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ELECTRIC IGNITION DEVICES

Filed Jan. 5, 1966

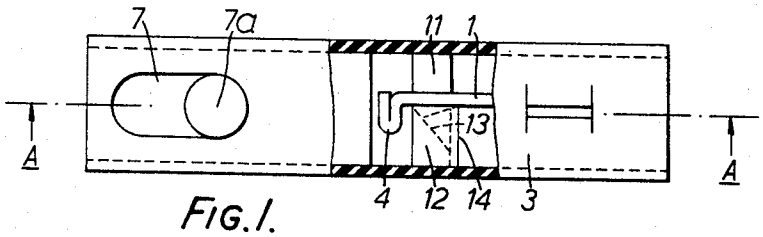


FIG. 1.

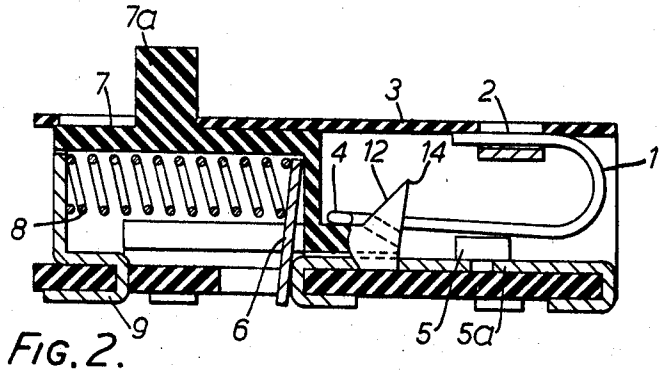


FIG. 2.

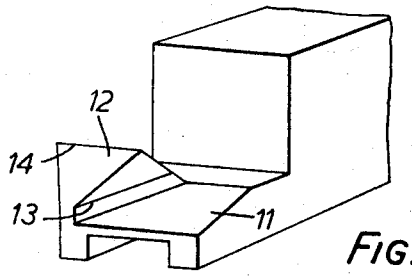


FIG. 3.

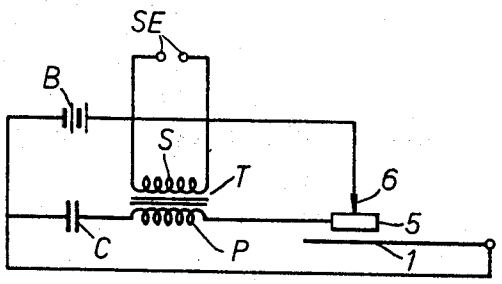


FIG. 4.

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ELECTRIC IGNITION DEVICES

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8 Claims. (Cl. 317—96)

ABSTRACT OF THE DISCLOSURE

An electric ignition device comprising a capacitor, a transformer having primary and secondary windings, ignition electrodes connected in the secondary winding of said transformer, charging means for charging said capacitor and switching means having fixed and moving contacts and actuating means capable of deflecting the moving contact so that the fixed and moving contacts make impact engagement for the purpose of discharging the capacitor, and in which the capacitor and the primary winding of the transformer are connected in series so that the charging and discharging currents of the capacitor flow in opposite directions in the primary winding of the transformer.

This invention relates to electric ignition devices eminently suitable for use in cigarette and cigar gas lighters.

According to the present invention an electric ignition device comprises a capacitor arranged to be charged in one condition of electric switching means of said device, a transformer through which said capacitor can discharge in another condition of said switching means and ignition electrodes defining between them a spark-gap connected in an output circuit of said transformer, said switching means comprising co-operating fixed and moving contacts, a moving contact being carried or constituted by an arm having associated with it actuating means for deflecting the arm against spring force and for suddenly releasing it so that said moving contact is caused momentarily to make impact engagement with a fixed contact to complete the capacitor discharge circuit, such impact engagement of said moving contact with said fixed contact being prolonged by appropriate weighting of the moving contact arm.

The weighting of the moving contact arm prevents substantially immediate rebound of the moving contact from the fixed contact upon impact due to the momentum of the weight causing the arm to continue in engagement after contact has been made. In this way not only is positive low resistance contact ensured between the moving and fixed contacts but such contact is continuous for a period sufficient to enable the capacitor to be substantially fully discharged through the transformer and thereby provide the strongest spark across the spark-gap for ignition purposes.

In carrying out the invention it is preferred to arrange that the moving arm which carries the moving contact is itself flexible so that the actuating means causes the arm to be flexed to store up energy before it is suddenly released to make impact engagement with the fixed contact. In this case the weighting of the arm causes the arm to continue to flex after contact with the fixed contact has been made.

In carrying out the invention the moving arm of the switch may be of wire or rod form and arranged to be deflected in two directions relatively to the fixed contact. This may be achieved by arranging that the moving contact arm is flexed away from its normal position at which the charging circuit of the capacitor is completed by

cam means contoured to release the arm suddenly so that the moving contact makes very rapid impact engagement with the fixed contact upon the release of the arm. The arm may have a weight secured to its free end to afford the necessary momentum to establish adequate electrical contact or, alternatively, the arm may comprise a retroverted end portion which serves for weighting purposes.

The ignition device may also include a further moving contact which disengages from the fixed contact to interrupt the capacitor charge circuit when the device is operated.

The actuating means for the ignition device preferably comprises an insulating body with two oppositely inclined ramp surfaces joined by an upstanding wall surface which surfaces co-operate with the weighted arm in response to actuation of the switch so that the free end of the arm rides up one of the ramp surfaces in response to return movement of the actuating means after the arm is released and as it does so it is deflected to one side by the upstanding wall surface until it reaches a point on the ramp surface where it snaps back to one side. This is the normal position of the arm. Upon actuation the weighted arm end rides up the oppositely inclined ramp surface thereby further flexing the arm away from the fixed contact of the switch means and finally snaps over the edge of the ramp surface to enable it to engage momentarily with the fixed contact for the discharge of the capacitor and the production of a spark across the spark-gap of the device.

As far as the electrical circuit arrangement is concerned it is preferred to arrange that the charging current as well as the discharge current flows through the transformer primary. In this way the core of the transformer is magnetised successively in opposite directions during charging and discharging of the capacitor with the result that residual magnetism of the core is discouraged. The spark-gap will be connected in series with the transformer secondary.

When used in conjunction with a cigarette or cigar gas (butane) lighter the battery as power source together with the electrical ignition arrangement according to the invention will be arranged within the body of a lighter with the spark-gap being located in close proximity to the outlet of the gas container.

It will also be arranged when applied to gas lighters that a valve for opening and shutting the gas supply will be actuated in response to actuation of the switch so that the gas supply will be switched on while the actuator of the switching means is in the operated position.

By way of example various embodiments of the invention will now be specifically described with reference to the accompanying drawings in which:

FIGURE 1 shows a broken plan view of switching means of an ignition device according to the invention;

FIGURE 2 is a sectional view taken along the line A—A of FIGURE 1;

FIGURE 3 is a perspective view of the actuator of the switching means of FIGURES 1 and 2; and

FIGURE 4 is a circuit diagram of the ignition device.

Referring to FIGURES 1 to 3, switching means of the ignition device which is shown in its normal condition comprises a generally U-shaped flexible wire arm **1** which in the present example constitutes a moving contact and is preferably composed of beryllium copper. This flexible arm **1** is anchored at **2** to a switch frame or casing member **3** and is weighted at its free end by retroverting the free end to define a loop **4** as can best be seen in FIGURE 1.

In the normal condition of the switching means as indicated the flexible arm **1** is spaced away from a fixed contact **5** preferably of tungsten. The switching means also

comprises another moving contact in the form of a metal strip 6 (FIGURE 2) which projects into a switch actuating structure 7 of insulating material. This actuating structure 7 is slidably mounted for horizontal movement as viewed in the drawing. The actuating structure is spring biased to its normal position as shown by means of a compression spring 8 through which electrical contact is made to the moving contact 6 from a terminal structure 9. As will be apparent from FIGURE 4 of the drawings the moving contact 6 which connects electrically with the fixed contact 5 through a conductive strip 5*a* (FIGURE 2) in the normal condition of the switching means completes a charging circuit for a capacitor C via primary P of a transformer T. The capacitor C consequently charges up from battery B when the switching means is in the normal condition.

When it is required to operate the device an operating projection 7*a* will be moved to the left so that the actuating structure 7 is moved against the biasing spring force of the compression spring 8 and thereby causes the moving contact 6 to disengage from the strip 5*a* and so interrupt the capacitor charging circuit and also causes the weighted or looped end 4 of the flexible wire arm 1 to ride up a ramp surface 12 causing the arm to be flexed upwardly away still further from the fixed contact 5 until the arm end drops over edge 14 of the actuating structure 7 to release the spring energy stored in the arm. The wire arm 1 accordingly swings down and makes impact engagement with the fixed contact 5 with the weighting of the arm by the looping of the free end portion causing the arm to continue flexing after contact has been established. When such contact is made a discharge path is set up for the charged capacitor C and the capacitor consequently discharges to produce a high voltage pulse in the secondary S of the transformer T across which spark electrodes SE are connected. A spark bridges the spark electrodes SE to effect ignition for example of butane gas which may be supplied through a valve arranged to be opened by a simple coupling between the valve and the actuating structure 7 when the switching means is in the operating position. This feature will be described later with reference to FIGURES 5 and, 6 and 7. The weighting of the flexible arm ensures substantially complete discharge of the capacitor C of the ignition device.

When the operating pressure is removed from the actuating structure 7 the structure is caused to move to the right as viewed in the drawing under the action of the compression spring 8. The weighted or looped end 4 of the flexible arm consequently rides up the lower ramp surface 11 and it will be seen from FIGURE 3 that the upstanding wall surface 13 will simultaneously deflect the flexible arm to one side. When the actuating structure reaches the limit of its movement to the right, moving contact 6 again engages with the strip 5*a* so as to recharge the capacitor C in readiness for the next operation of the device and the looped or weighted end 4 of the arm 1 is located on an intermediate surface between the ramp surfaces 11 and 12.

By referring to FIGURE 4 it will be appreciated that the charging current for the capacitor C passes through the transformer T in the opposite direction to the discharge current and in this way it discourages a permanent flux in the transformer core in a direction which adversely affects the efficient pulse generation during discharge operation. It will also be seen that the flexible arm 1 is out of contact with the fixed contact 5 during the time that the capacitor C is being charged and by this arrangement short circuiting of the battery which might otherwise occur is positively prevented.

It is especially contemplated embodying the device just above described in cigarette and cigar lighters.

What I claim is:

1. An electric ignition device comprising a capacitor, a transformer having primary and secondary windings, ignition electrodes connected in the secondary winding of said transformer, charging means for charging said capacitor and switching means having fixed and moving contacts and actuating means capable of deflecting the moving contact so that the fixed and moving contacts make impact engagement for the purpose of discharging the capacitor, and in which the capacitor and the primary winding of the transformer are connected in series so that the charging and discharging current of the capacitor flow in opposite directions in the primary winding of the transformer.

2. An electric ignition device as claimed in claim 1 in which the moving contact is carried by an arm which is weighted to prolong the impact engagement between the fixed and moving contacts and the flow of discharge current through the transformer primary winding.

3. An electric ignition device as claimed in claim 2, in which the moving contact arm is weighted by retroverting the end of the arm.

4. An electric ignition device as claimed in claim 1, in which the moving contact arm is flexible so that the actuating means flexes the arm against the spring force thereof.

5. An electric ignition device as claimed in claim 4, in which the moving contact arm takes the form of a flexible spring wire or rod.

6. An electric ignition device as claimed in claim 1, in which the actuating means comprises cam means adapted to cause movement in different directions of the moving contact arm in response to operation of the device.

7. An electric ignition device as claimed in claim 6, in which the actuating means comprises an insulating body with two oppositely inclined ramp surfaces joined by an upstanding wall surface which surfaces cooperate with the weighted arm in response to actuation of the switch so that the free end of the arm rides up one of the ramp surfaces in response to return movement of the actuating means after the arm is released and as it does so it is deflected to one side by the upstanding wall surface until it reaches the point on the ramp surface where it snaps back to one side wherein it is located in the normal position and wherein upon actuation the weighted arm rides up the oppositely inclined ramp surface thereby further flexing the arm away from the fixed contact of the switch means and finally snaps over the edge of the ramp surface to enable it to engage with the fixed contact for the discharge of the capacitor and the production of a spark across the spark gap of the device.

8. An electric ignition device as claimed in claim 1 comprising a second moving contact which is electrically connected to the fixed contact in the normal condition of the device and through which the capacitor charging circuit is completed and in which the second moving contact disengages from the fixed contact to interrupt the charging circuit consequent upon the actuation of the device.

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