DEVICE FOR IMPORTING MULTIPLE SPACED IMPACTS TO A PIEZOELECTRIC CRYSTAL

Filed May 20, 1969

3 Sheets-Sheet 1

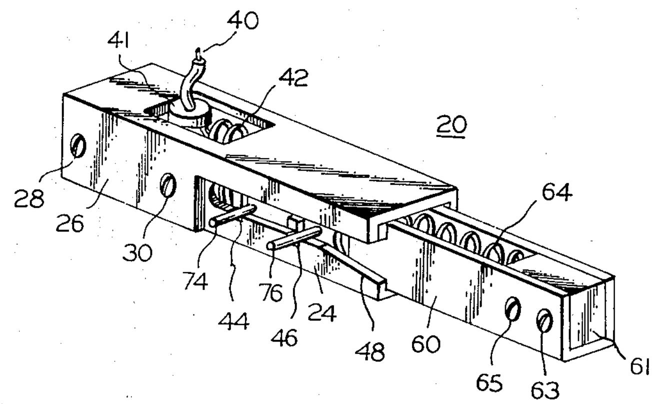

FIG.1

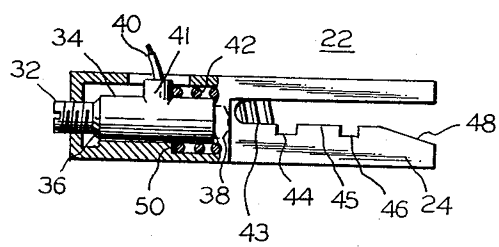

FIG.2

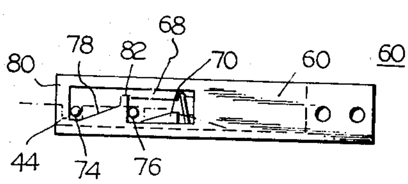

FIG.3

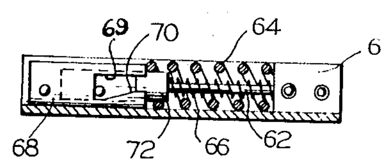

FIG.4

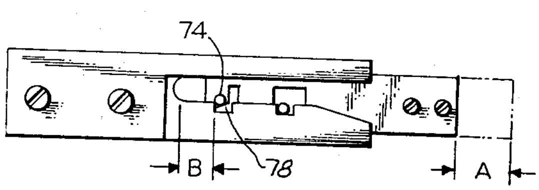

FIG.5

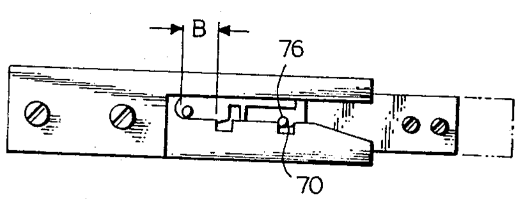

FIG.6

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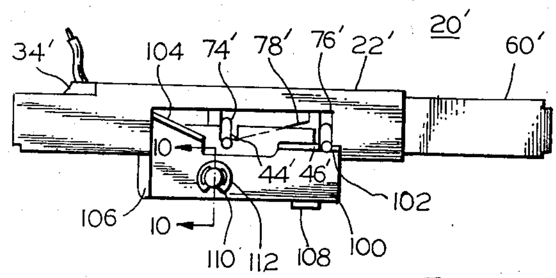

FIG.7

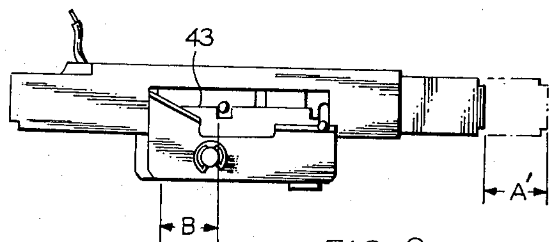

FIG.8

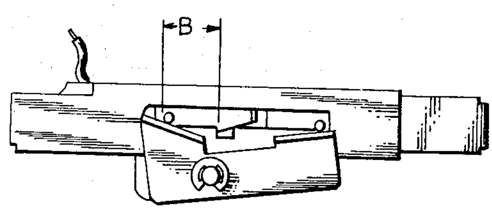

FIG.9

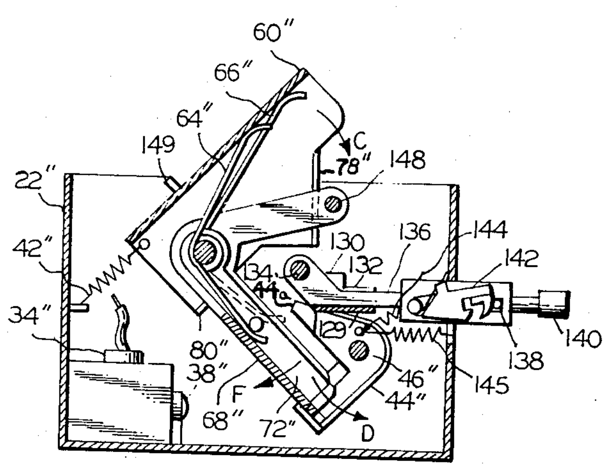

FIG.11

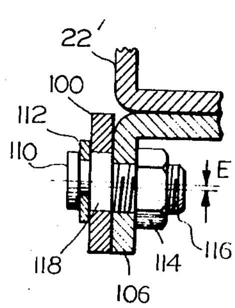

FIG.10

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Nov. 17, 1970 HIROHIKO TONARI 3,541,360
DEVICE FOR IMPORTING MULTIPLE SPACED IMPACTS TO A PIEZOELECTRIC CRYSTAL
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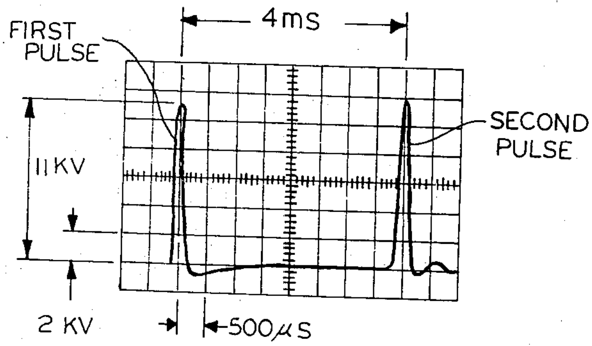
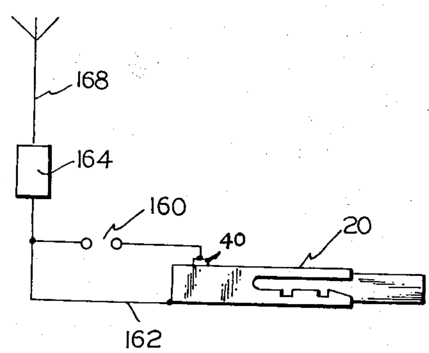


FIG.12

FIG.13



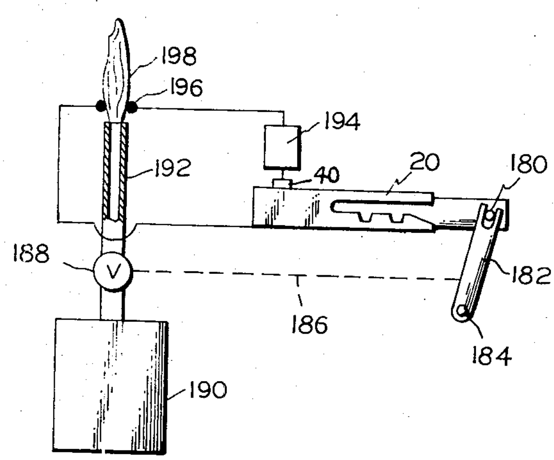


FIG.14

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United States Patent Office

3,541,360

Patented Nov. 17, 1970

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3,541,360

DEVICE FOR IMPORTING MULTIPLE SPACED IMPACTS TO A PIEZOELECTRIC CRYSTAL

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Filed May 20, 1969, Ser. No. 826,201

Claims priority, application Japan, May 21, 1968, 43/35,225, 43/35,226

Int. Cl. H01v *7/00;* H03k *3/00*

U.S. Cl. 310—8.7 8 Claims

ABSTRACT OF THE DISCLOSURE

A device for subjecting a piezoelectric element to an impact. The device has a piezoelectric element and two hammers for giving an impact to said piezoelectric element. Two springs are engaged with said hammers for driving said hammers. Operating means are engaged with said springs and are movable to a first predetermined position for energizing said springs. Two locking means are engaged with said hammers for temporarily blocking movement of said hammers, and two unlocking means are engageable with the respective locking means and the first of which is operatively associated with said operating means to said first predetermined position, for releasing one of said hammers from one of said locking means, said one hammer having the other unlocking means operatively associated therewith for releasing another of said hammers from said another of said locking means when said one of hammers is displaced to a second predetermined position. The piezoelectric element is thereby subjected to mechanical impacts at least two times at a predetermined time interval. The device also has means coupled to said hammers, said springs, said locking means and said unlocking means to return all of said means to the normal position after said hammers have applied to mechanical impacts to said piezoelectric element.

FIELD OF THE INVENTION

This invention relates to a high voltage generating device having a piezoelectric element which is subjected to a mechanical impact, and more particularly to an impact device capable of generating plural high voltages in one operation, said plural high voltages being spaced by a given time interval from each other.

DESCRIPTION OF PRIOR ART

It is well known that a piezoelectric element will produce a high voltage when subjected to a mechanical force, such as an impact force or static pressure. It is also well known that the arc discharge between two electrodes at a high voltage generates an electric signal.

The combination of these two phenomena provides a signal generator in which two electrodes spaced by a desired discharge gap from each other generate an electric signal by arc discharge, when biased by a high voltage generated by a piezoelectric element.

Such a signal generator has been widely used for controlling an electric toy, but is difficult to produce an electric signal having a specific frequency characteristic which is capable of being selectively coupled with a receiver circuit in the toy. Therefore, a conventional receiving circuit coupled with such a simple signal generator is apt to be operated accidentally in response to any other undesired signal caused by the arc discharge of an automobile ignition or electric contacts of various electric equipment.

In addition, the discharge arc caused by a piezoelectric element is widely used to ignite the fuel for a cigarette

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lighter or fuel gas. However, the conventional gas ignitor utilizing a piezoelectric element is not always of sufficiently high quality to ensure the ignition of the gas every time the piezoelectric element is triggered.

SUMMARY OF THE INVENTION

An object of this invention is to provide a high voltage generator having a piezoelectric element struck by an impact device so as to generate plural high voltage pulses spaced by a given time interval from each other.

A further object of this invention is to provide an impact device for striking a piezoelectric element so as to produce plural high voltage pulses in one operation.

A further object of this invention is to provide an impact device for striking a piezoelectric element so as to produce plural high voltage pulses, the time interval of which can be accurately controlled.

Another object of this invention is to provide an impact device for striking a piezoelectric element so as to produce a specified electric signal.

These objects are achieved according to the present invention by the provision of a piezoelectric element comprising said element; at least two hammers for striking the element; at least two springs for driving the hammers; an operating means for energizing the springs; at least two locking means for temporarily stopping the hammers; at least two unlocking means, one of which releases one of said hammers from one of said locking means when said operating means is displaced to a first predetermined position and another of which releases another of said hammers from another of said locking means when said one of hammers is displaced to a second predetermined position; and means for actuating the hammers, the springs, the locking means and the unlocking means to return to the normal position after the hammers have applied mechanical energies to the element. As a result, one operation of the impact device according to the present invention generates plural high voltage pulses which have predetermined output voltages and which are spaced by a predetermined time interval from each other regardless of the operating speed and force.

These and other features of this invention will be apparent upon consideration of the following detailed description taken together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of one embodiment of this invention shown in the normal position;

FIG. 2 is an elevation of a guide case for said embodiment with certain parts broken away;

FIG. 3 is an elevation of an operating case for said embodiment;

FIG. 4 is an elevation, partly cut away, of the operating case;

FIG. 5 is a side elevation of said embodiment when the operating case is pushed into said guide case a predetermined distance A so as to be given the energy required for striking the piezoelectric element and one of said hammers is at the point of unlocking;

FIG. 6 is a similar view of the same embodiment when said one of the hammers has moved a predetermined distance B and another hammer is at the point of unlocking;

FIG. 7 is an elevation of another embodiment according to this invention;

FIG. 8 is an elevation of said another embodiment when the operating case is pushed into a guide case a predetermined distance A′ so as to be given the energy required for striking the piezoelectric element and one of said hammers is at the point of unlocking;

FIG. 9 is a similar view of said another embodiment when said one of hammers has moved predetermined distance B' and another hammer is at the point of unlocking;

FIG. 10 is an enlarged section of FIG. 9 taken along line 10–10;

FIG. 11 is a sectional elevation of still another embodiment with certain parts cut off;

FIG. 12 is a graph showing the high voltage pulse patterns which are generated by these embodiments;

FIG. 13 is a schematic view of a transmitter which comprises a novel remote control system according to this invention; and

FIG. 14 is a schematic view of a novel gas ignitor which includes an impact device according to this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIGS. 1 to 6, the construction and operation of an impact device **20** according to the present invention will be explained.

A lower case **24** and an upper case **26** are connected together by screws **28** and **30** and form a guide case **22** having a square cross-section in which is slidably fitted an operating case **60**.

The guide case **22** has a screw **32** at the closed end thereof and has a piezoelectric element **34** positioned therein in such a way that said piezoelectric element **34** is opposite said screw **32**. The piezoelectric element **34** which is cylindrical in form has attached on the opposite end faces metal plates **36** and **38** and a lead **40** at the middle thereof. Said lead **40** acts as one electrode and metal plate **36** or **38** acts as another electrode for arc discharge.

A reset spring **42** positioned in contact with said piezoelectric element is supported by a projection **41** on piezoelectric element **34** and a projection **50** on lower case **24**. Said guide case **22** has a slot **43** in the end opposite said screw **32** into which slot recesses **44** and **46** for receiving locking means and which slot has a guide edge **48** formed on one side thereof.

With reference to FIGS. 3 and 4 which are a side view and an inside view of an operating case **60** slidably positioned in the guide case **22**, a center rod **62** is mounted on a block **61** which in turn is secured by screws **63** and **65** to one end of the operating case **60**.

The center rod **62** has a second hammer **72** which is cylindrical in form and slidably mounted thereon. The second hammer **72** has a second transverse stop rod **76** tightly mounted therein. A second spring **66** is located between said second hammer **72** and said block **61** and is supported by said center rod **62**.

Said second spring **66** is engaged, at both ends, in two small holes formed on said second hammer **72** and on block **61** respectively so that the second hammer **72** is urged to the left in FIG. 4 and the second stop rod **76** is depressed downward by the torsional force of said second spring **66**.

When the second stop rod **76** is engaged in the second recess **46** in the guide case **22**, the second hammer **72** is kept at the normal position shown in FIG. 1.

A first hammer **68** is slidably mounted on the second hammer **72** and has a slot **69** therein having a slant edge **70** extending in the axial direction. The second stop rod **76** extends through the slot **69** for engagement in the second recess **46**. Another stop rod **74** is tightly mounted in the first hammer **68**.

A first spring **64** is located between the first hammer **68** and the block **61** and is held in the inside of operating case **60**. The first spring **64** has the ends, engaged in two small holes formed in the first hammer **68** and the block **61** so that the first hammer **68** is urged to the left in FIGS. 3 and 4 and the first stop rod **74** is depressed downward by the torsional force of said first spring **64**. Since the first stop rod **74** is engaged in the first recess **44** formed in the guide case **22**, the first hammer **68** is kept at the normal position as shown in FIG. 1.

The stop rods **74** and **76** in the position shown by FIG. 3 are inserted into the guide case **22** as shown in FIG. 2 with the stop rods being guided by the guide edge **48**. In such a way the guide case **22** is easily combined with the operating case **60** so that the parts are in the normal position as shown in FIG. 1.

The reset spring **42** extends between a vertical edge **80** of the operating case **60** and the projection **50** on the lower part of the guide case **22** and pushes the operating case **60** outward of the guide case **22**. The operating case **60** is held in normal position as shown in FIG. 1, because the stop rod **74** is engaged in the recess **44**.

The following description will explain the operation of the impact device **20** according to the present invention.

When the operating case **60** is pushed a distance A as shown in FIG. 5, the stop rods **74** and **76** which are engaged in the recess **44** and **46** prevent the hammers **68** and **72** from moving.

In this condition, the first spring **64**, the second spring **66** and the reset spring **42** are compressed. The first stop rod **74** depressed to the bottom of recess **44** by the torsional force of the first spring **64** is pushed out of the first recess **44** by the slant edge **78** formed on the operating case **60**.

Therefore, at the next moment, the first stop rod **74** is released from the recess **44** and the first hammer **68** passes through the inside of the reset spring **42** and strikes the metal plate **38** on the piezoelectric element **34** under the effect of the spring force of said first spring **64**. When the first hammer **68** moves a distance B shown in FIG. 6, the second stop rod **76** is pushed out of the second recess **46** by the slant edge **70** of first hammer **68**. At a moment succeeding that at which the parts are as shown in FIG. 6, the second hammer **72** is moved by the spring force of the second spring **66** and follows the first hammer **68** and then delivers an impact to the piezoelectric element **34** after the first hammer **68**.

When the pushing force on the operating case **60** is withdrawn, the operating case **60** is pushed outward by the reset spring **42**. The first stop rod **74** is guided by a vertical edge **80** formed on the operating case **60** and the horizontal edge of slot **43** and returns to the recess **44**. The second stop rod **76** is supported by a vertical edge **82** and a horizontal edge **45** and returns to the recess **46**. Finally the first stop rod **74** and the second stop rod **76** fall into the recesses **44** and **46** respectively under the effect of the torsional force of the first spring **64** and the second spring **66**.

Therefore, the operating case **60** does not move outward any further and stops at the normal position shown in FIG. 1.

When the operating case **60** is again pushed into the guide case **22** from the normal position shown by FIG. 1, the hammers **68** and **72** are temporarily blocked against movement so that the first spring **64**, the second spring **66** and the reset spring **42** are compressed.

As made clear by the above explanation, one actuation of the operating case **60** of the impact device **20** causes the piezoelectric element **34** to be struck two times.

The piezoelectric element **34** when struck by the hammers **68** and **72** produces high voltages between the lead **40** and the metal tablet **36** or **38** as shown by a graph in FIG. 12.

Referring to FIG. 12, the first pulse and second pulse have a maximum voltage of about 11 kv. and are spaced from each other by a time interval of about 4 ms.

The output voltage of the piezoelectric element **34** can be controlled by controlling the striking force of the hammer, which is dependent upon the compression forces of the springs **64** and **66** as shown in FIG. 5. Therefore, the output voltage can be predetermined by the location of the slant edge **78** and is not affected by a force with which the operating case **60** is pushed in.

The time interval between the two pulses is the time interval between the impacts of the two hammers **68** and

72. The first hammer 68 moved from the position shown in FIG. 5 and strikes the piezoelectric element 34 in a time determined by the weight of the first hammer 68 and the compression force of the first spring 64.

The second hammer 72 moves from the position shown in FIG. 6 and strikes the first hammer and delivers an impact to the piezoelectric element 34 through the first hammer 68 in a time determined by the weight thereof and the compression force of the second spring. The second hammer 72 starts at the time when the first hammer 68 has run a given distance which is determined by the vertical position of the slant edge 70.

Therefore, the time interval between the impacts of the first hammer 68 and the second hammer 72 can be kept constant regardless of the speed with which the operating case 60 is pushed in.

The output voltage of two pulses and the time interval between them show little variation with repetition of operation of the impact device 20.

At the normal positions shown in FIG. 1, the piezoelectric element 34 is always pushed against the screw 32 by the reset spring 42.

The distance between the piezoelectric element 34 and the hammer 68 can be controlled by turning the screw 32.

In general the first hammer 68 and the second hammer 72 at a moment after that of FIG. 6 have different running speeds from each other.

When the second hammer 72 has a higher speed than the first hammer 68, the fixed running distance of the two hammers makes the time interval between the two pulses shorter. When the second hammer 72 has a lower speed than the first hammer 68, the fixed running distance of both hammers makes the time interval longer.

Therefore, a tolerance in the time interval between the two pulses due to the properties of the spring can be made closer by turning the screw 32.

The construction and operation of another embodiment of an impact device 20′ will be explained with reference to FIGS. 7, 8, 9 and 10. Similar reference numbers indicate components similar to those in the foregoing figures.

A guide case 22′ containing a piezoelectric element 34′ has a reset spring 42 therein and recesses 44′ and 46′ formed in the edge of slot 43 thereon.

A bracket 106 is fixed to the guide case 22′ and has an eccentric shaft 110 fixed thereto.

A rocking lever 100 is pivotally mounted on said eccentric shaft 110. The axis of a journal portion 118 on shaft 110 is offset by an amount E from the axis of a screw 116 fixed to the bracket 106. A stop ring 112 holds the rocking lever 100 on journal 118.

The rocking lever 100 has a slant edge 104 and a horizontal edge 102 formed thereon. A stop 108 formed on the bracket 106 restricts the clockwise motion of the rocking lever 100.

An operating case 60′ has a first hammer 68′, a second hammer 72′, a first spring 64′, and a second spring 66′ included therein and a slant edge 78′ formed thereon and is mounted slidably in the guide case 22′.

Stop rods 74′ and 76′ provided on the first hammer 68′ and the second hammer 72′, respectively, are engaged in the recesses 44′ and 46′ formed in the guide case 22′, respectively.

In the following, the operation of the impact device 20′ will be explained.

When the operating case 60′ is moved a distance A′ from the normal position shown in FIG. 7, the stop rods 74′ and 76′ which are engaged in the recesses 44′ and 46′ prevent the two hammers 68′ and 72′ from moving and the first spring 64′, the second spring 66′ and the reset spring 42′ are compressed.

At the next moment, the first stop rod 74′ is pushed out of the first recess 44′ by the slant edge 78′ and then the first hammer 68′ moves outward at the piezoelectric element 34′ under the effect of the compression force of the first spring 64′.

When the first hammer 68′ moves a distance B′, the first stop rod 74′ pushes down the slant edge 104 of the rocking lever 100 and pushes the second stop rod 76′ out of the second recess portion 46′. In the moment succeeding that in which the parts are as shown in FIG. 9, the second hammer 72′ follows the first hammer 68′ and delivers an impact to the piezoelectric element 34′.

When tht operator loosens a nut 114 shown in FIG. 10 and turns the eccentric shaft 110 180°, the slant edge 104 of the cocking lever 100 is moved as far away from the horizontal edge 43′ as is possible. After it moves a distance greater than B′, the first stop rod 74′ causes release of the second stop rod 76′ from the second recess 46′. With the parts in this position, one can obtain the longest time interval between the impacts of the first hammer 68′ and the second hammer 72′.

As made clear by the above explanation, the time interval between two high voltage pulses can be controlled by turning the eccentric shaft 110. The range of time intervals is from 3 millisec. to 6 millisec.

FIG. 11 shows another embodiment of the impact device 20″ in the normal position, the similar reference character designating components similar to those of forgoing figures.

The impact device 20″ has a piezoelectric element 34″ fixed thereto and a first hook 44″ and a second hook 46″ rotatably mounted thereon. An operating lever 60″ is rotatably mounted onto a shaft 146 together with a first swing hammer 68″ and a second swing hammer 72″. A first torsional spring 64″ is located between the first swing hammer 68″ and the operating lever 60″ and biases the first swing hammer 68″ clockwise. A stop 80″ formed on the operating lever 60″ stops the first swing hammer 68″.

Similarly, a second torsional spring 66″ is located between the operating lever 60″ and the second swing hammer 72″ and biases the second swing hammer 72″ clockwise. However, the second swing hammer 72″ is stopped by the stop 80″ through the first swing hammer 68″. A reset spring 42″ extending between the operating lever 60″ and a case 22″ biases the operating lever 60″ and both hammers 68″ and 72″ to the normal position shown in FIG. 11.

A stop 149 formed on the case 22″ prevents the operating lever 66 from over turning counterclockwise. The first hook 44″ is biased clockwise by a spring 144 and engages under the end of the first swing hammer 68″. The second hook 46 is biased clockwise by a spring 145 and engages under the end of the second swing hammer 72″. The operating lever 60″ is provided with a vertical edge 78″ to engage end 44*a* of hook 44″ disengage the first swing hammer 68″ from the first hook 44″ against the bias of spring 144.

The first swing hammer 68″ is provided with a drive pin 148. The first swing hammer 68 rotates toward a metal tablet 38″ at a given rotational angle and the drive pin 148 hits the first step 130 of a shift lever 129 which is pivotally mounted on a shaft 134. The rotation of the shift lever 129 causes the second hook 46″ to rotate counterclockwise so that the second swing hammer 72″ is released from the second hook 46″.

When the operating lever 60″ is turned in a direction shown by arrow C of FIG. 11, the torsional springs 64″ and 66″ are twisted and the reset spring 42″ is stretched because the hammers 68″ and 72″ are temporarily stopped by the hooks 44″ and 46″, respectively.

Further rotation of the operating lever 60″ causes the first hook 44″ to rotate in a direction of arrow D by the vertical edge 78″. Subsequently, the first swing hammer 68″ disengages from the first hook 44″ and rotates in the direction of arrow F to strike the metal tablet 38″ under the bias of the twisted spring 64″. As the first hammer 68″ swings toward the piezoelectric element 34″, the drive pin 148 hits the shift lever 129 so that the second hammer 72″ is disengaged from the second hook 46″ by the shift lever. The second swing hammer 72″ strikes the metal tablet 38″ subsequent to the first swing hammer 68″.

When the rotational force of the operating lever 60″ is released, the swing hammers 68″ and 72″ are biased by the stop 80″ and the reset spring 42″ and rotate counterclockwise and are again held by the hooks 44″ and 46″ at the normal position shown in FIG. 11.

The movement of the push button 140 to the left causes a pin 138 to be locked by a lever 142 and to shift the shift lever 129 to the left.

When the operating lever 60″ is again rotated in the direction of arrow C, the drive pin 148 hits a second step 132. As a result, the shift lever 129 rotates clockwise and drives the second hook 46″ so as to disengage it from the second swing hammer 72″. In this case, the rotational angle through which the first swing hammer 68″ rotates is larger than that of the FIG. 11 by the difference between the steps 130 and 132.

The further depression of the push button 140 allows the pin 138 to return to the position shown by FIG. 11 and causes the shift lever 129 to return to the previous position. In this way the operation of the push button 140 easily controls the time interval between two high voltage pulses produced by the piezoelectric element 34″. An experiment with the impact device 20″ of FIG. 11 shows that a time interval of 3 milliseconds is available between impacts.

The impact device 20 of FIGS. 1–6 according to the present invention can be constructed in a small size and can be easily and finely controlled with respect to the time interval between two high voltage pulses by turning of the screw 32.

Another advantage of this impact device is that the guide case 22 and the operating case 60 can be disassembled and either of the two can be replaced with a new one when it does not work.

It is a further advantage that the first spring 64 is guided along the inside of the operating case 60 and the second spring 66 is guided along the center rod 62. Such construction of the impact device prevents the two springs from buckling even when they are compressed. Furthermore the second hammer 72 supplies an impact to the piezoelectric element 34 through the first hammer 68 and another piezoelectric element is not needed.

In the impact device 20′ of FIGS. 7–10, the time interval between two high voltage pulses can be widely controlled by turning the eccentric shaft 110. In addition since there is no need to provide the first hammer with a slant edge, the first hammer can be made more easily.

The impact device 20″ of FIG. 11 is characterized by making available two time intervals between the two high voltage pulses. Such an impact device can be used as a signal generator capable of producing two kinds of electric signals.

All of these impact devices make it posible to produce high voltage pulses having a constant output voltage and being spaced by a constant time interval from each other regardless of the operation force and operation speed of the impact device.

The following description will describe a remote controller comprising the novel high voltage generator according to the present invention.

Referring to FIG. 13, reference character 20 indicates an impact device, 40 is one electrode of the piezo-electric element, 162 is a grounded electrode of said piezo-electric element, 160 is a spark gap and 164 is an impedance. Said impedance 164 is to promote the radiation of electric signal from an antenna 168 which is connected to one electrode of spark gap 160 through the impedance 164.

A spark gap of about 1 mm. biased by high voltage pulses produces an arc discharge and produces electrical signals through the antenna 168.

Such an electric signal can be selectively received by a receiver comprising an electric circuit matched with such electric signal, for example, a circuit comprised of several pulse circuits. Such remote controller does not need any electrical source and is much less expensive than a conventional transmitter.

The following description describes a fuel igniter comprising the novel impact device according to the present invention.

Referring to FIG. 14, reference character 20 indicates an impact device for a piezoelectric element according to the present invention and one electrode 40 of the piezoelectric element is connected to a discharge gap 196 through an impedance 194. A grounded electrode 162 is connected to another electrode of said discharge gap 196. A fuel reservoir 190 is connected to a nozzle 192 through a valve 188. The nozzle 192 is positioned adjacent to the gap 196. The operating case of impact device 20 is equipped with a stud 180 having a lever 182 coupled thereto so that the lever 182 rotates around a rod 184.

The movement fo the lever 182 is transmitted to the valve 188 through a connecting means 186. The discharge arc is produced between the spark gap 196 upon the depression of operating case. Simultaneously, the connecting means 186 causes the valve 188 to supply the nozzle 192 with fuel which is to be fired. One operation of this impact device generates plural discharge arcs and ensures the perfect firing of fuel.

Since the impact device acording to the present invention generates plural high voltage pulses having a constant output voltage and a controllable time interval between them regardless of the operation force and the speed, the impact device can be adjusted so as to ensure the ignition of the fuel and acts positively as an excellent igniter for fuel gas regardless of the manner of operation.

What I claim is:

1. A device for subjecting a piezoelectric element to an impact comprising a piezoelectric element; at least two hammers for giving an impact to said piezoelectric element; at least two springs engaged with said hammers for driving said hammers; operating means engaged with said springs and movable to a first predetermined position for energizing said springs; at least two locking means engaged with said hammers for temporarily blocking movement of said hammers; at least two unlocking means engageable with the respective locking means and the first of which is operatively associated with said operating means to said first predetermined position for releasing one of said hammers from one of said locking means, said one hammer having the other unlocking means operatively associated therewith for releasing another of said hammers from said another of said locking means when said one of hammers is displaced to a second predetermined position, whereby said piezoelectric element is subjected to mechanical impacts at least two times at a predetermined time interval; and means coupled to said hammers, said springs, said locking means and said unlocking means to return all of said means to the normal position after said hammers have applied to mechanical impacts to said piezoelectric element.

2. A device as claimed in claim 1, wherein said impact device further comprises shifting means coupled to said unlocking means operatively associated with said another locking means for shifting said second predetermined position.

3. A device as claimed in claim 1, wherein said at least two hammers move on a straight line by the compression force of said at least two springs.

4. A device as claimed in claim 3, wherein said another of unlocking means comprises a lever driven by said one of hammers at said second predetermined position for releasing of another of said hammers from another of said locking means by said lever.

5. A device as claimed in claim 4, further comprising an eccentric shaft having said lever rotatably mounted thereon, whereby the vertical position of said lever can be adjusted.

6. A device as claimed in claim 1, wherein said at least two hammers are swingably mounted.

7. A device as claimed in claim 6, wherein said device further comprises shifting means having a shift lever located between one of said hammers and another of said unlocking means and having a position transferring means coupled to said shift lever by which said shift lever is moved and said second predetermined position can be changed.

8. A device as claimed in claim 1, wherein said device further comprises distance adjusting means coupled to said piezoelectric element for adjusting the distance between said piezoelectric element and said hammers at the normal position of these parts.

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