

[54] **IMPACTING MECHANISM FOR IMPACTING A PIEZO-ELECTRIC BODY**

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abandoned.
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[51] Int. Cl. F23q 3/01
[58] Field of Search.....431/255; 310/8.7;
317/81, DIG. 11

[56]

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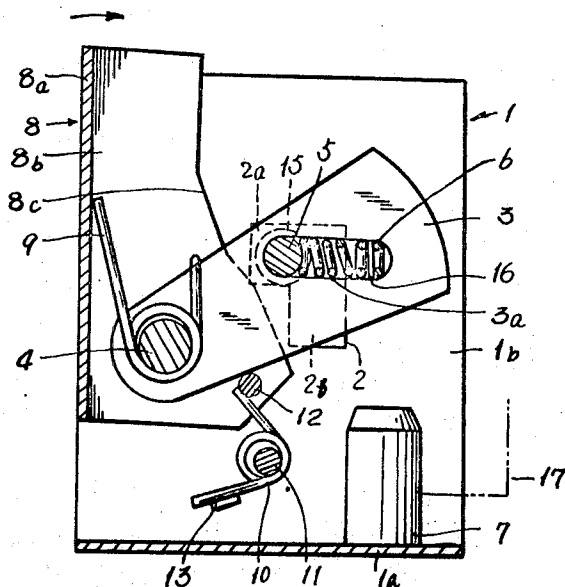
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[57]

ABSTRACT

An impacting mechanism for impacting a piezoelectric body in a piezoelectric ignition device including a spring loaded hammer having a track-like opening therein which contains a spring loaded pin which engages a pair of opposing openings formed in an enclosure, and a manipulator adapted to engage the pin during depression thereof to operate the spring loaded hammer.

14 Claims, 8 Drawing Figures



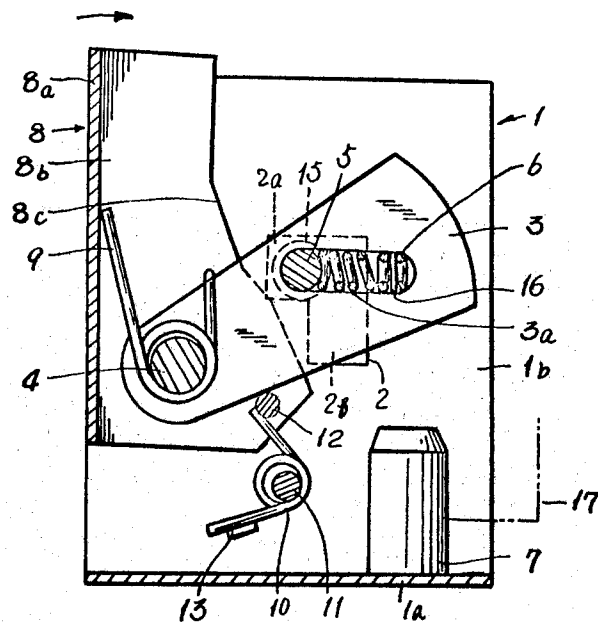


Fig. 1.

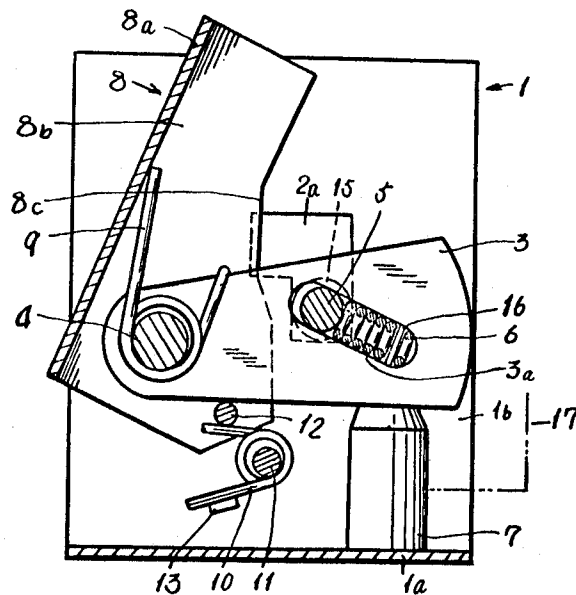
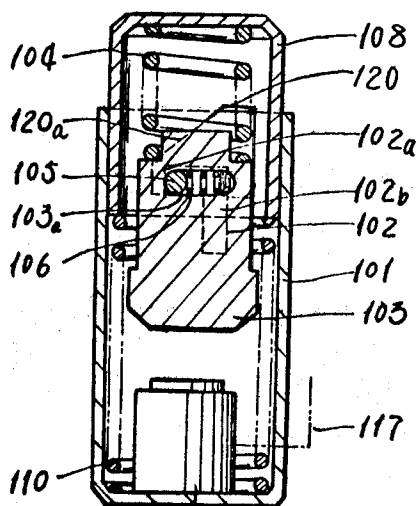


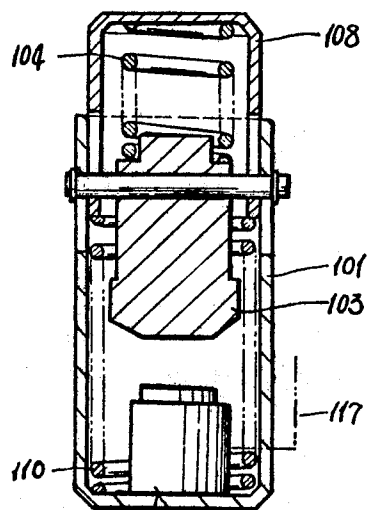
Fig. 2.

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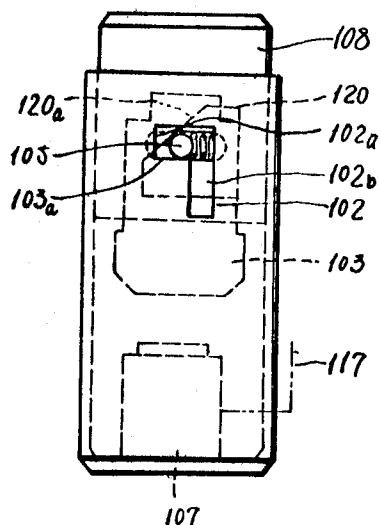
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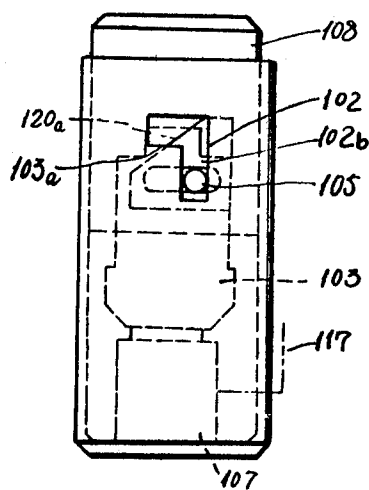
107
Fig. 3.



107
Fig. 4.



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Fig. 5.



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Fig. 6.

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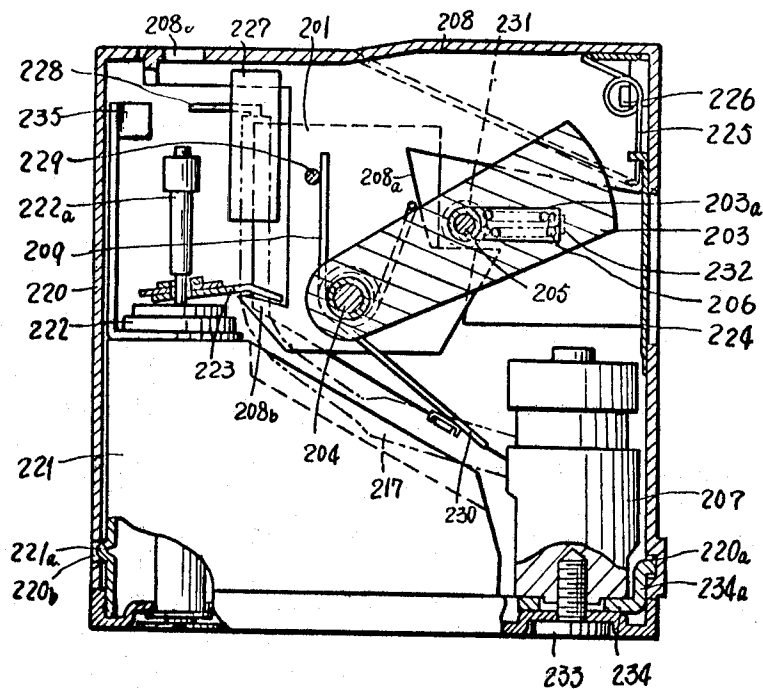


Fig. 7.

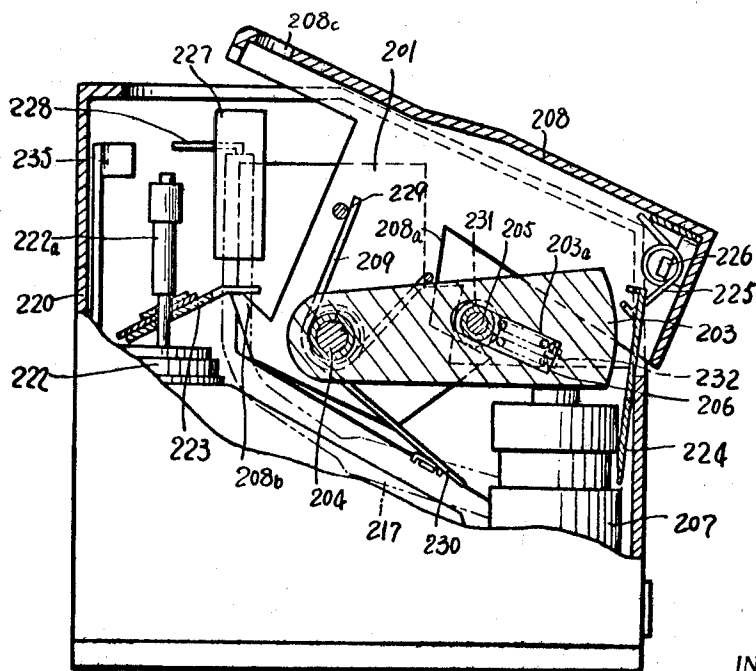


Fig. 8.

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IMPACTING MECHANISM FOR IMPACTING A PIEZO-ELECTRIC BODY

This is a continuation of copending U.S. application Ser. No. 85,328 filed Oct. 30, 1970, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to a mechanism for impacting a piezoelectric body utilized in relatively small sized piezoelectric ignition devices such as gas-lighters, gas-ovens or the like.

It has been well known in the prior art that a piezoelectric element may be used in a fuel ignition device such as a gas-lighter or the like and various ignition devices utilizing such elements have already been developed and sold. However, since such piezoelectric ignition devices have been designed only for the purpose of ensuring the impactation of the piezoelectric element by a hammer, the devices are complicated in structure, particularly the structure of the impacting mechanism for impacting the piezoelectric element and accordingly have some disadvantages.

SUMMARY OF THE INVENTION

On the other hand, the present invention, to avoid the use of the above mentioned complicated mechanisms, was designed without being limited by the principle basic to the prior art that the piezoelectric element produces high voltage only by imparting a blow thereto. As a result a piezoelectric ignition device having a simple impact-mechanism as described hereinafter was obtained.

Accordingly, an object of the present invention is to provide a simple impacting mechanism for impacting a piezoelectric body utilized in a small sized gas ignition device such as a gas lighter, a gas oven or the like.

Another object of the present invention is to provide a simple impacting mechanism for impacting a piezoelectric body wherein special means for holding and displacing a hammer for imparting a blow to the piezoelectric body are not required.

A further object of the present invention is to provide a gas lighter which utilizes a piezoelectric ignition device having a simple impacting mechanism for impacting the piezoelectric body.

Other objects and advantages of the present invention will become apparent from the following portion of the specification and from the accompanying drawings which illustrate in accord with the mandate of the patent statutes presently preferred embodiments incorporating the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational sectional view of a high voltage generating device using an impacting mechanism for impacting a piezoelectric body made in accordance with the teachings of the present invention, the device being shown in the normal position;

FIG. 2 is a sectional view of the high voltage generating device as shown in FIG. 1, the device being shown in the operating position;

FIG. 3 is a side elevational sectional view of a second embodiment according to the present invention, the device being shown in the normal position;

FIG. 4 is a view of the embodiment as shown in FIG. 3, taken through line 4—4 of FIG. 3;

FIGS. 5 and 6 are perspective views of the embodiment as shown in FIG. 3, the device being shown in the normal and operating position, respectively;

FIG. 7 is a sectional view of a gas-lighter including the impacting mechanism according to the present invention, the lighter being in the normal position; and

FIG. 8 is a sectional view of a gas lighter as shown in FIG. 7, the gas lighter being shown in the operating position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2, a chassis 1 is formed by a base 1a and opposing side walls 1b extending from the ends of the base. The side walls of the chassis each include an L-shaped opening 2 having a horizontal portion 2a and a vertical portion 2b. A hammer 3 is rotatably mounted on a shaft 4 which is supported by the chassis 1. The hammer has a track-like opening 3a therein. A pin 5 is slidable in the opening and is biased to the left by a spring 6 which engages the sides of the horizontal portions 2a of the L-shaped openings 2 in the side walls thereby maintaining the hammer in a position remote from a piezoelectric body 7 mounted on the base 1a of the chassis 1. In this embodiment, although the chassis 1 is formed with opposite L-shaped openings therein, these openings may be replaced by mere horizontal and vertical sections along which the pin 5 can move in the track-like opening 3a against the action of the spring 6. In FIGS. 1 and 2, the piezoelectric body 7 is simply represented since the present invention can be understood without an understanding of the detailed operation thereof. A manipulator 8 is rotatably supported on the shaft 4. The manipulator 8 has a vertical rear wall 8a and opposing side walls 8b which extend laterally from the vertical wall 8a and which have a portion 8c for engaging the pin 5 to horizontally displace the latter. A circle 15 represented by the dotted line is a collar mounted around the pin 5 to prevent the latter from being dislocated from its position. A barrier 16 prevents the dislocation of the spring 6 from the track-like opening 3a in the hammer 3. An impacting force storing spring 9 is wound up around the shaft 4. One end of the impacting force storing spring 9 engages the vertical rear wall 8a of the manipulator 8 and the other end engages the hammer 3. A return spring 10 is wound around a third shaft 11 mounted on the chassis 1. One end of the return spring 10 engages a pin 12 provided on the manipulator 8 and the other end engages a projection 13 on the chassis. Although it is not shown in the first embodiment, it will be understood that the return spring 10 may be eliminated by suitably selecting the pin biasing spring 6 in a reversed device, namely a device which disposes upwardly the piezoelectric body in FIG. 1. Reference numeral 17 is a high voltage lead which is electrically connected to a spark gap (not shown) which discharges high voltage produced from the piezoelectric body thereat.

The operation of the above mentioned device will now be described.

When the manipulator 8 is pushed in the direction of the arrow by the user it compresses the impacting force storing spring 9. The inclined portion 8c of the manipulator 8 engages and displaces the pin 5 in the track-like opening 3a of the hammer 3 along the horizontal por-

tions 2a of the opposing L-shaped openings 2 of the chassis 1 until it becomes situated within the vertical portions 2b of the opposing L-shaped openings 2 of the chassis 1. The hammer 3 supported by the pin 5 then imparts an abrupt blow to the piezoelectric body 7 with energy stored in the compressed impacting force storing spring 9. By the abrupt blow, the piezoelectric body 7 produces high voltage which discharges at a spark gap (not shown). When the compressive force to the manipulator 8 is released the high voltage generating device is returned to the normal position as shown in FIG. 1 by means of the return spring 10 which engages the manipulator 8. The return to the original position of the hammer 3 is completed by the aid of the pin 12 provided on the manipulator 8.

With respect to the second embodiment illustrated in FIGS. 3 to 6, a cylindrical body 101 is opened at the upper end thereof and supports a piezoelectric body 107 on a lower wall thereof. In the periphery of the cylindrical body 101 a pair of diametrically opposite L-shaped openings 102 are formed, each having a horizontal portion 102a and a vertical portion 102b, respectively. Disposed in a position spaced from the piezoelectric element 107 in the cylindrical body 101 is a hammer 103 which has a track-like opening 103a which contains a pin 105 for maintaining the hammer 103 spaced from the piezoelectric body 107 while engaging the horizontal portions of the pair of diametrically opposite L-shaped openings 102. A spring 106 urges the pin 105 toward one end of the horizontal portion of the opening 102a. Surrounding the hammer 103 and fitted to the upper open end of the cylindrical body 101 is a manipulator 108 which is in the form of a cylinder and which has a pair of diametrically opposite openings 120 including an inclined portion 120a, respectively. Between an upper flange 103b of the hammer 103 and an upper interior wall of the manipulator 108 is interposed an impacting force storing spring 104 which stores impacting force to impact the piezoelectric body 107 with the hammer 103. For returning the manipulator 108 after impactation, a spring 110 is inserted between a lower flange of the manipulator 108 and the lower wall of the cylindrical body 101. In the following description the operation of the second embodiment will be explained. Under the depression of the manipulator 108, the impacting force storing spring 104 will be compressed between the manipulator 108 and the hammer 103 while the pin 105 is within the horizontal portions of the L-shaped openings 102. The further depression of the manipulator 108 causes the pin 105 to engage the inclined portions 120a of the pair of diametrically opposite openings 120 and transversely moves the pin along the horizontal portions of the openings of the pair of diametrically opposite L-shaped openings 102 until it becomes situated within the vertical portions thereof. The hammer 103 supported by the pin 105 suddenly advances toward the latter with the energy stored in the spring 104 thereby striking the piezoelectric body 107. When the hammer 103 strikes the piezoelectric body 107 a high voltage is produced which discharges at a spark gap (not shown). The spark caused at the spark gap will ignite fuel of the ignition device incorporated within the high voltage generating device according to the present invention. The return to the original position of the device in FIG. 3 is accom-

plished by means of the return spring 110 as described in the first embodiment.

The following description relates to a gas lighter incorporating the piezoelectric ignition device having the impacting mechanism for impacting the piezoelectric body according to the present invention. Referring to FIGS. 7 and 8, reference numeral 220 is a casing which contains a fuel reservoir 221 and a piezoelectric ignition device as described in the first embodiment. The fuel reservoir 221 has a fuel spouting valve 222 including a movable nozzle 222a and a fuel supplying valve (not shown). The casing 220 is open at both upper and lower ends. The upper open end is covered by a manipulator 208 and the lower open end is closed by the bottom wall of the reservoir 221. The outer configuration of the gas lighter is substantially defined by the casing 220, the manipulator 208 and the bottom wall of the reservoir 221. One end of a valve opening and closing member 223, engages the movable nozzle 222a and the other end engages a portion of the manipulator 208. For rotating the manipulator 208, a space is provided between the rear ends of the manipulator 208 and the casing 220. This space is covered by a shield plate 224 which is normally urged against an inner side of the manipulator 208 by the aid of a torsion spring 225. One end of the spring engages a spring engaging portion 226 provided on the manipulator 208 and the other end engages the shield plate 224. The piezoelectric ignition device employed in this lighter has the construction according to the present invention as explained in the first embodiment. A chassis 201 disposed within the casing 220 mounts an electrode support 227 adjacent to the nozzle 222a and a piezoelectric body 207 in the lower end of the casing 220. A high voltage lead 217 extending from the piezoelectric body 207 is supported by the electrode support 227 to form one electrode 228 of a pair of discharge electrodes defining a spark gap therebetween. Designated at 235 is the other electrode electrically connected to the piezoelectric body 207 through the reservoir 221 and the casing 220 which, with the first electrode 228 defines the spark gap therebetween. A hammer 203 is supported by a shaft 204 in the chassis 201 and has a track-like opening 203a which contains a pin 205 and a spring 206 for urging the pin 205 in one direction. The hammer 203 is supported in spaced relation from the piezoelectric body 207 by engaging the pin 205 with steps 201a formed on the chassis 201. An impacting force storing spring 209 is wound up around the axis 204 and one end of the spring 209 engages the hammer 203 and the other engages a pin 229 mounted on the manipulator 208. The manipulator 208 has a portion 208a for engaging the pin 205 to urge the same against the action of the spring 206, a portion 208b for operating the valve opening and closing member 223 and at least one air intake opening 208c. Reference numeral 230 is a return spring for returning the manipulator 208 to its normal position. Designated by a circular dotted line 231 is a collar and reference numeral 232 is a barrier for preventing dislocation of the spring 206. The fixation of the fuel reservoir 221 and the chassis 201 in the casing 220 is carried out by means of a set screw 233 through a casing supporting plate 234 interposed between the bottom wall of the fuel reservoir 221 and the chassis 201. A bend portion 234a of the casing sup-

porting plate 234 is accommodated in a recess 220a of the casing 221. The fuel reservoir 221 is further secured by accommodating a projection 221a of the fuel reservoir 221 within an opening 221b in the casing 220. The following description concerns the operation of the gas lighter constructed as above described. When the manipulator 208 is rotated in the direction of the arrow mark, the impacting force storing spring 209 is compressed to store the impacting force between the pin 229 on the manipulator 208 and the hammer 203 and at the same time the movable nozzle 223a is lifted up by means of the valve opening and closing member 223 according to the action of the portion 208b of the manipulator 208 and then spouts the fuel contained in the fuel reservoir 221 through the fuel spouting valve 222.

The further rotation of the manipulator 208 causes the pin 205 to engage the portion 208a of the manipulator 208 so as to displace the pin 205 against the action of the spring 206 releasing the engagement between the pin 205 and the steps 201a formed on the chassis 201. The hammer 203 thereby imparts to the piezoelectric body 107 an abrupt blow, the magnitude of which depends on the energy stored in the impacting force storing spring 209. As the result of the impact, the piezoelectric body 207 produces high voltage which discharges at the spark gap where a spark is bridged. The spark bridged at the spark gap ignites the fuel which spouted from the nozzle 222a before impact. The burning flame is easily extinguished by releasing the manipulator 208 which is returned to its normal position in FIG. 7 by means of the return spring 230.

What is claimed is:

1. An impacting mechanism for impacting a piezoelectric body in a piezoelectric ignition device comprising a piezoelectric body; an enclosure including a pair of opposite engaging portions in side walls thereof;

a hammer supported in said enclosure away from said piezoelectric body to impact the latter and having a track-like opening;

a spring loaded pin accommodated in said track-like opening in said hammer and engaging with said pair of opposite engaging portion in said enclosure to maintain said hammer away from said piezoelectric body;

a manipulator for manipulating said hammer to impart a blow against said piezoelectric body and having a portion adapted to engage with said pin to move transversely in said track-like opening the latter along said pair of opposite engaging portions and an impacting force storing spring disposed between said hammer and said manipulator and compressed over said transverse movement of said pin to store impacting force therein.

2. An impacting mechanism for impacting a piezoelectric body in a piezoelectric ignition device comprising a piezoelectric body; a chassis provided therein with said piezoelectric body and formed in the form of U-shaped casing and having a pair of opposite engaging portion walls thereof; a hammer rotatably supported on an axis within said chassis and formed therein with a track-like opening; a spring loaded pin accommodated in said track-like opening in said hammer

and adapted to engage with said pair of opposite engaging portion in said chassis to maintain said hammer away from said piezoelectric body; a manipulator adapted to manipulate said hammer and having a portion adapted to engage with said spring loaded pin to move transversely in said track-like opening the latter along said pair of opposite engaging portion, said manipulator being rotatably supported by said axis which supports said hammer; and an impacting force storing spring disposed between said hammer and said manipulator and compressed over said transverse movement of said pin in said track-like opening to store impacting force therein.

3. A liquified gas fueled lighter utilizing a piezoelectric ignition device as an igniting source comprising a casing; a reservoir disposed in said casing and having a fuel spouting valve including a movable nozzle; a piezoelectric ignition device including a piezoelectric body, an enclosure formed with a pair of opposite engaging portions in sidewalls thereof and disposing therein said piezoelectric body, a hammer supported in said enclosure away from said piezoelectric body to impact the latter and having a track-like opening, a spring loaded pin accommodated in said track-like opening in said hammer and engaging with said pair of opposite engaging portions in said enclosure to maintain said hammer away from said piezoelectric body, a manipulator for manipulating said hammer to impart a blow to said piezoelectric body, and having a portion adapted to engage with said pin to move transversely in said track-like opening the latter along said pair of opposite engaging portions, and an impacting force storing spring disposed between said hammer and said manipulator and compressed over said transverse movement of said pin to store impacting force therein; and a spark gap formed above said said movable nozzle and electrically connected in series with said piezoelectric body.

4. An impacting mechanism for impacting a piezoelectric body in a piezoelectric ignition device according to claim 1 in which said mechanism further comprising a return spring for returning said manipulator to its normal position.

5. An impacting mechanism for impacting a piezoelectric body in a piezoelectric ignition device according to claim 1, in which said pair of opposite engaging portions in said enclosure have L-shaped configuration comprising a transverse section along which said pin moves transversely in said track-like opening in said hammer and a vertical section along which said pin moves vertically together with said hammer thereby to impart a blow against said piezoelectric body.

6. An impacting mechanism for impacting a piezoelectric body in a piezoelectric ignition device according to claim 1, in which said mechanism disposes coaxially said enclosure, said piezoelectric body, said hammer, said impacting force storing spring and said manipulator, said enclosure and said manipulator being in the form of a cylindrical configuration.

7. An impacting mechanism for impacting a piezoelectric body in a piezoelectric ignition device according to claim 1 in which said spring loaded pin having a stop portion thereon, and said spring for biasing said pin is disposed in said track-like opening in said hammer and having a barrier adapted to prevent fit-off of said spring from said track-like opening.

8. A mechanism for striking a piezoelectric body in a piezoelectric ignition device comprising a piezoelectric body, hammer means including track means, means for maintaining said hammer means substantially at a first predetermined position spaced from said piezoelectric body, means for exerting a force of selected direction and predetermined magnitude on said hammer means while said hammer means is at said first predetermined position whereby said hammer means will become cocked, and means for releasing said cocked hammer whereby the exerted force will propel said hammer means to a second predetermined position where said hammer means will strike against said piezoelectric body whereby a spark will be produced at the spark gap of the piezoelectric ignition device, said maintaining and releasing means including chassis means having opposing side wall portions, said side wall portions including opposing substantially L-shaped openings, rod means extending through said track means into said openings for interconnecting said hammer means and said chassis means whereby said hammer means will be maintained substantially at said first predetermined position when said rod means is displaced along one portion of said L-shaped openings and displacement of said rod means along a second perpendicularly related portion of said L-shaped openings will result in said hammer means being displaced to said second position, means for retaining said rod means within said one portion of said L-shaped openings until said hammer means has been worked, means for positioning said rod means in substantially overlying relationship with the second portion of said L-shaped openings when said hammer means has been cocked whereby said hammer means will be propelled to said second position.

9. A mechanism according to claim 8 wherein said track means extends substantially parallel to said one portion of said L-shaped openings when said hammer means is at said first predetermined position.

10. A mechanism according to claim 9 further comprising means for returning said hammer means from said second position to said first position.

11. A mechanism according to claim 10, wherein said retaining means comprises spring means compressively mounted within said track means for urging said

rod means towards one end of said track means.

12. A mechanism for striking a piezoelectric body in a piezoelectric ignition device comprising a piezoelectric body, hammer means including track means means for maintaining said hammer means substantially at a first predetermined position spaced from said piezoelectric body, means for exerting a force of selected direction and predetermined magnitude on said hammer means while said hammer means is at said first predetermined position whereby said hammer means will be cocked, and means for releasing said cocked hammer whereby the exerted force will propel said hammer means to a second predetermined position where said hammer means will strike against said piezoelectric body whereby a spark will be produced at the spark gap of the piezoelectric ignition device, said maintaining and releasing means including chassis means having opposing side wall portions, said side wall portions including opposing openings having substantially L-shaped engaging surfaces, rod means extending through said track means into said openings for interconnecting said hammer means and said chassis means whereby said hammer means will be maintained substantially at said first predetermined position when said rod means is displaced along one portion of said L-shaped engaging surfaces and displacement of said rod means along a second substantially perpendicularly related portions of said L-shaped engaging surfaces will result in said hammer means being displaced to said second position, means for maintaining said rod means in engaging relation with said one portion of said L-shaped engaging surface until said hammer means has been cocked, means for maintaining said rod means in engaging relation with the second portion of said L-shaped engaging surface when said hammer means has been cocked whereby said hammer means will be propelled to said second position.

13. A mechanism according to claim 12 wherein said track means extends substantially parallel to said one portion of said L-shaped engaging surfaces when said hammer means is at said first predetermined position.

14. A mechanism according to claim 13 further comprising means for returning said hammer means from said second position to said first position.

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