

## PATENT SPECIFICATION

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## COMPLETE SPECIFICATION

### Improvements in Devices for Controlling the Automatic Opening of Pyrophoric Lighters

We, LA NATIONALE SOCIETE ANONYME, a company organised under the Laws of Switzerland of 2, rue des Falaises, Geneva, Switzerland, and ALFRED DUNHILL LIMITED, a British Company of 30, Duke Street, London, S.W.1, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Automatic pyrophoric lighters having a cover which opens automatically, are always provided with a retaining member for the cover, said member acting in the manner of a pawl and being actuated from the outside either by a simple knob or by a more complicated device for the purpose of rendering accidental lighting of the lighter in a pocket less probable. Besides this danger of accidental lighting, these lighters also have the disadvantage that when they misfire it is necessary for the smoker to close the lighter before making a second attempt to light the same. For eliminating these two disadvantages some semi-automatic lighters with a spring-actuated cover have been constructed wherein, after the cover has been opened automatically, a second non-automatic movement is necessary to effect the lighting, which movement can then be repeated alone if the lighting has not taken place.

There are also known lighters in which the cover is retained in the closed position solely by the frictional engagement of the cover with the frictional wheel, which itself is prevented from movement by the frictional engagement with the pyrophoric flint. When actuating the friction wheel for effecting ignition, the cover is released at the same time. Such an arrangement, however, does not generally ensure that the cover returns into the same closing position after each operation as the friction wheel may stop in a different position after each operation. Further, as the cover is only held by friction, and is not locked in its closed position, it is liable to open very easily in a pocket, for example simply by an action

exerted directly thereon and not solely by action exerted on the friction wheel by which it is retained.

These known lighters however when the cover opens accidentally, have the disadvantage of allowing the petrol to evaporate in the pocket from which it distributes a strong disagreeable smell.

According to the present invention a pyrophoric lighter having a spring actuated cover and a manually operated friction wheel, and of which the cover is always held in the same closing position by a locking device, this locking device being provided with two members which engage with one another, is characterised in that the first portion of the rotary movement imparted to the friction wheel for the purpose of effecting ignition, effects the opening of the spring actuated cover through the medium of a kinematic chain, of which the first element is constituted by the axis of the friction wheel and of which the last element is constituted by a member connected mechanically to one of the two locking members, the kinematic chain being provided with at least one resiliently mounted member which always tends to return some of the elements of the kinematic chain into the same starting position.

One form of construction of the subject of the invention is shown by way of example in the accompanying drawing, wherein:

Figs 1 and 2 are views from opposite sides of the lighter, some of the parts being in section.

Fig. 3 is a cross-section to a larger scale on the line III—III of Fig. 2.

Fig. 4 is a detail view in section on the line IV—IV of Fig. 3.

Fig. 5 is a detail view in section on the line V—V of Fig. 3.

Fig. 6 is a plan view, with parts in section, of Figs. 1 and 2, the cover being removed.

In the drawing 1 indicates the body of the lighter to which is hinged a cover 2 actuated by a spring, not shown, which always tends to hold the cover in the open position. 3 is the wick tube on which is

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placed a wick cap 4 which is located in the body 5 screwed to the cover.

On the body of the lighter 1 is mounted a rotary wheel 6 adapted to be actuated by hand and which is secured to a friction wheel 7 against which there bears resiliently the pyrophoric flint 21 (Fig. 6).

The wheel 6 is provide on its periphery with dog teeth 8 adapted to engage with a pawl 9.

The pawl 9 is hinged at 10 to an arm 11 mounted in such a manner as to be capable of oscillating on the body 5.

The body 5, which serves as a guide for the wick cap 4, is provided in the upper portion thereof with a transverse bore in which is mounted a tube 12 secured to the arm 11. Through this tube passes a screw 15 to the end of which there is secured a lever 13 terminating in a hook 14. A lost-motion device is provided for ensuring the entrainment of the lever 13 by the lever 11, whilst enabling the former to move without entraining the latter. This is necessary so as to enable the end 14 of the lever 13 to pass over the hook 19 so as to come into engagement therewith without the pawl 9 being displaced rearwardly from its normal engaging position with one of the teeth 8 which would be liable, by reason of the friction of the flint 21 on the friction wheel 7, to prevent the hook 14 from coming into engagement with the hook 19. For this purpose the tube 12 is provided at its end, opposite the lever 13, with a cut-away portion 22 which extends parallel to its axis so that the tube only extends over an arc of less than 180°.

The lever 13 has a cylindrical portion 23 corresponding with the cut-away portion 22 of the tube, but of a smaller angle than the latter, so that the lever can turn with the screw 15 in the tube 12 through an angle  $\alpha$ , corresponding with the angular clearance provided between the parts 22 and 23. This clearance is sufficient, when closing the cover, to enable the hook 14 of the lever 13 to pass over the hook 19 so as to assume the position shown in Fig. 2, without producing a movement of the pawl over the teeth 8.

Below the bore containing the tube 12, the body 5 is provided with a recess 16 through which passes a vertical spindle 17 on which there is mounted a small coiled tension-spring 18 of which one end rests against the lever 13, whilst the other end thereof is located in an opening in the pawl 9. In order to enable the latter to move relatively to the lever 11 under the action of the spring 18, this lever is provided opposite the end of the spring with a shallow recess.

Adjacent the wick carrying tube 3 is mounted the fixed hook 19 adapted to engage with the end 14 of the lever 13, the axis of the friction wheel 7 and the members 9, 11, 12 and 13 constitute a kinematic chain, of which the axis of the friction wheel is the first element and the lever 13 the last element.

The operation of this device is as follows:

The cover 2, being closed as shown in full lines in Figs. 1 and 2, the lever 13 engages by means of its end 14 with the hook 19 under the action of the spring 18. In this position the pawl 9 engages with the teeth 8 of the wheel 6 also under the action of the spring 18.

When the wheel 6 is actuated in the direction of the arrow 20, the first portion of its movement entrains the pawl 9 and therewith the lever 11 on which it is mounted, against the action of the spring 18. As during this movement the lever 11 entrains the lever 13 through the medium of the tube 12, the hook 14 is disengaged from the fixed hook 19.

At this moment the cover 2 is released and is opened under the action of its spring.

It entrains therewith the body 5 carrying the levers 11 and 13 with the pawl 9, as also the wick cap 4 which latter exposes the wick.

As the movement of the wheel 6 produces the movement of the friction wheel 7, bearing against the pyrophoric flint, ignition takes place when the cover is open (Fig. 6), the friction wheel then turning freely on its shaft without any resistance other than friction on the pyrophoric flint.

From the foregoing description it will be readily seen that when, during the closing of the cover, the pawl 9 is at the apex of one of the teeth 8, it can oscillate on the lever 11 without preventing the hook 14 of the lever 13 coming into engagement with the fixed hook 19.

By reason of the fact that all the movable members of the device are attached to the cover 2, which moves away from the wick at the moment when a spark is projected towards the latter, dust from the pyrophoric flint will not interfere with the movement of these members in the course of time. The mounting of these members is further facilitated by the fact that the movable members are mounted on the body 5 which itself is mounted on the cover 2.

As will be seen this device which only necessitates a single and the same rotary movement for producing both the opening and ignition of the lighter, also has

the advantage of preventing in a practical and satisfactory manner, the accidental opening of the cover, as in order to effect this opening it is not only necessary to rotate the wheel, a movement which it is difficult to effect accidentally, but it is also necessary to overcome the resistance which the pyrophoric flint, which is pressed by a spring against the friction wheel, naturally opposes to this rotation.

The movable parts of the device, instead of being mounted on the cover, as shown in the example of construction described, may obviously also be mounted on the body of the lighter, in which case the cover is provided with a fixed hook or any other projection adapted to come into engagement with a movable retaining member.

The teeth adapted to come into engagement with the pawl may be formed in the friction wheel or in a member secured thereto. There may also be used directly for this purpose the teeth of the friction wheel, which teeth engage with the pyrophoric flint.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A pyrophoric lighter having a spring actuated cover and a manually operated friction wheel, and of which the cover is always held in the same closing position by a locking device, this locking device being provided with two members which engage with one another, characterised in that the first portion of the rotary movement imparted to the friction wheel for the purpose of effecting ignition, effects the opening of the spring actuated cover through the medium of a kinematic chain of which the first element is constituted by the axis of the friction wheel and of which the last element is constituted by a member connected mechanically to one of the two locking members, the kinematic chain being provided with at least one resiliently mounted member which always tends to return some of the elements of the kinematic chain into the same starting position.

2. A pyrophoric lighter according to claim 1, characterised in that one or more of the elements of the kinematic chain are attached to the cover and the other elements of the kinematic chain are attached to the body of the lighter, the arrangement being such that the opening of the cover automatically divides the kinematic chain and that the friction wheel then turns without any resistance

other than its frictional resistance with the pyrophoric flint.

3. A pyrophoric lighter according to claim 1, characterised in that the locking member which is not connected to the kinematic chain is fixed rigidly to the part of the lighter to which it is attached.

4. A pyrophoric lighter according to claims 1 and 2, and wherein one of the locking members is fixed and the other is movable, characterised in that the kinematic chain is provided with a lost motion device so that when closing the cover and the movable locking member is repelled by the fixed locking member, against the action of a spring, the last element of the kinematic chain connected to the movable locking member, can move without actuating the other elements of the kinematic chain which are already in the starting position.

5. A pyrophoric lighter according to any one of the preceding claims, characterised in that in order to enable a hook controlled by the last element of the kinematic chain to pass over a fixed hook, without moving the friction wheel, the last element is connected to the remainder of the kinematic chain by a lost motion device.

6. A pyrophoric lighter according to any one of the preceding claims, characterised in that it is provided with a milled wheel secured to the friction wheel and provided with teeth adapted to engage with a pawl mounted on a member secured to the cover, this pawl serving to effect the release of the cover when the milled wheel is rotated.

7. A pyrophoric lighter according to claim 6, characterised in that the pawl is pivotally mounted on an oscillating arm.

8. A pyrophoric lighter according to claim 6 or 7, characterised in that the last element of the kinematic chain and the pawl are subjected to the action of a common spring which enables them to carry out an angular movement independently of one another.

9. A pyrophoric lighter according to any one of the preceding claims, characterised in that the elements of the kinematic chain with the exception of the first element, are mounted on a body removably mounted on the cover and also containing the wick cover.

10. A pyrophoric lighter, according to any one of claims 1 to 8, characterised in that at least some of the elements of the kinematic chain are mounted on the body of the lighter.

11. Mechanism for controlling the opening of a spring-actuated cover pivotally mounted on the fuel container of a pyrophoric lighter, substantially as here-

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inbefore described with reference to the accompanying drawing.

Dated this 23rd day of April, 1940.

For the Applicants,  
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[This Drawing is a reproduction of the Original on a reduced scale.]

