

June 11, 1968

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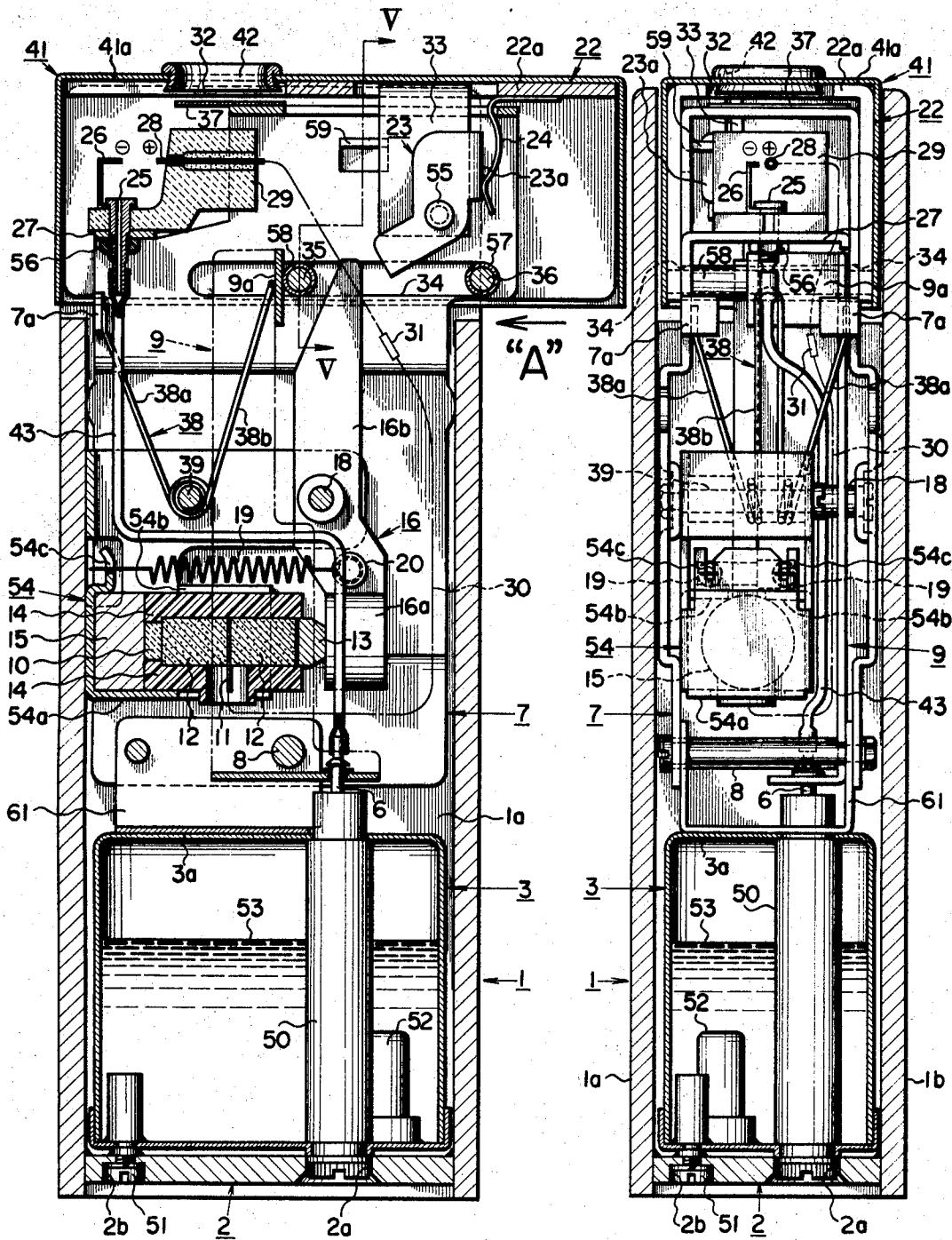
IGNITION MECHANISM OF LIQUEFIED GAS FUELED LIGHTER

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FIG. 1

FIG. 2



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FIG. 3

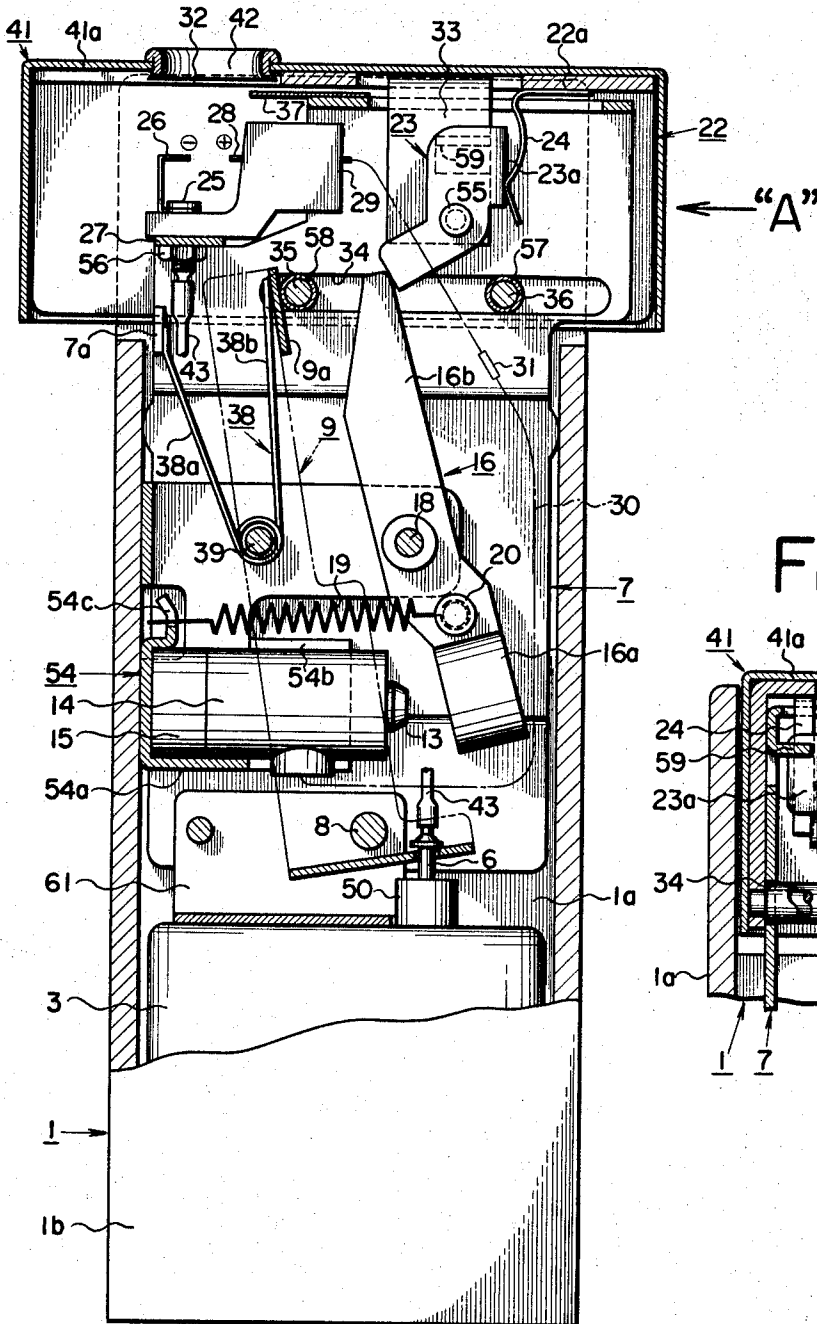
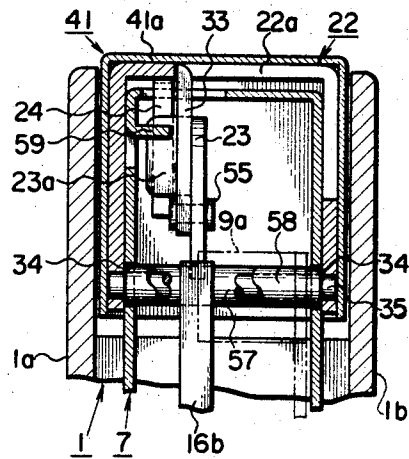


FIG. 5



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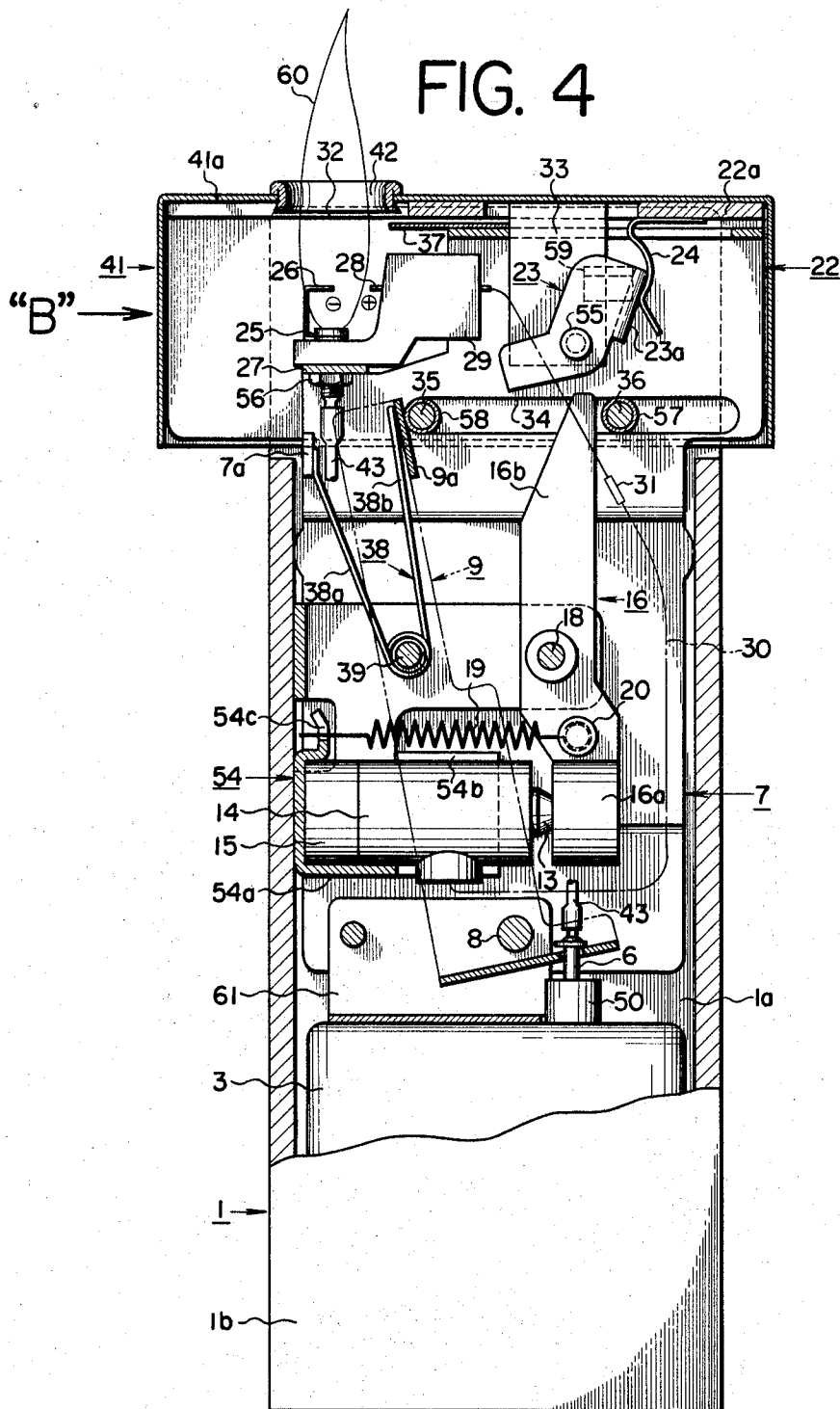
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IGNITION MECHANISM OF LIQUEFIED
GAS FUELED LIGHTER

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6 Claims. (Cl. 431-130)

This invention relates to improvements in and relating to an ignition mechanism of liquefied gas fueled cigarette lighters.

It has been known to those skilled in the art to design the aforementioned ignition mechanism in the form of a piezoelectric means combined with spark gap electrodes connected electrically therewith.

According to our practical experience, it is highly difficult to design such ignition mechanism as set forth above that it operates in a considerably smooth and reliable manner, especially with use of a manual manipulating means designed in the form of push-button-like member, because a considerable large amount of manual effort must be consumed for the generation of required high pressure electrical energy such as 7,000-10,000 volts to be induced in the piezoelectric means.

It is therefore the main object of the invention to provide an efficient and smoothly and positively working ignition mechanism of the aforementioned type which is capable of accumulating the necessary hammering energy in spring means and suddenly releasing such accumulated energy upon a hammer means adapted for cooperation with said piezoelectric means, said accumulation and release being carried out in one and the same working stroke of the push button or the like slidably operating means while assuring that the return stroke of the latter can be carried out in an automatic manner upon release of the manual operating effort exerted upon said slidably operating means.

Starting from an ignition mechanism of liquefied gas fueled lighter comprising a liquefied gas fuel reservoir tank, fuel valve assembly for on-off control of delivery of the gasified fuel from said tank, valve-operating means serving for said fuel control stationary piezoelectric means contained in said lighter, nozzle means fluidically connected with said fuel valve assembly, hammer means adapted for cooperation with said piezoelectric means for supplying the latter a sudden shock pressure, manual manipulator means for operating said hammer means, and a pair of spark electrodes connected electrically with said piezoelectric means and positioned in close proximity of said nozzle means for igniting the gas jet delivered therefrom when said fuel valve assembly is operated to its open position, main improvement proposed by the invention resides in the provision of an energy-accumulating means formed into springs acting upon said hammer means formed into a pivotable assembly comprising a lever and a hammering mass having a larger and a shorter level arm from its pivot, of a release means formed into a spring-loaded cam piece adapted for releasing the accumulated energy in said accumulator spring said energy accumulation and release being carried into effect during the course of an effective stroke of said manipulator means.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawing.

In the drawing:

FIG. 1 is a longitudinal section of a preferred embodi-

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ment of the invention, illustrative of the rest position of main working parts of lighter.

FIG. 2 is a vertical section taken on a plane selected substantially at right angles relative to that adopted in FIG. 1.

FIG. 3 is a substantially similar view to that of FIG. 1 wherein however a manual manipulator is operated until a spring-loaded hammer mass has been brought into its fully charged position.

FIG. 4 is a similar view to FIG. 5 wherein the hammer mass is released from its charged position and brought into striking engagement with a piezoelectric element through a metallic cap thereof.

FIG. 5 is a sectional view taken on the line V-V shown in FIG. 1.

Now referring to the accompanying drawings, especially FIGS. 1 and 2 thereof illustrative of a preferred embodiment of the invention, 1 denotes a casing of a liquefied gas fueled cigarette lighter, said casing being preferably formed into a rectangular box having its open top end and a pair of its four side walls, such as those denoted 1a and 1b, is formed taller than the remainder. The bottom wall, at 2, of the casing 1 is formed with bored openings 2a and 2b serving for the occasionally required adjusting of conventional burner valve at 50 and for the reception of a fixing screw 51. Although not seen in these FIGS. 1 and 2, there is provided another opening for the reception of a conventional fuel charge valve 52 which protrudes into the interior space of a liquefied gas fuel reservoir tank 3 which is a kind of pressure vessel as commonly known and fixedly mounted on the bottom wall 2 and within the casing 1. The bottom wall 2 is rigidly attached to the casing 1 such as by fusing or the like fixing means, and formed with another opening, not shown, similar to that denoted 2b in a diagonal line on the bottom wall 2, for reception of another fixing screw similar to that of 51.

Burner valve 50 passes through the upper and bottom wall of the tank 3 and is fixedly attached thereto again by fusing or the like conventional fixing means.

On the top of burner valve 50, there is provided a burner nozzle 6 which slidably protrudes into the interior space so as to operate an insidely mounted valve member, not shown. As conventionally, when the burner nozzle 6 is shifted forcibly relative to the burner valve 50 upwards from the position shown, a part of the liquefied gas contained in the interior space of the valve communicating with the body of the fuel 53 kept reserved in the tank 3 will be caused to issue out of the valve and delivered from the upper outlet end of nozzle 6.

Valve-operating member 9 is provided for this purpose and pivotably supported at 8 on a chassis 7 which is fixedly mounted through a channel base 61a on the top wall at 3a of tank 3. The bottom part of the member 9 is kept in cooperative engagement with the neck of the burner nozzle 6.

A high voltage generating unit comprises an insulating and rigid, yet hollow housing 14, preferably made of hard plastics and containing therein a backing insulator 10, made preferably of a ceramic material, a stack of piezoelectric elements 12, and a conductor lead 11 extending from the positive pole of said stack, a metallic cap 13 being fixedly attached on one end of said piezoelectric stack by applying a suitable sticking agent or the like, for receiving a hammer pressure at each time for the desired fuel ignition, as will be more fully described hereinafter.

The voltage generating unit so far described is backed up by a rigid block 15, made preferably of iron, zinc or the like metal or its alloy, said block being embraced by a supporting frame 54 and rigidly attached thereto by

applying a sticking agent or the like between the both. The frame 54 has substantially a channel-shaped configuration when seen in its top plan view, yet being formed with a bottom wall 54a rigidly and integrally united with the frame. This frame is further formed with a pair of inwardly directing and opposing projections 54b, as most clearly seen from FIG. 2, for securely keeping the voltage generating set in position.

For exerting a sudden shock through the cap 13 on the piezoelectric stack 12 when it is desired to initiate an ignition, there is provided a hammer lever 16 comprising a hammering mass 16a and a lever 16b united rigidly with each other, said lever being pivotable about a pivot shaft 18 passing through both side walls of the chassis 7. A coil spring 19 is tensioned between a pin 20 mounted on hammer lever 16b and a groove 54c formed on the frame 54 at its intermediate height. It is to be noted that, especially by reference to FIG. 2, there are provided a pair of such tension springs 19 in parallel rows with each other on a horizontal plane, so as to provide an even actuating force to the hammer lever assembly 16. For this purpose, the left-hand end of each of these springs 19 is looped so as to form an abutting enlargement. The hammer lever assembly 16 is urged resiliently to swivel about pivot shaft 18 in the clockwise direction in FIG. 1.

A cam piece 23 adapted for cooperation with the top end of hammer lever 16b is pivotably mounted through a pivot pin 55 on a depending tongue 33 of a slide 22, which has a substantially channel-shaped cross-section as most clearly seen from FIG. 2. A back-up spring 24 fixedly attached with its upper end to the top wall 22a of slide 22 is kept in pressure engagement with a lateral projection 23a formed on the cam piece.

Insulator block 29, made preferably of ceramic material such as steatite, is rigidly supported on a bent-down projection 27 of chassis 7, and a burner 25 and a negative spark electrode 26 are fixedly mounted on the insulator block in such a way that the electrode is kept in conductive connection with the metallic chassis 7 through the intermediary of the burner which is formed into a metallic flanged tube having a threaded lower portion which is kept in adjustably meshing relation with a screw nut 56 for positioning the burner. A flexible plastic tubing 43 connects the delivery end of burner nozzle 6 to the lower end of the said nozzle 25 so as to be fed with gasified fuel when the nozzle valve 50 is opened in the manner to be described.

A positive spark electrode 28 establishing a spark gap in combination with the counter or negative electrode 26 passes through insulator block 29 and is electrically connected by a wire conductor 30, also insulated although not shown and represented in the drawing only schematically by a chain line, to the conductor lead 11 through a spark-stabilizing and retarding resistor 31.

A shield plate 37 is fixedly attached such as by spot welding on one of the ends of the top wall plate of chassis 7 in close proximity of insulator block 29. This shield plate is so positioned that when the slide 22 is in its regular or non-operative position shown in FIGS. 1 and 2, it occupies the covering position for a flame outlet opening 32 at its root portion or just below that of the latter so as to substantially shut off the interior space of the lighter casing 1 from the ambient atmosphere, said opening being cut in the top wall 22a of slide 22. A manipulating member 41 of a box configuration, yet opening perfectly at its bottom is slid on the slide 22 from upper and its top wall 41a is formed with a flame opening 42 bored therethrough in an overlapped manner to the root portion of the aforementioned flame outlet opening 32. A wire spring 38 is mounted with its coiled main part on a pin 39 which is rigidly supported by chassis 7. The spring 38 has two straight legs 38c and an elongated U-leg 38b which resiliently abut against two rigid stops 7a formed inwardly on chassis 7 as most

clearly seen in FIG. 2, and against a larger lateral projection 9a formed valve-operating member 9, respectively, thereby the latter being urged resiliently to swivel around the shaft 8 and kept in pressure abutment against a roller 58 rotatably mounted on a pin 35. This pin-and-roller assembly is mounted on slide 22 and shiftable in unison therewith in a horizontal plane and guided in a pair of elongated horizontal slots 34 cut through the upper parts of the side walls of chassis 7.

At a proper horizontal distance measured from the first pin-and-roller assembly 35, 58, there is provided a second similar assembly comprising a pin 36 and a roller 57 and equally supported by said slide 22 and guided by the elongated slots 34.

The operation of the ignition mechanism of the aforementioned lighter is as follows:

When it is desired to ignite the lighter, the user of the latter pushes with his hand the manipulating member 41 at the right-hand end thereof from the rest position shown in FIG. 1 in the direction shown by the arrow A in FIG. 1 towards the position shown in FIG. 2.

In this case, the member 41 is accompanied by the slide 22 which carries in unison therewith two pin-and-roller assembly 35, 58 and 36, 57 guided in the elongated horizontal slots 34 of chassis 7. During this operation, spring bend or U-leg 38b is subjected to compression by the first pin-and-roller assembly 35, 58 through the intermediary of lateral projection 9a of valve-operating member 9, thereby the wire spring 38 being compressed resiliently and the member 9 being swiveled about pivot shaft 8 in the counter-clockwise direction in FIGS. 1 and 3. By this movement, the member 9 acts upon burner nozzle 6 so as to elevate the latter in its position as clearly observed by comparison between the both figures. As already mentioned, burner valve 50 is opened thereby and gasified fuel will issue from the outlet end of the nozzle and be conveyed through the tubing 43 to burner 25, thence discharged from the outlet end thereof in a gas jet through outlet opening 42.

In the course of the above-mentioned operation, the cam piece 23 mounted on the slide 22 is brought into striking engagement with the uppermost end of hammer lever 16b which has a longer lever arm from the pivot shaft 18 than the shorter lever arm for the hammering mass 16a and exerts a turning effort upon the lever-hammer assembly 16 so as to swivel the latter from the position shown in FIG. 1 to that shown in FIG. 3, about said shaft 18, while tensioning the coil spring 19 in the corresponding degree, thereby the hammering mass 16a being separated from the pressure-receiving cap 13 of the piezoelectric stack 12.

With further advancing movement of the slide 22 together with the manipulating member 41 from the position shown in FIG. 3, wherein the lateral projection 23a of cam piece 23 is brought into contact with a stop 59 formed on chassis 7 in the form of an inwardly bent-down projection, the cam piece is forcibly swiveled in the clockwise direction about its pivot pin 55 when seen in FIG. 3 so as to occupy a non-operating position shown in FIG. 4. Therefore, hammer lever 16b is disengaged from the contact with the cam piece and thus the accumulated energy in the elongated coil spring 19 is suddenly released so as to accelerate the hammering mass 16a against the cap 13 which receives an abrupt striking pressure given by the hammer. This sudden pressure is transmitted from the cap to the piezoelectric stack 12, thereby a high voltage as high as 7,000-10,000 volts being generated in the stack and convey therefrom through conductor lead 11, wire conductor 30 and spark-stabilizing and retarding resistor 31 to the positive electrode 28, on the one hand, and from the stack 12 through cap 13, lever-hammer assembly 16, pivot shaft 18, chassis 7 and burner 25 to the negative electrode 26, on the other hand, thereby heavy electric sparks being generated in the spark formed between both electrodes 26 and 28. These sparks will

naturally ignite the issuing gas jet from the burner so as to maintain a continuously burning gas flame as illustrated in FIG. 4 at 60.

It should be noted in the present igniting stage, the shield plate 37 has been receded from the working position covering the flame outlet opening at 42 from therebehind or from the interior space of the gas lighter assembly, thereby allowing free out-going of the now established flame of the gasified fuel, as clearly seen from a comparative observation of FIGS. 3 and 4 with FIG. 1.

When it is desired to extinguish the ignited flame, it is sufficient to release the finger pressure from the manipulating member 41. By this measure, the accumulated energy of wire spring 38 acting as return spring is released and become active to push the valve-operating member 9 directly and the slide-manipulator assembly 22, 41 through the first pin-and-roller assembly 35, 58 back to their initial position shown in FIGS. 1 and 2.

By the returning swivel movement of valve-operating member 9, the burner nozzle 6 is lowered in position to the initial non-operating one for closing the burner valve 50 so as to shut off the gasified fuel jet issuing from the burner 25.

In the course of the returning movement of the slide-manipulator assembly in the right-hand direction shown by the arrow "B" in FIG. 4, the lateral projection 23a of cam piece 23 is brought into separation from stationary stop 59 and thus will be subjected to the resiliently urging force provided by the return spring 24 so as to swivel in the counter-clockwise direction in FIG. 4 about pivot pin 55, thereby recovering its ready-active position shown in FIG. 1 from its non-operating position shown in FIG. 4.

While the invention has been particularly shown and described with reference to substantially a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

I claim:

1. Ignition mechanism of liquefied gas fueled lighter comprising a liquefied gas fuel reservoir tank, fuel valve assembly for on-off control of delivery of the gasified fuel from said tank, valve-operating means serving for said fuel control, stationary piezoelectric means contained in said lighter, nozzle means fluidically connected with said fuel valve assembly, hammer means adapted for cooperation with said piezoelectric means for supplying the latter a sudden shock pressure, manual manipulator

means for operating said hammer means, and a pair of spark electrodes connected electrically with said piezoelectric means and positioned in close proximity of said nozzle means for igniting the gas jet delivered therefrom when said fuel valve assembly is operated in its open position, said mechanism is characterized by the provision of an energy-accumulating means formed into a spring acting upon said hammer means formed into a pivotable assembly comprising a lever and a hammering mass having a larger and a shorter lever arm from its pivot, of a release means formed into a spring-loaded cam piece adapted for releasing the accumulated energy in said accumulator spring, said energy accumulation and release being carried into effect during the course of an effective stroke of said manipulator means.

2. Ignition mechanism as set forth in claim 1, characterized by that said manual manipulator means comprises a slide movable relative to the casing of the gas lighter, and a box type manipulator slid on said slide.

3. Ignition mechanism as set forth in claim 2, characterized by that said slide is provided with a stop which acts upon said cam piece for receding the latter from its working to its non-working position.

4. Ignition mechanism as set forth in claim 1, characterized by that said nozzle means constitutes a part of the connecting means provided between one of said spark electrodes and said piezoelectric means.

5. Ignition mechanism as set forth in claim 4, characterized by a resistor for stabilizing and retarding the sparks generated between said electrodes.

6. Ignition mechanism as set forth in claim 1, characterized by that said manual manipulating means is formed with a flame outlet opening which is closable from inside of the gas lighter when the manipulator-slide assembly is kept in its non-operating position.

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