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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, Kamiakochi, 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:—

This invention relates to smokers' lighters. In accordance with the invention, a smokers' lighter comprises a casing, a fuel reservoir housed with the casing, and a fuel discharge valve accommodated within and extending to the exterior of the reservoir to be adjacent a spaced pair of electrodes in electrical connection with one or more piezoelectric elements included in a voltage generating device which also includes a striker and a reciprocable finger piece which in the normal inoperative condition of the lighter extends to the exterior of the casing, and the striker is loaded by a spring interposed between itself and the finger piece and normally is held in spaced relationship to the piezoelectric element or elements, the finger piece being depressible to stress the spring and then release the striker so that the striker is driven into impact against the said element or elements to establish a spark creating electric potential across the electrodes and ignite gaseous fuel discharged from the valve.

Other features of the lighter are claimed in our Divisional Application No. 50365/70. In order that the invention may be understood and carried into practice more readily, reference will now be made to the accompanying drawings wherein:—

Fig. 1 is a vertical section of one preferred form of smokers' lighter constructed in accordance with the present invention, showing the lighter in its normal inoperative state; a hinged cap is situated at the top of the lighter;

Fig. 2 is a fragmentary perspective view, on an enlarged scale, of an electrode support incorporated in the lighter of Fig. 1;

Fig. 3 is a vertical section of the lighter

of Fig. 1 but showing the lighter in its operated state;

Fig. 4 is a vertical section of a smokers' lighter constructed in accordance with a modification of the present invention; and

Fig. 5 is a fragmentary perspective view, on an enlarged scale, of a voltage generating device incorporated in the lighter shown in Fig. 4.

The lighter shown in Figs. 1 to 3 of the drawings, comprises an upright casing 1 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 an 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 underside 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 ends of a stay comprises 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 Fig. 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 to its open position as shown in Fig. 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 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 10. 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 Fig. 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.

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 a head 20a whereby

the shank is prevented from being withdrawn from the said central hole; the carrier 26 is accommodated and is 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, abut, 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 towards 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 the 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 and 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 Fig. 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 Fig. 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 anti-clockwise 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.

5 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, 10 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 15 contacts the head 20a of the shank and returns the striker to its initial position, where 20 upon 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.

25 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 30 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, 35 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 40 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.

The modified lighter shown in Figs. 4 and 45 5 resembles the lighter shown in Figs. 1-3, differing from the latter mainly in that it comprises a modified or alternative voltage generating device.

The said modified lighter comprises an upright casing 101 which houses its component 50 parts. A tank or reservoir 102 fixed within the casing, extends vertically upwards from the bottom wall and in contact with one side wall of the latter through a distance in excess 55 of one half of the height of the casing, and is adapted to receive and discharge a supply of pressurized and liquefied gaseous fuel. A fuel discharge valve 103 (of known construction) contains a spring (not shown) and 60 is provided with an axially reciprocable fuel discharge nozzle 103a which projects from and co-axially of its upper end and, between its ends, with a port (also not shown) whereby communication is established between the 65 interiors of the valve and reservoir. The

lower end of the valve is fixed in the bottom wall of the casing 101 which wall also constitutes the bottom wall of the reservoir 102 and the upper end extends through the top 70 wall of the reservoir into the upper portion of the casing. A known fuel filler valve 104 extends vertically upwards through the bottom wall of the casing 101 into the interior of the reservoir at a position spaced laterally 75 of the valve 103. Since the construction and operation of the two valves of the modified lighter are known and are the same as those of the valves 3 and 4, detailed descriptions thereof are also omitted.

An electrode support 105 is fixed on and 80 externally of the top wall of the reservoir 102 by a screw 106 which extends through a plain hole in the base 105c of the support and is screwed into a blind, tapped bore of a pillar 105' which depends from the base 105c 85 through the said top wall into the interior of the reservoir. The electrode support 105 has, at a position spaced laterally from the pillar, a circular hole 107 through which the upper portion of the valve 103 extends and a 90 pair of parallel and laterally spaced arms 105a and 105b which extend vertically upwards from opposite ends of the base 105c through the top of the casing, the arm 105b 95 being narrower than the arm 105a and being provided with a laterally projecting lug at its upper end.

A cap 108 in which a bracket (not shown) similar to the bracket 9, is fixed, is pivoted at one end upon the upper edge of the casing 101 by a hinge 110. The said bracket has a 100 transverse and laterally projecting pin 111 fixed thereto. One closed and recessed end of a two-part telescopic cylinder 112 engages and is adapted to rock about the projecting 105 portion of the pin, whereas the other and closed end 112a of the cylinder is tapered and engages and makes rolling contact with the inner wall of a pocket 105a' in the internal surface of the arm 105a. Normally, and as 110 shown in Fig. 4, the telescopic cylinder is maintained in a substantially horizontal position. A coil spring 113 contained within the cylinder 112 urges the two parts of the cylinder in directions which tend to move the 115 closed ends away from one another and increase the length of the cylinder, the degree of such extension being determined by the distance between the pin 111 and the floor of the pocket 105a'. A normally horizontal 120 valve control member 114 is supported at one end by the upright flange of a substantially L-shaped bracket 116 of which the other and horizontal flange is fixed to the base 105c of the electrode support by the screw 125 106. The above one end of the valve control member 114 is formed with an opening (not shown) which loosely receives the upright flange of the bracket 116 and the said end is supported by and is adapted to rock upon 130

lateral shoulders of the flange. The opposite end of the valve control member is also formed with a suitably shaped opening through which the nozzle 103a extends and is supported by an external annular shoulder on the nozzle. The valve control member is further provided at a suitable position along its length, with an upwardly extending boss 114a around which the lower end of a coil spring 115 fits, the other or upper end of the said spring being in abutment with the underside of the cylinder 112 so that, normally (that is when the cap is in its fully closed position shown in Fig. 4) the spring acting through the member 114, depresses the nozzle downwardly against the action of the internal valve spring, and closes the valve. The provision of the coiled spring 115 has the advantage that should the component parts of the lighter have been formed with the dimensions slightly deviated from the requisite specification, the valve control member and the cap may operate effectively without difficulty.

The modified voltage generating device of the lighter shown in Fig. 4, comprises a piezoelectric assembly 117 which includes a vertically aligned pair of piezoelectric elements having a terminal 132 interposed between their adjacent ends. The piezoelectric assembly 117 has an impact receiving top 117a, is surrounded by an electrical insulating sleeve 133, and its lower end seats on a rigid supporting block 131.

Each of the piezoelectric elements has, on its end adjacent to the other element, a lateral extension 117b, the two extensions are in contact and located within an open-ended, hollow boss projecting radially from the sleeve 133, and the terminal 132 extends between the said extensions. A metal sheath 134 surrounding the sleeve, has an aperture which receives the hollow boss and its lower end is screw threaded externally and screwed into a tapped, cup-like holder 135 having, on its underside, a central projection 135a which is fixed within a hole 101a in the bottom wall of the casing.

A synthetic resin outer sheath 136 surrounding the upper part of and extending upwardly beyond the metal sheath 134, also has an opening which receives the hollow boss on the sleeve 133. The upper end of the metal sheath 134 is provided with a transverse partition 134a having a central opening 134b through which the impact receiving top of the piezoelectric assembly extends and the resin sheath 136 is formed in its peripheral wall and upwardly of the metal sheath, with a diametrically opposed pair of inverted L-shaped slots 136b (see Fig. 5).

A hammer or striker 120 slidably accommodated within the resin sheath above the partition 134a is provided with a transverse pin 120a of which the opposite ends

extend respectively through and beyond the slots 136b. Normally, the upper portion of the striker projects beyond the top of the resin sheath 136 into a synthetic resin, thimble-like finger piece 125 of which the open lower end sockets on to and is slidable in the upper end of the said sheath. The finger piece is formed with a diametrically opposed pair of substantially parallelogram shaped apertures 125a into each of which a corresponding one of the opposite ends of the pin 120a extends. As clearly shown in Fig. 5, the area of each aperture 125a is larger than that of each of the inverted L-shaped slots 136b, the longer legs of the slots extending longitudinally while the shorter legs extend circumferentially of the outer resin sheath 136. The finger piece 125 has a lateral projection 125b on its side adjacent to the arm 105a of the electrode support 105 and the projection is adapted to abut a shoulder 105a' on the said arm so as to serve as a stop for limiting the upward movement of the finger piece. The lower portion of the finger piece 125 is formed with an external protrusion on its side remote from the lateral projection 125b and the protrusion portion is adapted to slide in contact with the inner surface of the side wall of the casing 101 opposite to the side wall contacted by the fuel reservoir, for guiding the finger piece 125 in its upward and downward movement.

One end of a return coil spring 127 provided between the finger piece 125 and sheath 136 abuts the internal surface of the top wall of the finger piece 125 while its other end abuts the rim of the upper end of the sheath 136. The opposite ends of a second coil spring 128, which is of a smaller diameter than and is located within and coaxially of, the return spring 127, respectively engage and fit snugly around a central boss on the internal surface of the crown of the finger piece 125, and a central boss on the upper end of the striker 120.

A lead wire 121 in which a resistance 137 is connected, extends from the terminal 132 to an electrode 123 fixed in an insulating mounting block 122 which, in turn is fixed to the internal surface of the arm 105a; the lead wire and terminal electrically connect the electrode 123 to the positive side of the piezoelectric assembly 117. Located opposite to the electrode 123, is another electrode 124 which is screwed into and extends through a tapped hole in the arm 105b of the electrode support 105. The electrode 124 is connected to the negative side of the piezoelectric assembly 117 through the casing 101, and, as is the electrode 24 of the lighter shown in Figs. 1-3, is adjustable towards or away from the electrode 123 to vary the width of the inter-electrode gap.

The upper end of the arm 105b is provided

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with a lateral projection against which the bracket carrying the pin 111, is adapted to abut so as to limit the angular travel of the cap when the latter is swung to its open position.

The operation of the lighter shown in Figs. 4 and 5 is substantially the same as that of the lighter shown in Figs. 1 to 3, except for the operation of the modified voltage generating device and a brief explanation of the operation of the said device will now be given.

When the user of the lighter swings the cap 108 to its open position and then depresses the finger piece 125, the springs 127 and 128 are compressed during the initial portion of the downwards travel of the finger piece because, before depressing the finger piece, the opposite ends of the pin 120a are disposed within the shorter, circumferential legs of the L-shaped slots 136b and in the lower acute angled corners of the parallelogram shaped apertures 125a, each of which is formed by two vertical edges connected by two inclined edges. Thereafter, as the finger piece 125 is depressed through the remaining portion of its downwards travel, the upper inclined edges of the apertures 125a abut the pin ends whereupon the latter side up and along the said edges thereby imparting to the striker a rotary movement in the direction which removes the pin ends from the circumferential legs into the longitudinal legs of the L-shaped slots so that the compressed spring 128 drives the striker down the sheath 136 into impact with the impact receiving top 117a of the assembly 117 whereby a potential difference, sufficient to strike a spark across the inter-electrode gap, is applied to the electrodes 123 and 124, and the spark ignites the gasified fuel flowing from the reservoir 102 through the valve 103 and nozzle 103a.

Upon releasing the depressive force from the finger piece 125 the latter is returned to its initial upper position by the compressed spring 127 whereupon the lower inclined edges of the parallelogram shaped apertures 125a abut the pin ends as the latter reach the upper ends of the longitudinal legs of the L-shaped slots and the pin ends ride down the said lower edges and impart a reverse rotary movement to the striker so that the pin ends enter and travel along the circumferential legs of the slots and the striker is locked against spring-driven downwards travel. Thereafter, the cap 108 is swung to its closed position so that the telescopic cylinder 112 is returned to its substantially horizontal position and, acting through the spring 115 and control member 114 recloses the discharge valve 103. It should be noted that, due to the engagement of its projecting ends in the slots 136b and apertures 125a, the pin 120a connects the outer sheath 136 and finger piece 125

together thereby preventing inadvertent displacement of the sheath and finger piece relatively to the stationary parts of the voltage generating device.

It should also be noted that the extension 18a is screwed or otherwise detachably secured within the hole 1a; hence, by removing the extension from the hole and removing the screw 6, the electrode support and voltage generating device of the lighter shown in Figs. 1-3 may be removed for inspection repair or replacement; similarly the projection 135a is detachably secured within the hole 101a so that, as and when necessary or desired, the electrode support and voltage generating device of the lighter shown in Figs. 4 and 5 may also be removed; further, when once the electrode support of either lighter has been removed, the corresponding discharge valve may be disconnected from the base of the casing and withdrawn through the top of the reservoir. Thus the construction of the lighter is simple, economical and efficient.

WHAT WE CLAIM IS:—

1. A smokers' lighter comprising a casing, a fuel reservoir housed within the casing, and a fuel discharge valve accommodated within and extending to the exterior of the reservoir to be adjacent a spaced pair of electrodes in electrical connection with one or more piezoelectric elements included in a voltage generating device which also includes a striker and a reciprocable finger piece which in the normal inoperative condition of the lighter extends to the exterior of the casing, and the striker is loaded by a spring interposed between itself and the finger piece and normally is held in spaced relationship to the piezoelectric element or elements, the finger piece being depressible to stress the spring and then release the striker so that the striker is driven into impact against the said element or elements to establish a spark creating electric potential across the electrodes and ignite gaseous fuel discharged from the valve.

2. A lighter as claimed in claim 1 wherein one of the two electrodes is adjustable relatively to the other electrode so as to vary the dimension of the spark gap.

3. A lighter as claimed in claim 1 wherein the electrodes are carried in a support which is mounted on the fuel reservoir and the finger piece is provided with a stop adapted to engage the support to limit the travel of the finger piece and striker away from the piezoelectric element or elements.

4. A lighter as claimed in claim 1 wherein the piezoelectric element, or elements, is or are accommodated within a sheath of which one end is detachably engaged with a positioning member for the said element



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with a lateral projection against which the bracket carrying the pin 111, is adapted to abut so as to limit the angular travel of the cap when the latter is swung to its open position.

The operation of the lighter shown in Figs. 4 and 5 is substantially the same as that of the lighter shown in Figs. 1 to 3, except for the operation of the modified voltage generating device and a brief explanation of the operation of the said device will now be given.

When the user of the lighter swings the cap 108 to its open position and then depresses the finger piece 125, the springs 127 and 128 are compressed during the initial portion of the downwards travel of the finger piece because, before depressing the finger piece, the opposite ends of the pin 120a are disposed within the shorter, circumferential legs of the L-shaped slots 136b and in the lower acute angled corners of the parallelogram shaped apertures 125a, each of which is formed by two vertical edges connected by two inclined edges. Thereafter, as the finger piece 125 is depressed through the remaining portion of its downwards travel, the upper inclined edges of the apertures 125a abut the pin ends whereupon the latter side up and along the said edges thereby imparting to the striker a rotary movement in the direction which removes the pin ends from the circumferential legs into the longitudinal legs of the L-shaped slots so that the compressed spring 128 drives the striker down the sheath 136 into impact with the impact receiving top 117a of the assembly 117 whereby a potential difference, sufficient to strike a spark across the inter-electrode gap, is applied to the electrodes 123 and 124, and the spark ignites the gasified fuel flowing from the reservoir 102 through the valve 103 and nozzle 103a.

Upon releasing the depressive force from the finger piece 125 the latter is returned to its initial upper position by the compressed spring 127 whereupon the lower inclined edges of the parallelogram shaped apertures 125a abut the pin ends as the latter reach the upper ends of the longitudinal legs of the L-shaped slots and the pin ends ride down the said lower edges and impart a reverse rotary movement to the striker so that the pin ends enter and travel along the circumferential legs of the slots and the striker is locked against spring-driven downwards travel. Thereafter, the cap 108 is swung to its closed position so that the telescopic cylinder 112 is returned to its substantially horizontal position and, acting through the spring 115 and control member 114 recloses the discharge valve 103. It should be noted that, due to the engagement of its projecting ends in the slots 136b and apertures 125a, the pin 120a connects the outer sheath 136 and finger piece 125

together thereby preventing inadvertent displacement of the sheath and finger piece relatively to the stationary parts of the voltage generating device.

It should also be noted that the extension 18a is screwed or otherwise detachably secured within the hole 1a; hence, by removing the extension from the hole and removing the screw 6, the electrode support and voltage generating device of the lighter shown in Figs. 1—3 may be removed for inspection repair or replacement; similarly the projection 135a is detachably secured within the hole 101a so that, as and when necessary or desired, the electrode support and voltage generating device of the lighter shown in Figs. 4 and 5 may also be removed; further, when once the electrode support of either lighter has been removed, the corresponding discharge valve may be disconnected from the base of the casing and withdrawn through the top of the reservoir. Thus the construction of the lighter is simple, economical and efficient.

WHAT WE CLAIM IS:—

1. A smokers' lighter comprising a casing, a fuel reservoir housed within the casing, and a fuel discharge valve accommodated within and extending to the exterior of the reservoir to be adjacent a spaced pair of electrodes in electrical connection with one or more piezoelectric elements included in a voltage generating device which also includes a striker and a reciprocable finger piece which in the normal inoperative condition of the lighter extends to the exterior of the casing, and the striker is loaded by a spring interposed between itself and the finger piece and normally is held in spaced relationship to the piezoelectric element or elements, the finger piece being depressible to stress the spring and then release the striker so that the striker is driven into impact against the said element or elements to establish a spark creating electric potential across the electrodes and ignite gaseous fuel discharged from the valve.

2. A lighter as claimed in claim 1 wherein one of the two electrodes is adjustable relatively to the other electrode so as to vary the dimension of the spark gap.

3. A lighter as claimed in claim 1 wherein the electrodes are carried in a support which is mounted on the fuel reservoir and the finger piece is provided with a stop adapted to engage the support to limit the travel of the finger piece and striker away from the piezoelectric element or elements.

4. A lighter as claimed in claim 1 wherein the piezoelectric element, or elements, is or are accommodated within a sheath of which one end is detachably engaged with a positioning member for the said element

or elements and the said positioning member is connected to the casing.

5 5. A lighter as claimed in claim 1 wherein the striker is held in spaced relationship to the piezoelectric element or elements by a catch which, as the finger piece is depressed and after the spring has been stressed, is disengaged from the striker by the finger piece to enable the striker to be spring driven into impact with the said element or elements.

10 6. A lighter as claimed in claim 1 wherein the striker is provided with a transverse pin and is accommodated in a sheath and is normally held in spaced relationship to the piezoelectric element or elements, the sheath is provided with a diametrically opposed pair of slots which are engaged respectively by opposite ends of the pin projecting from the striker, the said pin and slots co-operating with one another so that, upon depression of the finger piece and after the spring has been stressed, the striker is released and is spring driven into impact with the element or elements.

25 7. A lighter as claimed in claim 1 wherein the striker and piezoelectric element or elements are accommodated in a sheath having a diametrically opposed pair of L-shaped slots each having a leg extending circumferentially of the sheath from the upper end of the other leg which extends longitudinally of the sheath, the said circumferential legs being normally engaged respectively by the opposite project-

ing ends of a pin provided in the striker and the finger piece being adapted, when depressed and after stressing the spring, to drive the pin ends out of the circumferential legs into the longitudinal legs to enable the striker to be spring driven into impact with the element or elements. 35 40

8. A lighter as claimed in any of claims 4, 6, 7 wherein the finger piece and sheath are composed of an electric insulating material, such as a synthetic resin. 45

9. A lighter as claimed in any of claims 4, 6, 7 wherein the finger piece makes telescopic engagement with the sheath and a return spring interposed between the sheath and the end of the finger piece remote from the sheath, is adapted to be stressed by the depression of the finger piece. 50

10. A lighter as claimed in claim 1 wherein the voltage generating device and one of the electrodes are electrically interconnected by a lead wire in which an electrical resistance is connected. 55

11. A smokers' lighter substantially as herein described with reference to Figs. 1—3, or Figs. 4—5, of the accompanying drawings. 60

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