

Description

[0001] This invention relates to lighters, particularly but not exclusively cigarette lighters.

[0002] Conventional butane lighters comprise a lighter body including a reservoir containing butane or other suitable fuel, a mounting frame affixed upon the lighter body, a nozzle inserted through the mounting frame into connected relationship with the reservoir, a lever for actuating the nozzle, and a piezoelectric igniter or a more conventional mechanical igniter such as a striker wheel, flint and flint-spring combination. The igniter is positioned close to the rear end of the lever so that the igniter and the rear end of the lever may be actuated simultaneously or nearly so.

[0003] While the traditional mechanical igniter with a striker wheel and flint can still be found in the marketplace, the butane lighter equipped with a piezoelectric igniter has become very popular. Instead of using a striker wheel and flint, a modern lighter is equipped with a piezoelectric unit which draws a spark when operated. The piezoelectric unit is typically activated by a thumb-operated push cap which not only operates the lever for actuating the nozzle, but also operates the piezoelectric unit to draw a spark, causing a flame to shoot upward from the lighter.

[0004] Piezoelectric igniters are popular because the spark which they draw is very predictable compared with the older mechanical igniters.

[0005] Another reason for the popularity of modern lighters is that the height of the flame produced by the lighter can be varied over a wide range by varying the amount of fuel allowed to be ejected from the lighter. However, this feature also makes such lighters dangerous. When the lighter produces a flame in an uncontrolled circumstance, particularly when the lighter is set on its high setting, materials such as curtains, clothing or hair may be accidentally ignited. Modern butane lighters are particularly dangerous in the hands of children.

[0006] There have been several prior disclosures of lighters intended to discourage use by children, for example US 5854530 and US 5228849. These are complex mechanisms so that conventional components are not employed in their manufacture.

[0007] According to a first aspect of the present invention, a child resistant lighter comprises a piezoelectric igniter contained within a body structure;

the lighter having a push button adapted to release gas and actuate the igniter to generate a spark;

wherein the igniter comprises an actuator rod and a coaxial housing, the rod being coaxially slidable from an extended position into the housing against the restoring force of a first spring located within the housing to generate a spark, the spring biasing the rod towards the extended position;

the housing including an abutment adjacent the actuator rod;

wherein a second spring is located around the ac-

tuator rod,

the second spring being guided longitudinally upon the rod,

a first end of the second spring engaging the abutment and a second end of the spring engaging the push button to create a restoring force to urge the button into the fully extended position.

[0008] The second spring is preferably helical.

[0009] The lighter of the present invention has a number of advantages. A conventional piezoelectric igniter may be used permitting economical use of readily available components without the need for a complex mechanism which may be difficult to manufacture and potentially unreliable.

[0010] The igniter and second spring may be conveniently provided as a unitary pre-assembled component allowing existing manufacturing processes to be easily modified to produce child resistant lighters. Expensive tooling modifications may be avoided.

[0011] According to a second aspect of the present invention a piezoelectric igniter for a childproof lighter comprises an actuator rod and a coaxial housing, the rod being coaxially slidable into the housing against the restoring force of a first spring located within the housing to generate a spark,

the spring biasing the rod towards an extended position,

the housing including an abutment adjacent the actuator rod,

a second spring being located around the actuator rod and engaging the rod preventing radial movement of the spring,

a first end of the second spring abutting the abutment.

[0012] The second spring is preferably helical.

[0013] The second spring is preferably secured to the actuator rod prior to assembly into a lighter. The spring may be secured by frictional engagement around the rod. The spring may be adapted to engage the rod before it is expanded radially by longitudinal compression during assembly. Alternatively, retaining means such as a small quantity of adhesive material or a retaining lug on the igniter body may be used.

[0014] The restoring force applied to the second spring on the push button urges the push button outwardly of the lighter body and provides a force which must be overcome before the push button can be depressed. Thus there may be no slack play or free movement in the operation of the push button to encourage a child to operate the push button. In contrast in prior art lighters a small amount of slack or free play may show a child how to actuate the lighter and may encourage use of greater force sufficient to cause ignition.

[0015] In preferred embodiments the total force applied by the first and second springs is not less than 3.8 kgf, preferably 5.7-6.3 kgf, more preferably 5.8-6.2 kgf.

[0016] In alternative preferred embodiments the total force is preferably equal to or greater than 3.5 kgf or

preferably 5.5-6.0 kgf.

[0017] The actuator rod is preferably cylindrical and dimensioned to fit snugly within the hollow of the second helical spring. The external diameter of the rod and internal diameter of the spring may be arranged so that the spring can pass freely over the rod when compressed longitudinally during assembly but engages securely when the longitudinal force is released. Little or no lateral movement or bending of the spring is allowed in use so that the whole of the restoring force is applied axially to the push button.

[0018] In preferred embodiments the length of the second helical spring may be greater than the distance between the abutment and the push button so that the spring is partially compressed even when the button is fully extended.

[0019] The invention is further described by means of example but not in any limitative sense, so that reference to the accompanying drawings of which:

Figure 1 is an exploded view of a piezoelectric lighter of the type known in the prior art;

Figures 1A and 1B depict the piezoelectric igniter unit shown in Figure 1 in greater detail;

Figure 2 is an exploded view of a piezoelectric lighter in accordance with the present invention;

Figures 2A and 2B show the push button in its normal unactuated state and in its actuated state, respectively;

Figure 2C is a bottom view of the push button or actuating lever;

Figure 3A is a side exterior view of the lighter, shown fully assembled;

Figures 3B and 3C are side-sectional views, partially cut away, showing the internal arrangement of the lighter; and

Figure 4 is a side sectional view of the piezoelectric igniter.

[0020] Figure 1 shows a conventional butane lighter. The butane lighter includes a push button 1 and a piezoelectric unit 2, 3. Butane fuel is stored in a fuel reservoir 9 in the lighter and can be released to ambient via a valve adjacent or near nozzle 8. Piece 5 is used to help keep the various components in proper alignment, to conveniently encase them in lighter body 10 and to help attach cap 11.

[0021] Elements 2 and 3 of the piezoelectric unit are moveable with respect to each other and when they do move, they induce an electrical charge through piezoelectric action to produce a flame when the lighter is lit

and the fuel is released. A piezoelectric unit 2, 3 is shown in greater detail in Figs. 1A and 1B. In Fig. 1A it is shown in its normal, unactuated state. In Fig 1B it is shown in its actuated (depressed) spark inducing state.

In normal operation, when the actuating lever or push button 1 is depressed, the piezoelectric device 2, 3 is actuated causing an electric current to be conducted through a conductor or conducting wire (not shown) to somewhere near the outlet of nozzle 8 as an ignition source. The depression of the push button and hence the actuating rod 2 simultaneously causes the rear part of gas lever 6 to move in a downward direction. As a result, the front part of the gas lever 6, which engages nozzle 8, moves upwardly causing nozzle 8 to raise and its associated valve to open. Of course, the opening of the valve allows the fuel to flow or release from the fuel reservoir 9 to fuel the aforementioned flame. Such operations are quite simple and the lighter can be easily mishandled by a child.

[0022] In prior art lighters of the type shown in Figure 1 a force of 1.5 to 2.0 kgf is required to depress actuating lever or push button 1 downward so as to move actuating rod 2 into the housing 3 inward causing a spark to be generated. A child typically possesses a thumb depressing force of up to 1.5 to 2.0 kgf and therefore a child can often operate the type of prior art lighter depicted by Figure 1.

[0023] Figure 2 shows a lighter in accordance with the present invention. It is generally similar to the lighter shown in Figure 1, but is provided with a second helical spring 4 which acts against the manual operation of push button or actuating lever 1. The push button 1 and actuator rod 2 of piezoelectric igniter 2, 3 are modified to accommodate a second helical spring 4.

[0024] After the second helical spring 4 is duly mounted onto push button 1 and piezoelectric unit 2, 3 and the remaining parts are assembled, as also shown in Figures 3B and 3C, with helical spring 4 disposed about actuator rod 2. Actuator rod 2 preferably has a cylindrical or columnar shape. The bottom portion 4B of spring 4 rests on shoulder on abutment 3A of piezoelectric igniter unit 2, 3. The top 4A of spring 4 engages a shoulder or other surface 1B in the interior of push button 1. Push button 1 is shown in a cutaway view in the Figures 2A and 2B and in a bottom view in Figure 2C in order to show better the interior shoulder 1B which is preferably provided at the base of channel 1C of the push button 1 when practicing the invention.

[0025] Figure 2A shows the igniter, 3 push button or actuating lever 1 and spring 4 combination in its normal, unactuated position. When not assembled into a lighter the spring 4 preferably assumes its full normal length in an at rest position without providing any rebounding force.

[0026] In the first embodiment of the invention in an assembled lighter, the spring form is partially compressed so that an outwardly extending force is exerted on the push button 1 at all times. In an alternative em-

bodiment of the invention the length of the spring is selected so that the spring is not compressed by the interior surface of the push button 1 in the fully extended position so that an outwardly extending force is only applied to the push button when the latter is depressed in use.

[0027] The igniter and second spring may be provided as a single component to facilitate manufacture of the lighter. The second spring 4 may be secured to the actuator rod 2 by frictional engagement. For this purpose the internal diameter of the helical spring may provide a friction fit on the cylindrical actuator rod. For example the spring may be dimensioned to grip and engage the rod in the normal, extended state but may have a suitable diameter so that it can pass freely over the rod when slightly compressed during assembly of the igniter unit. Alternatively, or in addition the spring may be retained by means of an adhesive portion or by engagement with a lug or other locking means on the igniter body.

[0028] In order to ignite a flame, the top portion 1A of push button or actuating lever 1 is pressed downwardly, typically by the user's thumb. Actuator rod 2 of piezoelectric unit 2, 3 moves downwardly under the action of the projection 1B inside push button or actuating lever 1 and thus assumes the position depicted by Figure 2B. The movement of actuator rod 2 relative to housing 3 causes the piezoelectric effect to occur which in turn causes the lighter to be lit. The movement of actuator rod 2 also causes gas lever 6 to rock on its rounded front part 6A and against protuberances 12 as its arms 6C move in a clock-wise direction (compare Figures 3B and 3C) as the bottom edges 1D of push button 1 bear thereagainst. Only one protuberance 12 is shown for ease of illustration, it being understood that preferably two such protuberances would be provided, one on each side of the lighter. Gas lever 6 has a notch 6B which engages nozzle 8, lifting it when element 2 is pushed downwardly by the action of push button 1. The lifting motion of nozzle 8 causes its associated valve to open and gas to flow from the reservoir 9 in the base of the lighter. Gas flow from nozzle 8 is preferably conducted by a gas pipe 7 to the point of combustion at element 5.

[0029] When lighting a flame, the second helical spring 4 resists the downward movement of push button or actuating lever 1. Thus, the compression of spring 4 provides a rebounding, upwardly directed force against the movement of push button or actuating lever 1 and therefore the force required to operate the lighter is increased.

[0030] In a preferred embodiment the compression of spring 4 provides an upwardly directed restoring force which acts against the inner surface of the push button at all times including when the push button is in the fully extended position. This ensures that there is no slack or free play in the movement of the push button.

[0031] The piezoelectric igniter 2,3 includes a hammer 23A which impact a headpin 23B above ceramic

23C. The hammer 23A striking the headpin and hence the ceramic causes an electrical discharge to occur. The piezoelectric unit 2,3 typically includes a return spring 23D for urging element 2 away from element 3. Typically, the force required to overcome spring 23D is on the order of 1.5 to 2.0 kgf. It is preferred to use an auxiliary spring 4 in order to increase the force required to activate the lighter as opposed to merely increasing the spring constant of spring 23D. The reason for this is that increasing the spring constant of spring 23D could tend to shorten the life of the piezoelectric igniter unit 2,3. Thus, the use of an auxiliary spring 4 is preferred.

[0032] Preferably, the auxiliary spring 4 is selected such that the force required to light the lighter is at least 3.5 kgf and more preferably falls in the range of 5.5 to 6.0 kgf. A child typically does not possess enough strength to be able to operate push button 1 and also overcome the additional resistance provided by spring 4. An adult, on the other hand, can impart more than enough force using their thumb to overcome the resistance of spring 4 and cause element 2 of the piezoelectric unit to collide with components 23B and 23C of portion 3 of the piezoelectric unit to generate an electrical discharge and light a flame.

[0033] When the push button 1 is released, it returns to its normal position shown Figures 2A and 3B. This allows arms 6C to move in a counterclockwise direction allowing the valve associated with nozzle 8 to close and the flame to be extinguished.

[0034] Assuming that an auxiliary spring 4 is used to increase the force required to activate the lighter as discussed above, then a conventional piezoelectric igniter 2,3 may be used. Indeed, in practicing the present invention, the applicant prefers to use a conventional piezoelectric igniter 2,3. In the case of some prior art piezoelectric igniters 2,3, they induce a spark when the top element 2 of the piezoelectric unit is moved about 80% of its full possible stroke into element 3. As indicated above, the spring constant of auxiliary spring 4 is selected such that the total force required to activate the lighter, i.e. when the piezoelectric igniter 2,3 is at least 3.5 kgf.

Claims

1. A child resistant lighter comprising a piezoelectric igniter contained within a body structure;
the lighter having a push button adapted to release gas and actuate the igniter to generate a spark;
wherein the igniter comprises an actuator rod and a coaxial housing, the rod being coaxially slidable from an extended position into the housing against the restoring force of a first spring located within the housing to generate a spark, the spring biasing the rod towards the extended position;
the housing including an abutment adjacent

the actuator rod;

wherein a second spring is located around the actuator rod,

the second spring being guided longitudinally upon the rod,

a first end of the second spring engaging the abutment and a second end of the spring engaging the push button to create a restoring force to urge the button into the fully extended position.

2. A piezoelectric igniter for a childproof lighter comprising an actuator rod and a coaxial housing, the rod being coaxially slidable into the housing against the restoring force of a first spring located within the housing to generate a spark,

the spring biasing the rod towards an extended position,

the housing including an abutment adjacent the actuator rod,

a second spring being located around the actuator rod and engaging the rod preventing radial movement of the spring,

a first end of the second spring abutting the abutment.

3. A lighter or igniter as claimed in claim 1 or 2 wherein the second spring is helical.

4. A lighter or igniter as claimed in any preceding claim wherein the second spring is secured to the actuator rod.

5. A lighter as claimed in claim 1 or any claim dependent on claim 1 wherein the second spring urges the push button outwardly of the lighter body to provide a force which must be overcome before the push button can be depressed.

6. A lighter or igniter as claimed in any preceding claim wherein the actuator rod is cylindrical.

7. An igniter as claimed in claim 6 wherein the second spring is dimensioned to fit closely around the actuator rod.

8. A piezoelectric lighter in which a piezoelectric igniter contained in a body structure is responsive to downward movement of a push button to provide a spark to ignite gas being released through a valve to provide a flame wherein said piezoelectric igniter comprises an actuator rod and a coaxial housing in which the rod extends partially beyond the housing and is coaxially movable with respect to the housing, the housing having an upper end defining a shoulder, and a first spring is contained in the housing adapted to bias the rod to a maximum extended position with respect to the housing, the path of movement of the rod defining an axis which is an

axis common to the first spring contained in the housing and the housing is axially immovable relative to the body structure and the push button is positioned above and in contact with an upper end of the actuator rod and is axially movable relative to the housing to push the rod into the housing, further comprising:

a second spring surrounding the rod and having a first end in contact with the push button and a second end in contact with the shoulder of the housing so that when the push button is depressed, the second spring is compressed, the second spring being more resistant to compression than the first spring, whereby the degree of effort to activate the piezoelectric igniter is sufficiently great to render the piezoelectric lighter child resistant such that only a force exceeding the force required to compress the first spring is necessary to cause activation of the piezoelectric lighter.

9. The lighter as claimed in claim 8 in which the first and second spring provide a total force necessary to activate the piezoelectric igniter of at least 3.5 kgf.

10. The lighter as claimed in claim 9 in which a first and second spring provide a total force necessary to activate the piezoelectric igniter in the range of 5.5 to 6.0 kgf.

11. The lighter as claimed in any preceding claim in which the second spring is responsive by compression to depress the push button through the entire extent of travel of the push button whereby the exceeding force is present through the entire depressing travel of the push button until the piezoelectric igniter causes a spark.

12. A piezoelectric lighter comprising:

a gas container having an outlet valve through which ignitable gas is released;

a piezoelectric igniter having an actuator rod mounted for reciprocating movement within a coaxial housing and having a portion exterior to the housing and having a spring inside the housing biasing the rod to an extended position and resisting its movement to a retracted position, the piezoelectric igniter being operative to produce a spark when the actuator rod is sufficiently axially retracted into the housing;

a push button operative by depression to cause opening of said outlet valve and axial movement of the actuator rod in the retracting direction to produce a spark;

a second spring contributing a second predetermined force resisting depression of the push

button by a resisting force greater than that of the first spring, the second spring having one end in contact with the push button and a second end rigidly fixed with respect to movement of the push button;

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whereby said piezoelectric lighter is constructed and arranged such that the total force required to depress the push button is child resistant, by which a force exceeding the force necessary to compress the first spring is necessary to cause ignition of the piezoelectric lighter.

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13. The lighter of claim 12 in which the second spring surrounds the actuator rod and is compressed upon depression of the push button simultaneously with the axial movement of the first element in the retracting direction.

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14. The lighter of claim 13 in which the housing has an upper end defining a shoulder and an end of the second spring is in contact with the shoulder.

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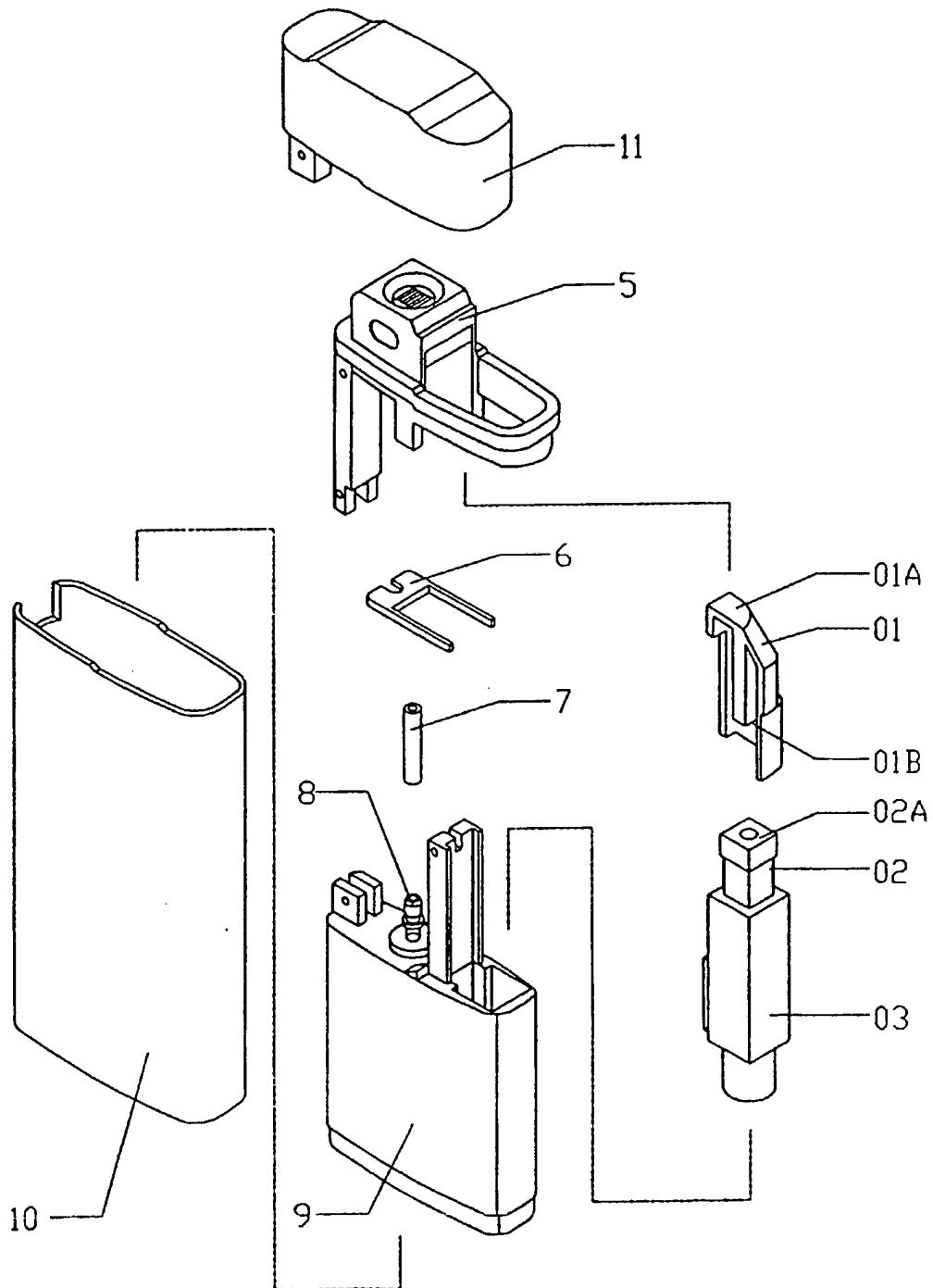


FIG 1

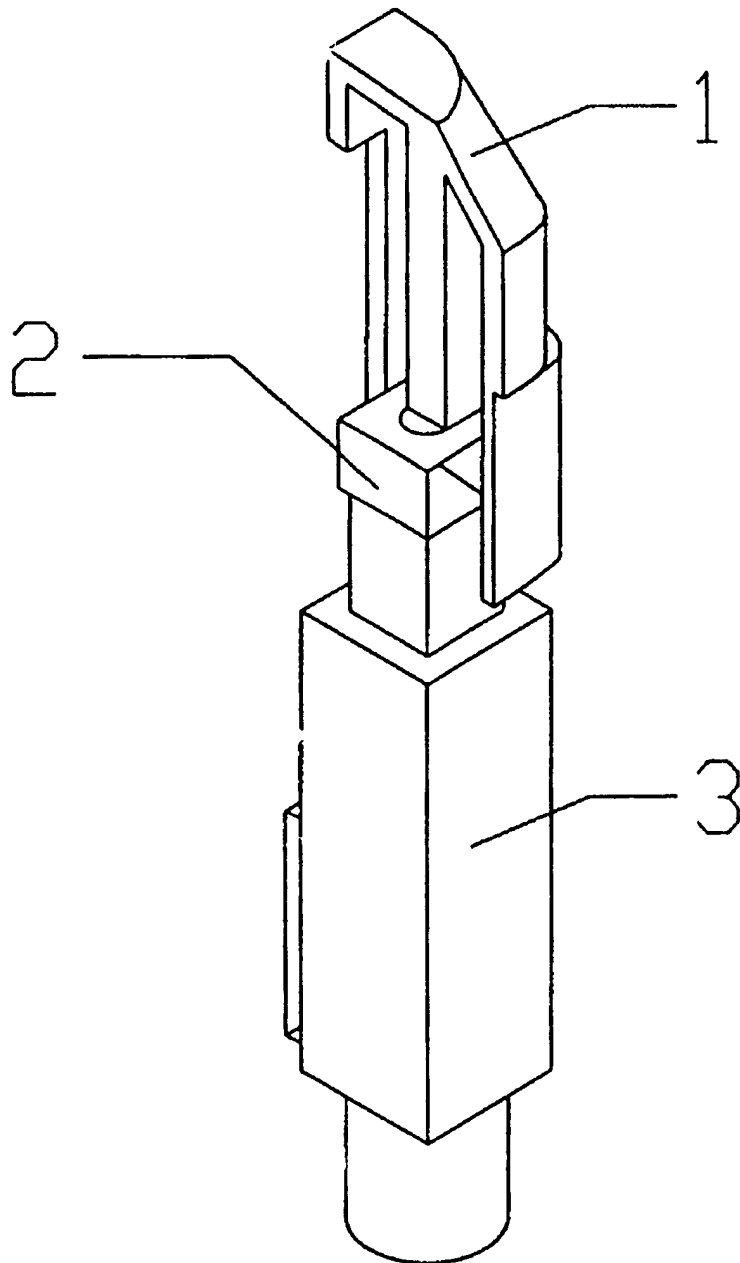


FIG 1A

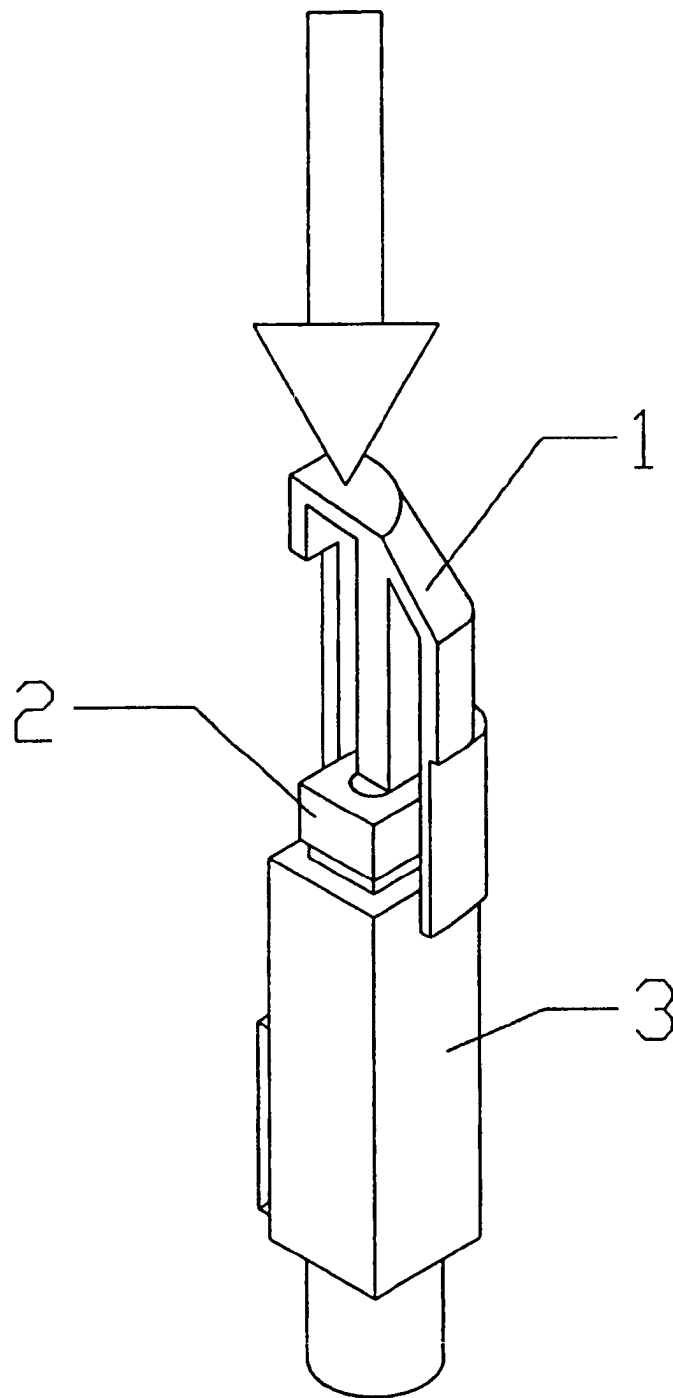


FIG 1B

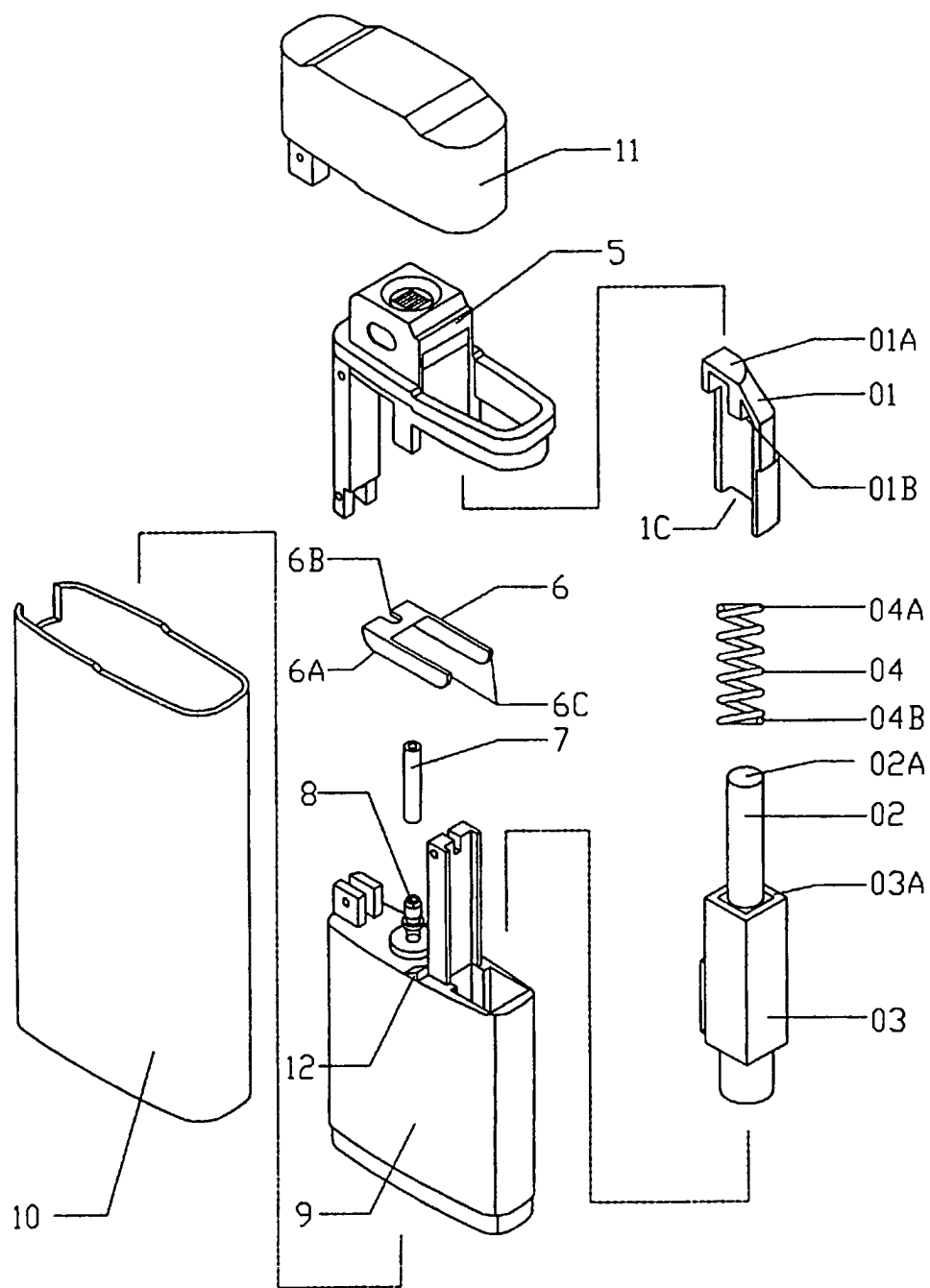
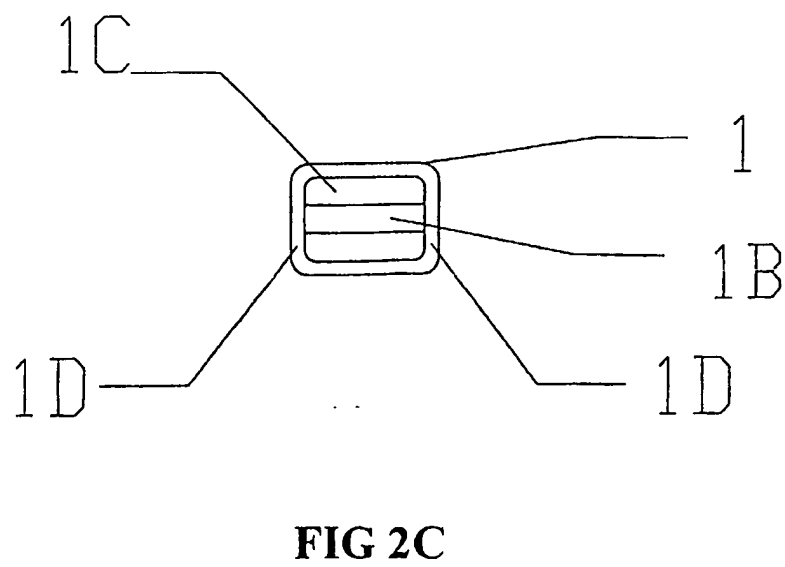
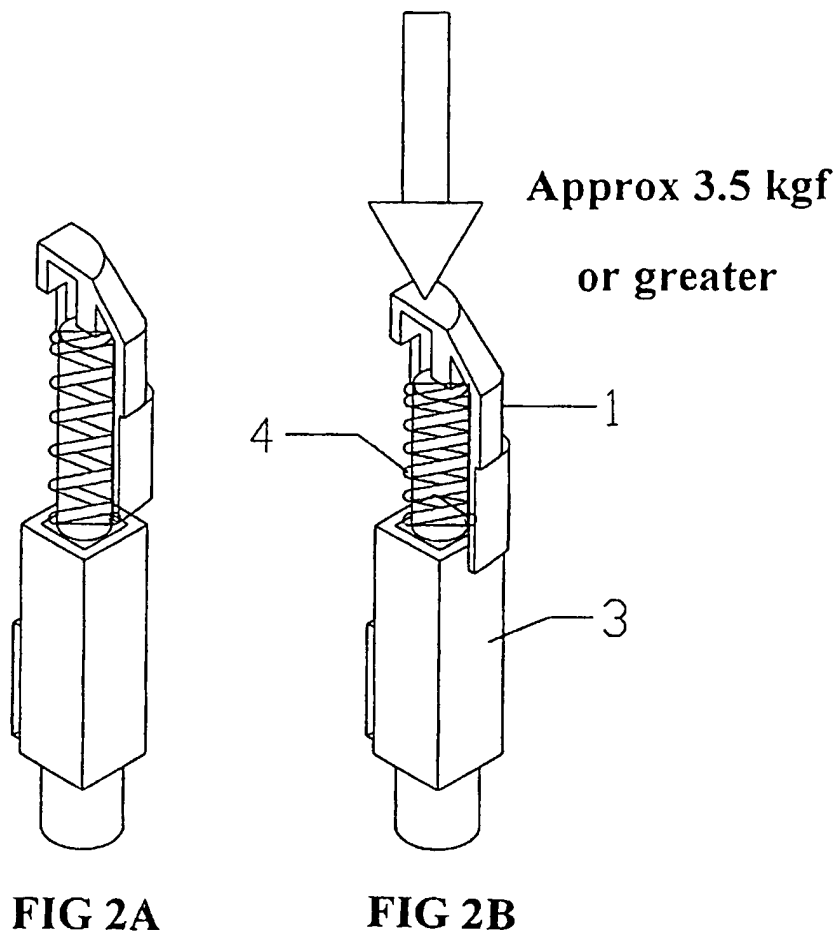


FIG 2



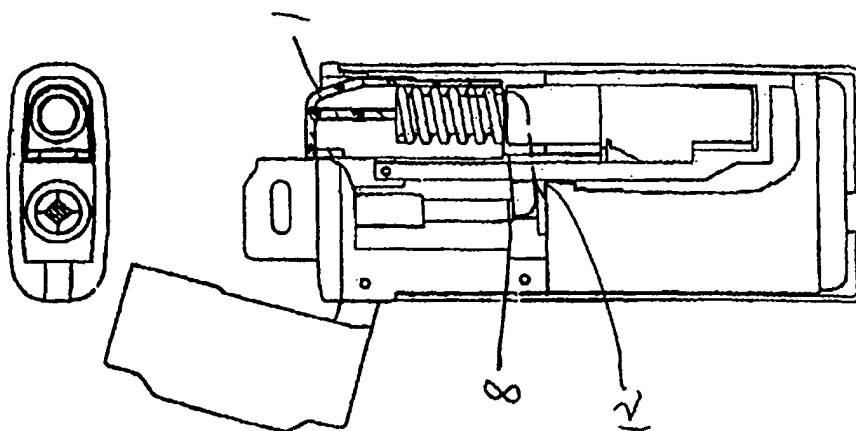


FIG. 3C

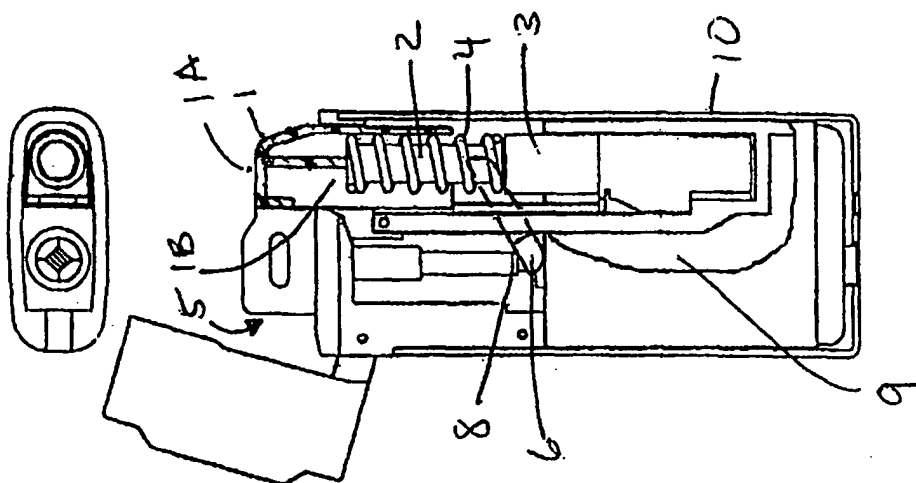


FIG. 3B

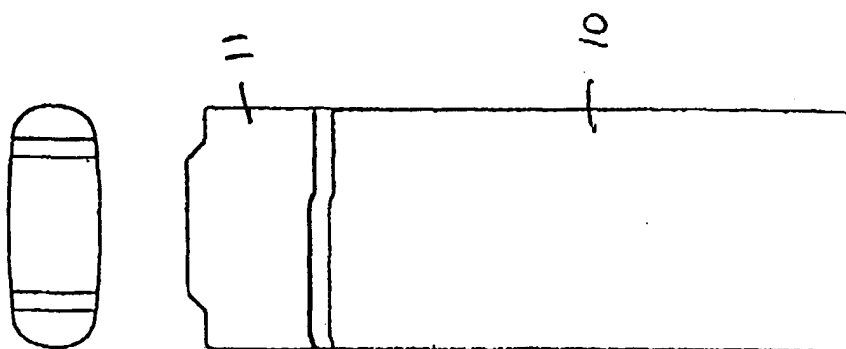


FIG. 3A

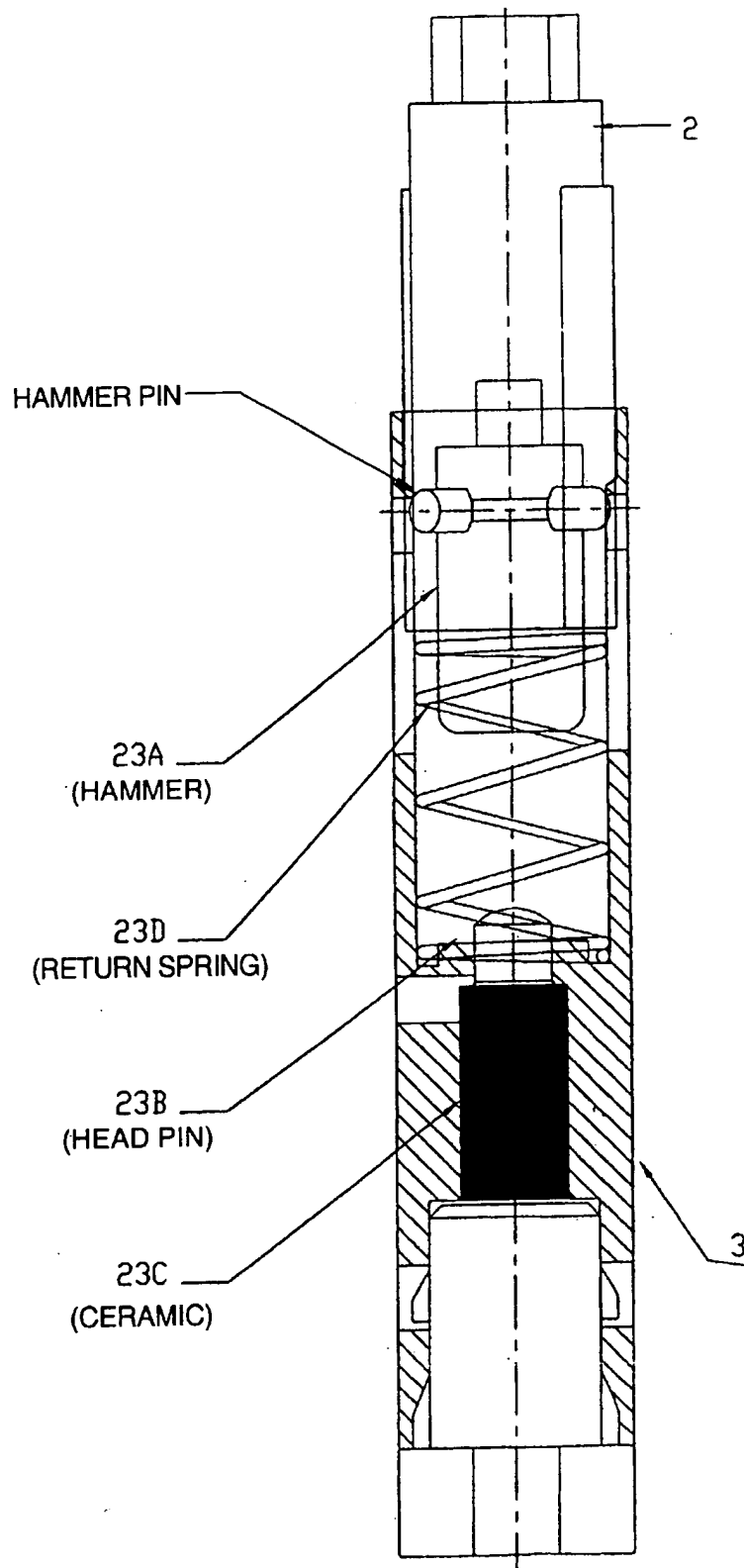


FIG 4



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 25 0686

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 2002/197577 A1 (SHER TAK CHI) 26 December 2002 (2002-12-26) * the whole document *	1-14	F23Q2/16
A	US 5 854 530 A (MEURY MARCEL ET AL) 29 December 1998 (1998-12-29) * claim 1; figure 3 *	1	
A	US 6 506 046 B1 (LUO YING WEN) 14 January 2003 (2003-01-14)		
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			F23Q
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		21 June 2004	Vanheusden, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date O : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 04 25 0686

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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