

Oct. 28, 1969

SHIGERU OCHIAI ET AL

3,475,654

PIEZOELECTRIC ELEMENT IGNITION DEVICE

Filed Oct. 8, 1967

3 Sheets-Sheet 1

Fig. 1

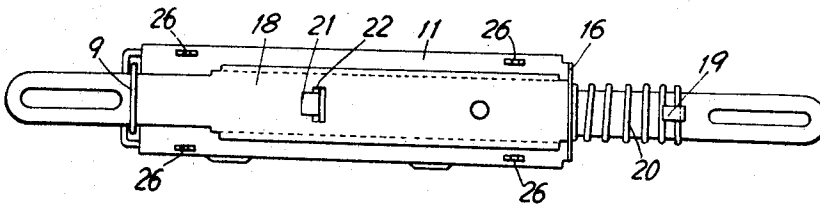


Fig. 2

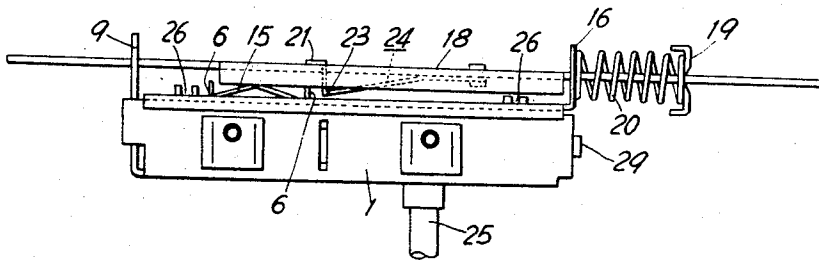
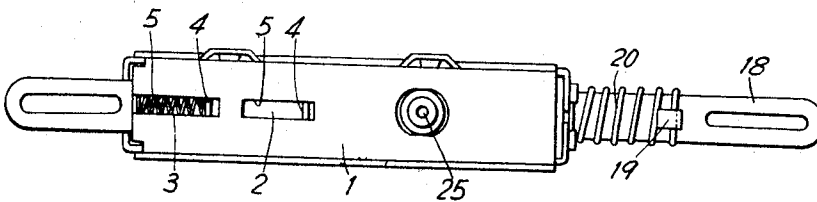


Fig. 3



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Fig. 4

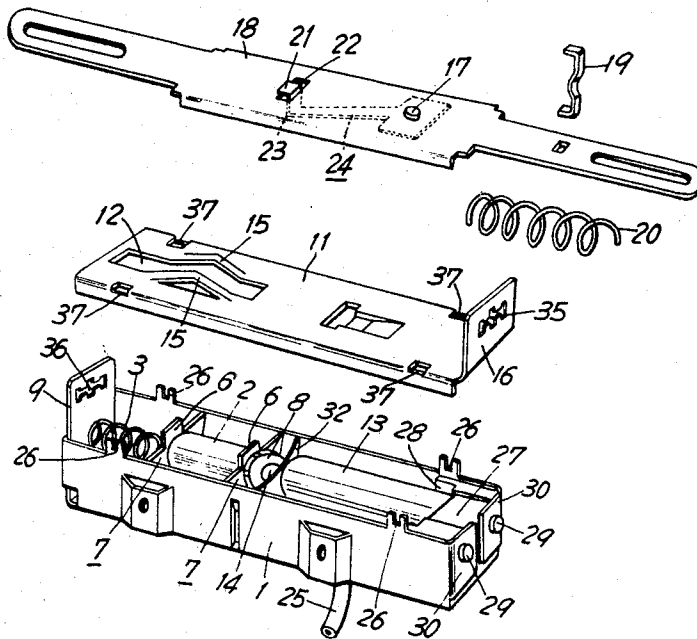
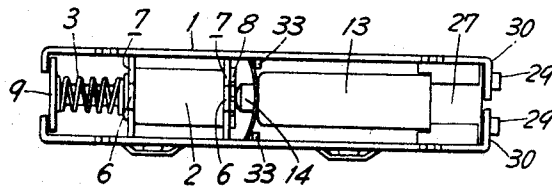


Fig. 5



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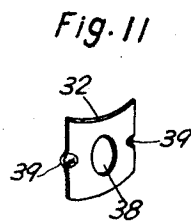
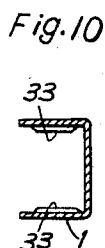
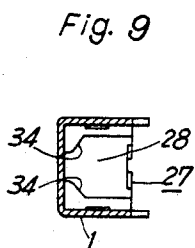
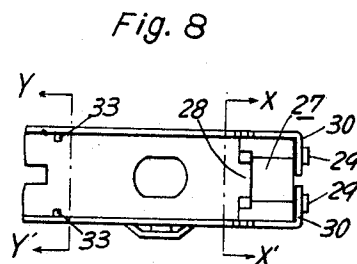
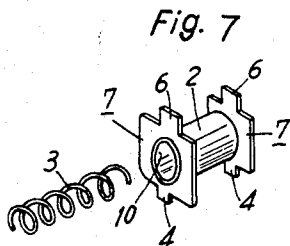
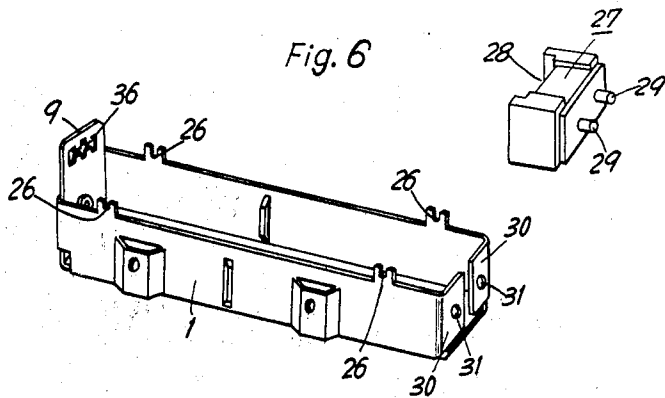
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PIEZOELECTRIC ELEMENT IGNITION DEVICE
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4 Claims

ABSTRACT OF THE DISCLOSURE

A piezoelectric ignition device having a simply formed box frame slidably mounting a biased, economically formed beater arranged to strike a piezoelectric element in the frame. The frame slidably supports an actuating lever which, when moved in one direction, moves the beater from the element, compresses a beater spring, and releases the beater to strike the element and cause ignition.

DESCRIPTION OF THE INVENTION

The present invention relates generally to an ignition device using a piezoelectric element, and particularly concerns a beating device and actuating lever for such an element.

There have been many ignition devices using piezoelectric elements for both automatic and manual operation. However, most of these devices have been complicated structures and operation has not been sufficiently reliable. The present invention satisfies the desire for a simple structure having a reliable action.

Accordingly, it is an object of the invention to provide a piezoelectric element beating device of simple design and low cost.

Another object is to provide such a beating device which is reliable in operation and which remains reliable over a long service life. In more detail, it is an object to provide a device of the above kind with an actuating lever which positions, tensions and releases a beater in one stroke of the lever.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIGURE 1 is a plan of an ignition device embodying the invention;

FIG. 2 is a side elevation of the device shown in FIG. 1;

FIG. 3 is a bottom view of the device shown in FIG. 1;

FIG. 4 is an exploded perspective of the device shown in FIG. 1;

FIG. 5 is a plan of the box frame portion of the device shown in FIG. 4;

FIG. 6 is an exploded perspective of the box frame shown in FIG. 5;

FIG. 7 is an exploded perspective showing the beater and spring of the device of FIG. 1;

FIG. 8 is a fragmentary plan showing a portion of the frame appearing in FIG. 6;

FIG. 9 is a section taken approximately along the line X-X in FIG. 8;

FIG. 10 is a section taken approximately along the line Y-Y in FIG. 8; and

FIG. 11 is a perspective view of a plate utilized in the device of FIG. 1.

While the invention will be described in connection with a preferred embodiment, it will be understood that we do not intend to limit the invention to that embodiment. On the contrary, we intend to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Referring now to the drawings, there is shown a preferred form of ignition device including a beater 2, a spring 3 for operating the beater and a piezoelectric element 13 opposing the beater, all located in a box frame 1. The bottom of the box frame is provided with guide slots 5 that receive lower guide projections 4 connected to the beater 2.

Fixing plates 7 define the opposite ends of the beater 2 and the plates have upper and lower guide projections 6, 4. One end of the spring 3 bears on a head portion 8 of the beater 2 by the spring being passed through a cylindrical opening 10 in the beater. The opposite end of the spring is abutted on the inside surface of an end wall 8 of the box frame 1 (see FIG. 5). The piezoelectric element 13 is held in a recess 28 of a base plate 27; that is, the end portion of the element 13 is wedged between tapered portions 34 formed at the bottom of the recess 28 (see FIG. 9).

The base plate 27 has projections 29 on the opposite side of the recess 28, and the projections extend through perforations 31 provided in the side walls 30. The base plate 27 is fixed to the box frame by calking or upsetting the projections 29.

The beater 2 is slidably mounted in the box frame 1 for movement along the axis of the spring 3 between the piezoelectric element 13 and the end wall 9. For this purpose, the upper and lower guide projections 6, 4 are fitted in the guide slot 5 of the box frame 1 and in a guide slot 12 in the cover 11. The head portion 8 of the beater 2 is normally positioned against an end portion 14 of the piezoelectric element 13.

On both sides of the guide slot 12 a pair of cams 15 are formed integrally with the cover 11. An actuating lever 18 is slidably mounted through an opening 35 provided in the end wall 16 of the cover 11, and through an opening 36 provided in the end wall 9 of the box frame 1. A spring 20 is held between the end wall 16 and a spring stopper 19 fixed to the lever 18. The spring 20 thus establishes a normal inactive position for the lever 18, which is to the right in the drawings.

A deflectable hook spring plate 24 is fixed on the inner surface of the lever 18 at 17 so that the free end 21 of the spring plate 24 is movably engaged within an opening 22 provided on the actuating lever 18. The spring plate 24 has a bent portion 23 which is adapted to pass over the cams 15 when the lever 18 is moved in opposition to the spring 20. The ignition device also has a conductor 25 connected to the piezoelectric element 13. The box frame 1 has fork-shaped protrusions 26 for receiving the cover 11, and the cover 11 has holes 37 which fit over the protrusions 26.

A curved elastic plate 32 holds one end of the piezoelectric element 13 to the base plate 27. The plate 32 has a central opening 38 provided for receiving the end 14 of the element 13, and the plate also has protrusions 39 at each edge which are fitted on projections 33 formed on the inner surface of the box frame 1. The plate 32 thus positions the piezoelectric element 13.

In operation, the actuating lever 18 is slid to the left in the drawing against the force of the spring 20 by an actuating mechanism (not shown). The bent portion 23 of the hook spring plate 24 engages the upper projection 6 of the beater 2 and, when the actuating lever 18 is moved further to the left, the beater 2 is moved left along the guide slot 12 against the force of the spring 3.

Movement of the lever 18 and the beater 2 leftward continues until the bent portion 23 of the hook spring plate 24 is lifted by the cams 15 on the cover 11, and when the bent portion 23 reaches the top of the cams 15, the portion 23 clears or is lifted from the projection 6.

As soon as the portion 23 clears the projection 6, the

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beater 2 is driven rapidly to the right by the compressed spring 3 and the head portion 8 of the beater 2 sharply strikes the end portion 14 of the piezoelectric element 13. When the piezoelectric element 13 is thus beaten, electricity is generated and sparks can be seen between the conductor 25 and any convenient electrically grounded element. The sparks cause the desired ignition in the gas appliance with which the device is associated.

It will be seen that the parts described above can be economically formed of sheet metal and easily secured together using the means described above and the configurations shown in the drawings. The interlocking parts making up the ignition device securely hold their relative positions and thus the device, despite its low cost, remains efficient and reliable over a long period.

We claim as our invention:

1. A piezoelectric element ignition device comprising, in combination, a box frame having at one end thereof an end plate provided with an opening therein, a cover having at the opposite end to said end plate a second end plate provided with an opening therein, an actuating lever mounted slidably through said end plate openings, a piezoelectric element in said box frame, ignition means electrically connected to said piezoelectric element, a beater in said frame adapted for engagement with said lever, and a spring urging said beater against said element, said lever being adapted to move said beater against the force of said spring and release said beater to cause the beater to compress the piezoelectric element and energize said ignition means said box frame having a plurality of fork-shaped protrusions on the side walls thereof, said box frame and said cover being coupled by engaging said protrusions with holes in said cover.

2. The combination of claim 1 including a base plate having projections mounted in an end portion of said box

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frame by fixing the projections in a side wall of the box frame, and the end portion of said piezoelectric element being held in a recess formed on said base plate.

3. The combination of claim 1 including fixing plates each having an upper and lower projection secured at each end of said beater, said beater having a cylindrical body and a head portion, said spring being inserted in the cylindrical body portion of said beater, one end of said spring being abutted on the inside surface of said head portion and the other end of said spring being abutted on an end plate of said box frame, said beater being slidable against the force of said spring, said upper and lower projections being guided in guide slots provided on said box frame and cover, and the head portion of said beater being faced against one end of said piezoelectric element.

4. The device of claim 1 including a curved elastic plate having an opening and being in said box frame, one end portion of said piezoelectric element being inserted into said opening in the curved elastic plate, said plate having protrusions formed on both sides, and said box frame having projections formed on the side walls and being engaged by said protrusions.

References Cited

UNITED STATES PATENTS

3,200,295	8/1965	Owens et al.	310—8.7 X
3,298,421	1/1967	Tezuka et al.	317—81 X
3,307,053	2/1967	Furth	310—8
3,387,912	6/1968	Goto	431—130

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U.S. Cl. X.R.

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