

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) SMOKERS' LIGHTERS

(71) We, MANSEI KOGYO KABUSHIKI KAISHA, a Joint Stock Company organised under the Laws of Japan, of 3035 1-Chome Kamiaoki-cho, Kawaguchi City, Saitama Prefecture, Japan do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

- 10 This invention relates to smokers' lighters. According to the invention a smokers' lighter comprising a casing having an open end, a cap pivotally mounted on the open end of the casing, a fuel reservoir housed in the casing and a piezoelectric voltage generating device disposed parallel to the reservoir and partially within the casing, said device incorporating at least one piezoelectric element, a spring-loaded striker for striking the element and means to operate the striker, which means, in the normal inoperative condition of the lighter, extend beyond the open end of the casing, the device being adapted, when operated to generate a potential difference and cause a spark to strike across a gap between a pair of spaced electrodes so as to ignite fuel flowing from the reservoir.

- 25 Other features of the lighter are claimed in our Application No. 37205/68 Serial No. 1234412 from which this Application has been divided.

- 30 Thus the operating means is protected from inadvertent use when the cap is closed but is easily accessible for manual operation when the cap is opened. Also it is possible to withdraw the voltage generating device from the casing without disturbing the fuel reservoir.

- 35 An embodiment of the invention will now be described as an example with reference to the accompanying drawings, in which:

40 Figure 1 is a vertical section through a smokers' lighter standing upright with a hinged cap on top;

- 45 Figure 2 is an enlarged perspective view of an electrode support incorporated in the lighter of Figure 1: and

Figure 3 shows a lighter of Figure 1 in its operated state.

The lighter shown in Figures 1 to 3 of the drawings, comprise an upright casing 1 the top end of which is open and a tank or reservoir 2 which is fixed within but is narrower than the casing, extends vertically upwards from the bottom wall and is in contact with one side wall of the casing through a distance in excess of one half of the casing depth, and is adapted to receive and discharge a supply of pressurized and liquefied gaseous fuel.

A fuel discharge valve 3, of known construction extending vertically through the reservoir, has a peripheral port (not shown) whereby communication is established between the interiors of the valve 3 and the reservoir 2, and is provided with an axially reciprocable discharge nozzle 3a which projects through and beyond the upper end of the valve and is loaded by a spring (also not shown) provided internally and urging the nozzle 3a outwardly of the valve so as to open the latter when the lighter is operated.

The lower end of the valve 3 is fixed in the bottom wall of the casing 1 which wall also constitutes the bottom wall of the reservoir 2, and its upper end extends through the top wall of the reservoir so as to locate the nozzle 3a above the reservoir. A known fuel-filler valve 4 fixed in and extending upwardly from the bottom wall of the casing 1 into the interior of the reservoir at a position laterally spaced from the valve 3, has a central passage extending through the length thereof to enable fuel to be fed into the reservoir.

Since the construction and operation of the valves 3 and 4 are known and do not constitute part of the present invention, detailed descriptions of these valves are omitted.

The base 5c of a U-shaped electrode support 5 is fixed on and externally of the top wall of the reservoir 2 by a screw 6 which is screwed into a tapped hole (not shown) in the said top wall and a tapped blind axial bore of a pillar 5' which depends from the under-

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side of the wall internally of the reservoir. The electrode support 5 has, laterally of the pillar 5', a circular hole 7 through which the upper portion of the valve 3 extends and its arms 5a and 5b (of which the former is wider than the latter) extend vertically upwards from the opposite ends of the base 5c.

A shallow cap 8 of the same cross-section as the casing is hinged, at 10, upon the upper edge of the side wall of the casing adjacent the fuel reservoir. The cap 8 is provided with a bracket 9 which is fixed to the inner surface of its top wall adjacent its hinged end and which projects beyond its lower edge. The bracket 9 supports a transverse pin 11 which engages a recess in one of the two closed ends of a substantially horizontal two-part telescopic cylinder 12 located laterally of the nozzle 3a and containing a coil spring 13. The spring 13 urges the two parts of the cylinder 12 in the direction which extends the cylinder so as to retain the recess in rolling engagement with the pin 11 and limits the spring driven movement of the recessed cylinder part. The other closed end 12a of the cylinder 12 is tapered outwards and is slidably received in and makes rolling contact with the inner wall of a pocket 5a' in the inner surface of the arm 5a of the electrode support 5.

A horizontal valve control member 14 is supported, at one end, on an upwardly extending and vertical flange of a substantially L-shaped bracket 16 the other and horizontal flange of which is fixed to the upper surface of the base 5c of the electrode support 5 by the above-mentioned screw 6. The supported end of the control member 14 is provided with an opening which is of greater area than that of the cross section of, and is engaged by, the upper part of the upwardly extending flange of the bracket 16. A stressed leaf spring 15 is secured, at one end, to the upper surface of the valve control member 14 and the other end of the spring is abutted against the underside of the cylinder 12. The other end to the supported end of the valve control member 14 has an opening in which the nozzle 3a is received and the nozzle has a circumferential shoulder on which the said member seats so that the stressed spring 15 is adapted to drive the nozzle inwardly of the discharge valve in opposition to the force of the nozzle loading spring within the valve so as to close the latter. The arrangement is such that when the cap 8 is in its closed position as shown in Figure 1, the control member 14, assisted by the spring 15, drives the nozzle inwardly of and closes the discharge valve whereas, when the cap is swung into its open position as shown in Figure 3, the nozzle is displaced axially by its loading spring, in the direction which opens the valve and allows fuel to flow from the reservoir through and out of the nozzle 3a.

A voltage generating device provided partially within the casing, extends upwardly

from the bottom wall of the casing to a position short of the top wall of the cap 8, between the reservoir and the side wall of the casing remote from the hinge 1. Thus the device is disposed parallel to the reservoir and spaced from the hinge by the reservoir. The voltage generating device comprises a piezoelectric assembly 17 having an impact receiving top end 17a and a cup shaped positioning member 18 having a depending extension 18a which is received and fixed in a hole 1a in the bottom wall of the casing 1 so as to hold the assembly 17 in position. The piezoelectric assembly 17 includes an aligned pair of conventional piezoelectric elements between the adjacent ends of which a current conducting terminal 32 is interposed. The terminal serves as one pole of the piezoelectric assembly 17 and is provided with a lead wire 21 which is connected to an electrode 23 fixed in a mount 22 composed of electrical insulating material and, in turn, fixed on the internal surface of the arm 5a upwardly of the pocket 5a'. A resistance 31 is connected in the lead wire 21 between the piezoelectric assembly 17 and the electrode 23. The positioning member 18 serves as the other pole of the assembly 17 and is electrically connected through the casing 1 to another electrode 24 which extends through the other arm 5b of the electrode support 5. As seen in Figure 1 the electrodes 23 and 24 are arranged in alignment with each other and their adjacent ends are in a spaced relation so as to form a spark gap therebetween. The electrode 24 is so carried in the arm 5b that it may be moved toward or away from the electrode 23 to enable the width of the spark gap to be adjusted as desired or necessary. The piezoelectric elements are surrounded by a sheath 19 which is composed of electrical insulating material, and of which the lower end portion is threaded externally and is screwed into the interior of the positioning member 18. The sheath 19 is provided, between its ends, with a transverse partition 19a having a central hole 19b through which the impact receiving top end of the piezoelectric assembly 17 extends, and is formed upwardly of the partition 19a, with a longitudinal aperture 19c.

The operating means of the voltage generating device will now be described.

A cylindrical spring-loaded hammer or striker 20 is accommodated in and is adapted to reciprocate within and lengthwise of the sheath 19 upwardly of the partition 19a; the striker 20 is fixed upon the lower end of a shank which extends through and is slidable in a central hole in the base of a cup-shaped carrier 26 and of which shank the upper end is flared to form the head 20a whereby the shank is prevented from being withdrawn from the said central hole; the carrier 26 is accommodated in a slidable fit within an inverted,

thimble-like finger piece 25 which sockets on to and is slidable upon the upper end of the sheath 19. The opposite ends of a striker actuating, partially compressed coil spring 28 surrounding the striker shank, respectively, against the upper end of the striker 20 and the underside of the base of the cup-shaped carrier 26 so that the striker 20 is urged away from the carrier 26 and the shank head 20a is urged toward the internal surface of the carrier base. The carrier 26 is formed with an external annular shoulder and the opposite ends of a second and larger diameter, partially compressed, coil return spring 27 which surrounds the striker-actuating spring 28 and the lower portion of the carrier 26, abut, respectively, against the said shoulder and rim of the upper end of the sheath 19 so that the carrier 26 is urged into abutment with the top wall of the thimble-like finger piece 25. A lateral projection or stop 25a provided on and externally of the finger piece 25 at a position adjacent to but upwardly of the lower end thereof, abuts the base 5c of the electrode support below the arm 5a to limit the upwards spring driven travel of the finger piece 25, but enables the finger piece 25 to move downwardly when depressed manually against the force of the springs 27 and 28.

The lower end 29a of a catch 29 located externally and extending vertically along the sheath 19 having a nose 29c which extends through the aperture 19c to the interior of the said sheath 19, seats and is adapted to rock away from the sheath 19, upon an external shoulder of the positioning member 18. The upper end 29b of the catch is inclined downwardly towards the sheath 19 and is adapted to be engaged by the lower edge of the finger piece 25 when the latter is depressed manually through a predetermined distance so as to swing the catch 29 away from the sheath about its lower end 29a and thereby remove the nose 29c outwardly of the aperture 19c. The nose 29c of the catch is adapted to serve as a seat for the striker 20 and, when the finger piece 25 is at the limit of its spring driven upwards stroke, is urged inwardly of the aperture 19c to the interior of the sleeve and the underside of the striker by a bowed leaf spring 30 which is secured at, or substantially at, its mid point 30a to the side of the catch remote from the sheath so that the ends of the spring 30 abut the internal surface of the adjacent side wall of the casing, the spring 30 is compressed and stressed between the catch and the wall, the catch is pressed against the exterior of the sheath, and the striker seats upon the nose and is locked against downwards movement within the sheath.

To operate the lighter, first the cap 8 is swung upwards (that is to say clockwise as shown in Figure 1) about the hinge 10 by, for example, the thumb of the user's hand

in which the lighter is being held, to the fully open position shown in Figure 3. As the cap swings upwardly, the bracket 9 which is fixed thereto, turns about the axis of the hinge 10 and, acting through the pin 11, simultaneously telescopes the two part cylinder 12 against the action of the spring 13, and swings the said cylinder upwards and anticlockwise about its tapered end 12a which rocks upon the inner wall of the pocket 5a' after the cap 8 has been swung through a predetermined angular distance or portion of its full angular travel, the cylinder 12 and bracket 9 reach, and then move beyond, a dead centre position wherein they are in alignment, whereupon the spring 13 extends the cylinder and drives the cap rapidly to, and then retains it resiliently in, the said fully open position which is determined by the abutment of the bracket against the underside of a lug 5d (see Fig. 2) projecting laterally from the upper end of the electrode support arm 5b. In addition and as the telescopic cylinder rocks about its tapered end 12a, the leaf spring 15 fixed to the valve control member 14, is unstressed with the result that the pressure exerted by the said member on the shoulder of the discharge nozzle, is relieved and the nozzle is driven outwardly of the valve 3 by the internal spring of the valve thereby opening the valve and allowing pressurized fuel to be discharged, in gaseous form, from the reservoir through the nozzle, and to be jetted across the spark gap between the electrodes 23, 24.

As soon as possible after the discharge of fuel commences, the user of the lighter depresses, again for example by the thumb of the hand holding the lighter, the finger piece 25 with the result that, first, the carrier 26 is depressed and slides down the striker shank, secondly the striker actuating spring 28 and carrier return spring 27 are compressed, and thirdly the lower end of the finger piece 25 impacts and then rides downwardly of the inclined or bevelled upper end of the catch thereby swinging the catch about its lower end away from the sheath against the action of the bow spring 30, and withdrawing the nose 29c outwardly of the aperture 19c from the interior of the sheath and from below the striker. As the catch is rocked and as soon as the nose is clear of the striker, the latter is driven rapidly down the interior of the sheath by the compressed spring 28, into violent impact with the impact receiving end 17a of the piezoelectric assembly 17 with the result that the piezoelectric elements of the assembly are compressed, and a high voltage current pulse is generated and fed to the electrodes 23, 24, thereby creating a sufficient potential difference across the spark gap to enable a spark to strike across the gap and ignite the gasified fuel flowing from the nozzle.

The length of the striker shank is such that, during the operative stroke of the striker, the head 20a of the shank does not impact the carrier 26 and reduce the force exerted by the striker on the impact-receiving end of the assembly 17. On the other hand, the said length is such that, as the thumb-initiated or other depressive force is removed from the finger piece so that the carrier and finger piece are returned to their initial positions (determined by the abutment of the stop 25a against the base 5c of the electrode support) by the spring 27, the carrier base contacts the head 20a of the shank and returns the striker to its initial position, whereupon the catch is swung into contact with the sheath by the bow spring 30 and the nose of the catch passes to the underside of the striker thereby re-locking the latter against downwards movement.

The gasified fuel being discharged from the nozzle continues to burn until the cap 8 is swung back manually towards its fully closed position; during this reverse swinging movement of the cap, the bracket 9 rocks the telescopic cylinder about its tapered end 12a towards the horizontal position thereby re-stressing the spring 15 until the spring overcomes the action of the internal valve spring and, acting through the control member 14, depresses the nozzle and re-closes the valve so that the discharge of gasified fuel is terminated and the flame is extinguished. During the reverse swinging movement of the cap, the bracket 9 and cylinder 12 again reach and travel beyond their dead centre position whereupon the compressed cylinder spring 13 drives the cap to the said fully closed position with a snap action.

It should also be noted that the extension 18a is screwed or otherwise detachably secured within the hole 1a; hence by removing the screw 6 and the extension 18a from the hole 1a, the electrode support and the voltage generating device may be removed for inspection, repair or replacement. Further, once the electrode support has been removed, the discharge valve may be disconnected from the base of the casing and withdrawn through the top of the reservoir. Thus the construction of lighter is simple, economical and efficient.

Another example of a lighter of similar

construction is described in our co-pending application No. 37205/67 Serial No. 1234412 from which this application is divided.

WHAT WE CLAIM IS:—

1. A smokers' lighter comprising a casing having an open end, a cap pivotally mounted on the open end of the casing, a fuel reservoir housed in the casing and a piezoelectric voltage generating device disposed parallel to the reservoir and partially within the casing, said device incorporating at least one piezoelectric element, a spring-loaded striker for striking the element and means to operate the striker, which means, in the normal inoperative condition of the lighter, extend beyond the open end of the casing, the device being adapted, when operated to generate a potential difference and cause a spark to strike across a gap between a pair of spaced electrodes so as to ignite fuel flowing from the reservoir.
2. A lighter as claimed in Claim 1 in which the voltage generating device is detachably secured to the end of the casing remote from the open end.
3. A lighter as claimed in either Claims 1 or 2 in which movement of the cap operates a fuel discharge valve connected to the reservoir.
4. A lighter as claimed in Claim 3 in which a support for the electrodes is mounted on the reservoir in a position which locates the spark gap in the path of fuel flowing through and from the discharge valve.
5. A lighter as claimed in Claim 4 in which a member adapted to operate the discharge valve engages a telescopic cylinder of which one end is pivoted to the cap whereas the opposite end engages the electrode support so that the operating member is adapted to be actuated in response to angular movement of the cap.
6. A lighter as claimed in any of the preceding claims in which the voltage generating device is spaced from the pivotal axis of the cap by the reservoir.

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