

June 10, 1969

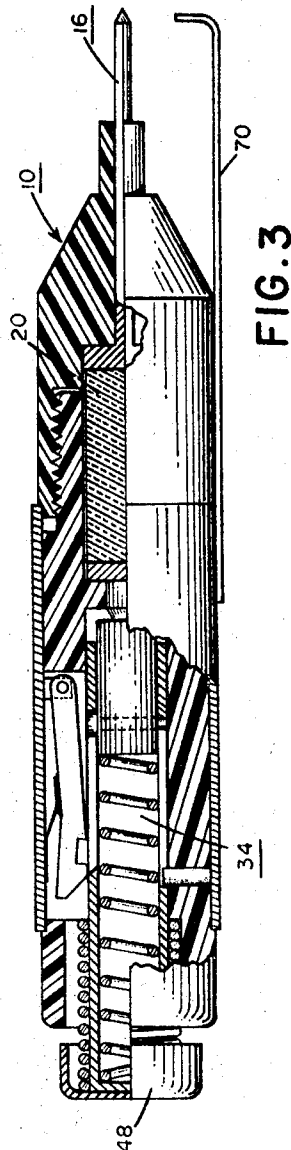
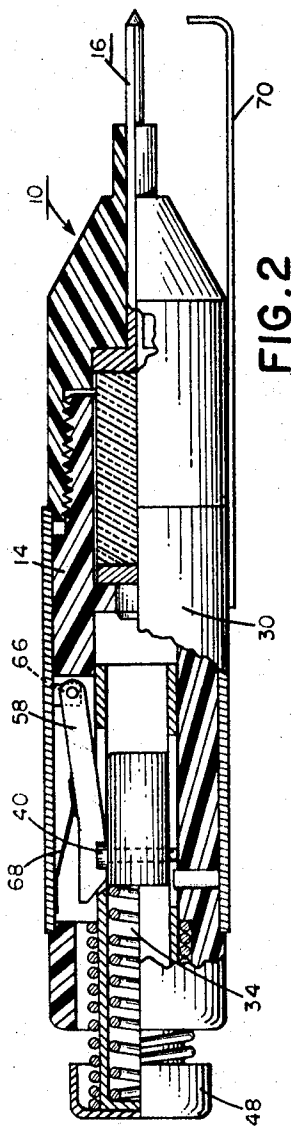
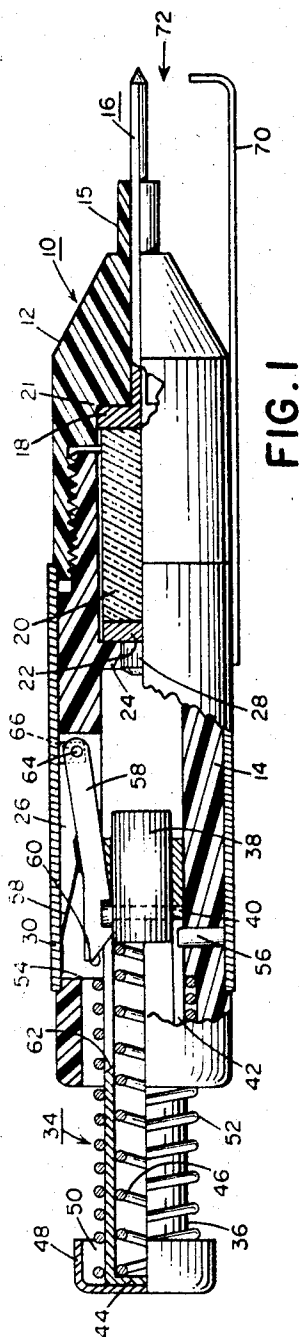
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3,449,637

PUSHBUTTON PIEZOELECTRIC IGNITER

Filed Dec. 29, 1967

Sheet 1 of 2



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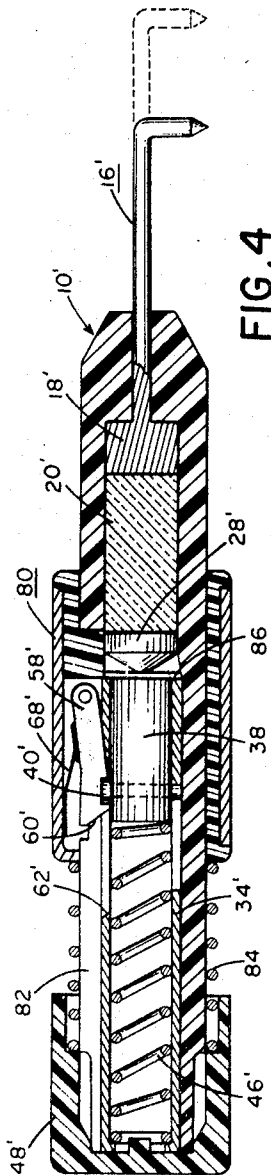


FIG. 4

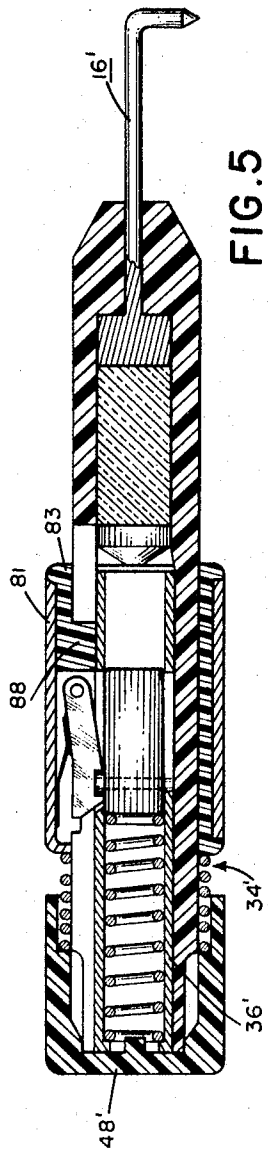


FIG. 5

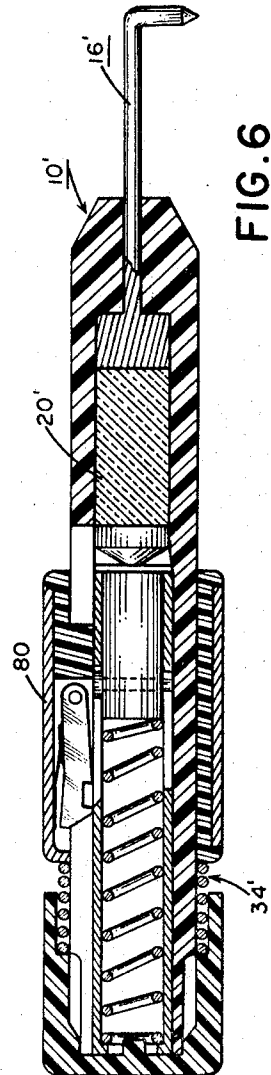


FIG. 6

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PUSHBUTTON PIEZOELECTRIC IGNITER

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10 Claims

ABSTRACT OF THE DISCLOSURE

A pushbutton piezoelectric igniter for manual actuation having an elongated tubular housing carrying a piezoelectric element which is actuated by impact. The impact mechanism is also generally tubular and includes a push rod carrying a spring biased hammer, a latch for restraining the hammer while the push rod is being depressed until the rod lifts off the restraining force and permits the hammer to suddenly strike the piezoelectric element. A modification includes a stationary outer sleeve telescoped over the housing so that the main body but particularly the electrode may be shifted into and retracted from the flame area.

This invention relates generally to piezoelectric igniters and more particularly to piezoelectric igniters of the type having a mechanism in which the piezoelectric element is actuated by means of a sudden hammer blow.

In the prior art piezoelectric igniters, as categorized in the preceding paragraph, are already known. Most of these devices are neither compact nor generally suitable for use in household gas appliances or the like. This type of application requires utmost simplicity of operation. It has also been found that at times the tip of the electrodes forming the spark gap are exposed continuously to the flame area of the device in which the igniter is employed and the exposure to excessive heat causes deterioration of the electrode.

It is therefore the primary object of this invention to provide a tubular, pushbutton type piezoelectric igniter of utmost simplicity.

It is a further object of this invention to provide a piezoelectric igniter of the type described in the preceding paragraph in which the electrode or electrodes forming part of the igniter can be moved into the area proximate to the source of gas which is to be ignited and can be retracted after ignition.

An aspect of the present invention resides in the provision of a pushbutton piezoelectric igniter which includes a longitudinally extending housing and a piezoelectric element which is carried in the housing and is responsive to pressure in the longitudinal mode to generate a voltage. The housing also contains a striking mechanism which is normally spaced relative to the piezoelectric element and is adapted to impart a sudden hammer blow upon the latter. The striking mechanism is housed within a tubular push rod coaxially disposed within the housing. A spring arranged between the striking mechanism and the relative end of the tubular rod is effective for biasing the striking mechanism toward the piezoelectric element. A latch initially restrains the movement of the striking mechanism while the tubular push rod is moved against the bias of the spring toward the piezoelectric element until the tubular rod causes the restraining force of the latch to be lifted and the striking mechanism to be free to impart a hammer blow to the piezoelectric element to generate a voltage.

Another aspect of the present invention resides in the provision of a piezoelectric igniter of the type described

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in the preceding paragraph in which, however, a tubular sleeve is telescoped over the housing for relative axial movement therewith and is adapted to carry one end of the latch so that the electrode extending centrally from the forward end of the element through the tip of the housing may be moved into and retracted from the ignition area.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

In the drawings:

FIGURE 1 is an axial view, showing partly in cross section, of the device in accordance with this invention;

FIGURE 2 is a view similar to FIGURE 1, illustrating the igniter with the push button actuator partly depressed;

FIGURE 3 is a view similar to FIGURE 1, illustrating the igniter with the push button completely compressed and just after the release of the hammer;

FIGURES 4 to 6 are views similar to FIGURE 1, illustrating in the same sequence as FIGURES 1 to 3, respectively, a modification of the present invention.

Referring now to the drawings and, more particularly, to FIGURES 1 to 3 thereof, there is shown a tubular, longitudinally extending housing 10, composed of plastic insulating material such as polytetrafluoroethylene or the like. The tubular housing 10 comprises at the forward end thereof a cap having a female thread to receive a rearwardly extending body 14 of the housing 10 which threadedly protrudes into the end cap 12. The end cap 12 is provided with an axial extension 15 to carry and support the hot lead 16. The hot lead or electrode 16 is an elongated wire which extends substantially beyond the terminal end of the axial extension 15 and may be formed in a number of ways, in the preferred embodiment the forward end thereof has a pointed end and the rear portion has an integral radial flange 18 which abuts against a shoulder 21 formed in the end cap 12 to prevent the axial or lateral movement of the electrode 16.

A piezoelectric element 20 of cylindrical configuration and composed of a poly-crystalline ceramic material such as barium titanite, lead titanite zirconate or the like is suitably polarized and electroded to respond to a compressive force in the longitudinal mode and the end opposite to the hot lead flange 18 or disc is grounded by means of a metal end disc 22. The predominant portion of the ceramic element 20 is embedded in the tubular body 14 while a forward end portion projects into the end cap 12. The disc 22 abuts a shoulder 24 of the housing 14 to prevent axial displacement of the piezoelectric element 20. The element 20 is loaded into the housing body 14 by removing the end cap 12 and by loading the body 14 with the disc 22, the element 20 and the electrode 16, all of these members being suitably in axial alignment.

The housing body 14 is formed with a slot 26 extending lengthwise parallel to the longitudinal device and in depths extending radially completely through the housing body 14 to accommodate a component of the actuating mechanism 34 which is hereafter further described.

The actuating mechanism 34 comprises a tubular rod 36 which in part is movably disposed within the tubular housing body 14, in coaxial fashion, and in a manner permitting reciprocatory movement. The tubular rod 36 or, as hereafter also referred to as push rod, slidably carries within the forward end thereof a hammer 38 of cylindrical configuration adapted for axial movement within the push rod. This movement is limited by a detent 40 extending transversely through the cylindrical body of the hammer 38. The hammer detent 40 traverses with-

in the confines of narrow, longitudinally extending slots 42 formed 180 degrees apart in push rod 36. The location of slots 42 and detent 40 and the geometric configuration of the hammer 38 are to permit the hammer 38 in its most forward position, as shown in FIGURE 1, to project axially beyond the push rod 36 in order to permit a hammer blow contact with metal striker pin 28 which is disposed in the tubular body 14 in bearing relation to the piezoelectric element 20 by abutting the ground disc 22.

The rear end of push rod 36 is provided with an integral end wall 44 and a helical compression spring 46 is interposed between the wall 44 and the hammer 38 in order to bias the hammer at all times in the forward direction. A pushbutton 48 is telescoped over the wall 44 with cylindrical wall portions thereof in radially spaced relation to the housing body 14 in order to form a space 50 therebetween. The tubular housing body 14 has a recessed diameter at the rear end so that a compression spring 52 can be placed helically around the push rod 36 and between the push button 48 and the shoulder 54 which results from the recess mentioned above. The function of the spring 52 is to bias the push rod 36 rearwardly at all times. A detent 56 in the form of a radially extending screw projecting into the slot 42 to limit the outward movement of the push rod 36 and to prevent an accidental ejection thereof.

With the springs 46 and 52 in place, the push rod 36 carrying hammer 38 assumes the position as shown in FIGURE 1, a latch 58 normally grips the detent 40 to restrain the movement of the hammer. The latch 58 is provided with a cutout which is generally complementary to the configuration of detent 40 and the rear end thereof has an inclined surface 60, substantially matching the slanted surface 62 of the wall defining the rearward limits of the slot 42 of the push rod body 36. In the preferred embodiment, the latch 58 is provided at the forward end with a transversely extending pin 64 which rests in a transverse cutout 66 in the circumference of the housing body 14; the latch 58 thus being rotatably anchored at one end by means of pin 64. The latch is free to move within slot 26 radially about the axis of pin 64. This radial movement is limited by means of a leaf-type spring 68 soldered at one end to the latch 58 and bearing against an outer tubular metal sleeve 30 which is part of the housing. The spring 68 is effective to bias the latch toward the hammer 38 and, more particularly, the detent 40.

The tubular metal sleeve 30 which is placed over the housing body 14, thereby covering the slot 26, securely receives one end of the ground electrode 70 the other end of which terminates proximate to the axial end of electrode 16 to establish an ignition spark gap therebetween.

In operation when the device is in a condition as shown in FIGURE 1, the push button 48 is pressed in relation to the housing body 14 thereby compressing, as shown in FIGURE 2, the spring 46 arranged between end wall 44 and the hammer 38 as well as the spring 52 disposed between the pushbutton 48 and the housing body 14. In this first stage of the operation, the latch 58 causes the hammer 38 to stay stationary relative to the housing body 14 while the push rod 36 moves relative thereto. In other words, the slots 42 in the push rod 36 permit the hammer 38 to be maintained in the position noted above.

FIGURE 2 illustrates a condition just prior to the lift-off of latch 58 due to the bearing contact of the slanted surface 62 of push rod 36 with the inclined surface 60 of the latch 58.

Additional forward movement of the push rod 36 causes the latter to release the restraining force of the latch 58 upon the detent 40 thereby releasing the potential energy of the spring 46 causing the hammer 38 to move against and impart a blow to the striker pin 28

which in turn causes the piezoelectric element to be compressed and to generate a voltage which is transmitted through the electrode 16 thereby causing the gap 72 to be ionized and the gas or the combustible material to be ignited. The release of the actuating force, which in most instances will be manual, causes the spring 52 to return the push rod 36 to its original position, at which point the device is in a position again for the next ignition cycle.

While the so-called hot lead of the electric circuit is composed of electrode 16, 18, the ground connection is circuitous and at the moment of impact and voltage transmission leads through the metal end disc 22, striker pin 28, hammer 38, detent 40, latch 58, leaf-type spring 68, tubular sleeve 30 and ground electrode 70.

The FIGURES 4 to 6 illustrate a modification of the device described in the preceding paragraphs and like reference characters are utilized to designate like or similar parts of the modified device except that a prime mark has been utilized for distinguishing purposes.

In the modified device, no relative axial movement takes place between the push rod 36' and the tubular housing member 10'. The end cap 12 has been deleted and the piezoelectric element 20' and associated parts are loaded into the tubular body from the rearward end of the housing. Thereafter the actuating mechanism 34' together with associated parts, such as the hammer 38', are inserted from the back into the tubular housing 10'. The restraining latch 58' works in the same manner as before discussed except that this member is carried by a circular sleeve 80 consisting of an outer metal tube 81 and an inner tube 83. The sleeve is telescoped over the housing body 10' and with a radial projection 88 extending from the inner tube 83 into and movable within a longitudinal slot 82 in the housing body 10'. A compression spring 84 is interposed between the pushbutton 48' and the sleeve 80 in order to retract the actuating mechanism 34'.

In the operation of the device shown in FIGURES 4 to 6 the sleeve, in the preferred manner of carrying out this invention, is held stationary and the pushbutton 48' is depressed in the direction of the sleeve causing the tubular housing 10' and the push rod 36' and, of course, the electrode 16', to be axially displaced relative to the sleeve 80 thereby compressing springs 46' and 84.

The dotted line in FIGURE 4 outlines the extent to which the electrode 16' is projected into (the high temperature flame area) and retracted from the area ignition takes place. An ignition gap is not shown but may be arranged as illustrated in FIGURE 1.

FIGURE 5 shows the device just prior to contact between the inclined surfaces 60' of the latch 58' and 62' of the push rod 36'. In FIGURE 6, a further depression of the pushbutton 48' has caused the latch 58' to be lifted off the detent 40' and the latch 58' now rests in the vicinity above the slanted surface 62'. The spring 46', after the restraining force of the latch 58' has been removed, causes the hammer 38' to suddenly strike the striker pin 28'. In this embodiment, a spring 86 is interposed between the hammer 38' and the striker pin 28' so that the compressive force is transmitted first through the spring 86 and only then through the striker pin 28'. The spring 86 is anchored with an interference fit in the tubular housing 10' to prestress the piezoelectric element 20' as desired.

The invention described above is particularly suitable as an igniter in gas appliances, gas lighters such as cigarette lighters, torches or the like. It is also obvious that the pushbutton may be modified to fit the particular application without deviating from the basic concept of this invention.

While there have been described what are at present considered to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made

therein without departing from the invention, and it is aimed, therefore, in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A pushbutton piezoelectric igniter comprising, in combination:
 - a longitudinally extending tubular housing;
 - piezoelectric element means disposed within said housing in electrical non-conducting contact with the latter and responsive to pressure in the longitudinal mode to generate a voltage;
 - striking means spaced relative to said element means and adapted to impart a hammer blow upon the latter;
 - a tubular member coaxially within said housing; said striking means being movably carried within said tubular member at the forward end portion thereof;
 - spring means between said striking means and the rear end of said tubular member for biasing said striking means toward said piezoelectric element means; latch means adapted for restraining the movement of said striking means;
 - a pair of electrode means, one end of each electrode means electrically connected to said piezoelectric element means and the other end of each electrode means forming a spark gap;
 - and manually actuated means on said tubular member for moving the latter against the bias of said spring means toward said element means while said latch means holds said striking means stationary until said tubular member releases the restraining force of said latch means causing said striking means to impart a hammer blow to said piezoelectric means to generate a voltage and to spark across said gap.
2. A pushbutton piezoelectric igniter according to claim 1, and one of said electrode means extending centrally from the forward end of the element means coaxially through the tip of the housing.
3. A pushbutton piezoelectric igniter according to claim 1, and an actuating pushbutton on the rear end of said tubular member.
4. A pushbutton piezoelectric igniter according to claim 3, and a helical compression spring coaxially sur-

rounding said tubular member and being interposed between said pushbutton and said housing to return said tubular member to its normal rearward position.

5. A pushbutton piezoelectric igniter according to claim 4, and a detent member within said tubular member and abutting said striking means adapted for causing said striking means to be returned rearwardly together with said tubular member.

6. A pushbutton piezoelectric igniter according to claim 1, a tubular sleeve telescoped over said housing for relative axial movement with the latter and adapted to carry one end of said latch means.

7. A pushbutton piezoelectric igniter according to claim 6, wherein said tubular member and said housing are caused to be moved relative to said tubular sleeve in response to actuation of said actuated means.

8. A pushbutton piezoelectric igniter according to claim 7, one of said electrode means extending centrally from the forward end of the element means coaxially through the tip of the housing, whereby upon actuation of said actuated means said electrode is axially displaced relative to said sleeve.

9. A pushbutton piezoelectric igniter according to claim 6, and an actuating pushbutton telescoped over the common rear end of said tubular member and the housing.

10. A pushbutton piezoelectric igniter according to claim 9, and a spring interposed between said pushbutton and said sleeve.

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U.S. Cl. X.R.

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