve.

12. A liquified gas-fueled smoking lighter as set forth in claim 11, wherein an insulative electrode mount is disposed on an end of the chassis and includes an insulative means receiving a resistor connected in series with the piezo-electric elements.

13. A liquified gas-fueled smoking lighter as set forth in claim 11, wherein the chassis mounts the fuel reservoir, the high voltage generating device, the impacting device...
and the actuating member, said chassis being secured to said casing by a threaded pin extending through a bottom cover closing the bottom of the casing into the bottom of the high voltage generating device.

14. A liquified gas-fueled smoking lighter as set forth in claim 11, wherein the casing is provided with a side opening for receiving a casing support plate located between the chassis and a bottom cover.

15. A liquified gas-fueled smoking lighter as set forth in claim 11, wherein means is provided for positively mounting the fuel reservoir and the chassis within the casing, said mounting means being formed of an elastic rigid material disposed between the fuel reservoir and the chassis.

References Cited

UNITED STATES PATENTS

3,384,786 5/1968 Oyamada et al. ------ 317—81 X
3,387,912 6/1968 Goto ------------- 431—130
3,408,153 10/1968 Ishiguro ----------- 431—143

VOLODYMYR Y. MAYEWSKY, Primary Examiner
U.S. Cl. X.R.
317—81, 95; 431—264