March 3, 1953 L. BOLLE 2,629,998

PYROPHORIC LIGHTER

Filed Jan. 25, 1950 2 SHEETS—SHEET 1

Fig. 2.

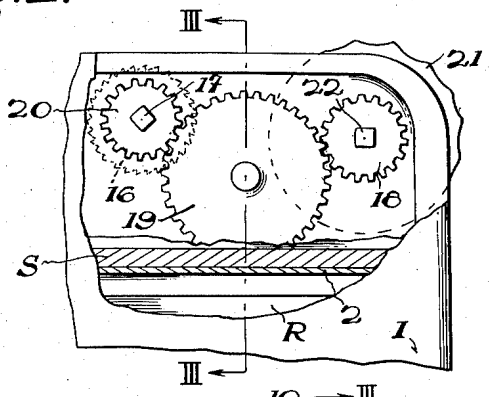
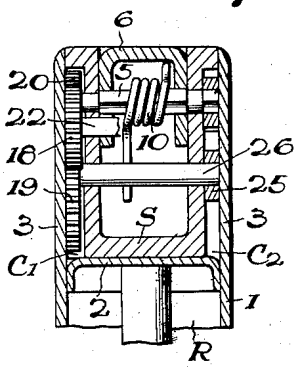



Fig. 3.



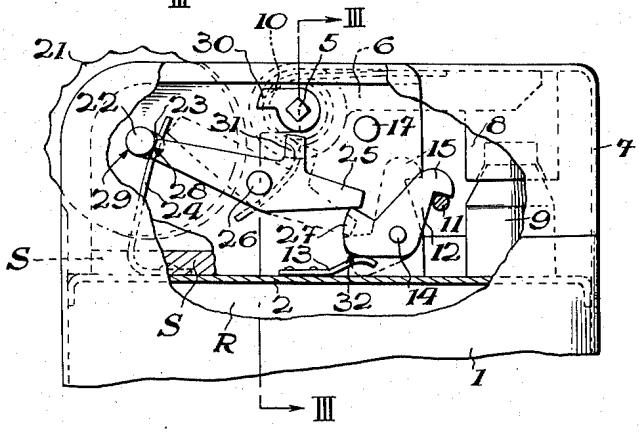




Fig. 1.

Fig. 4.

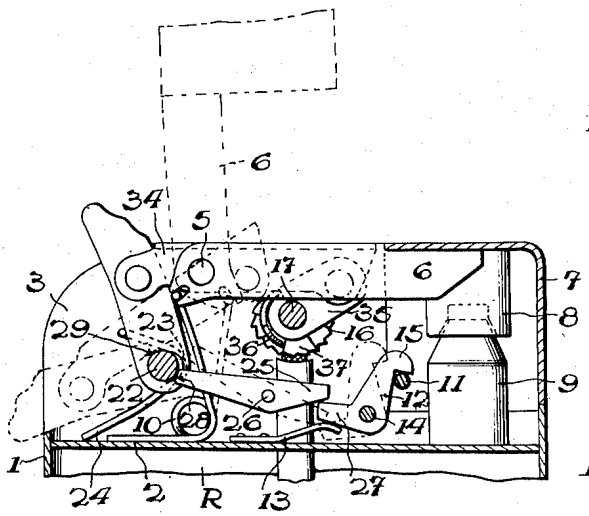



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Fig.6

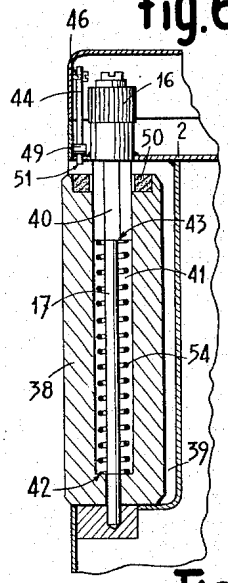



Fig.5

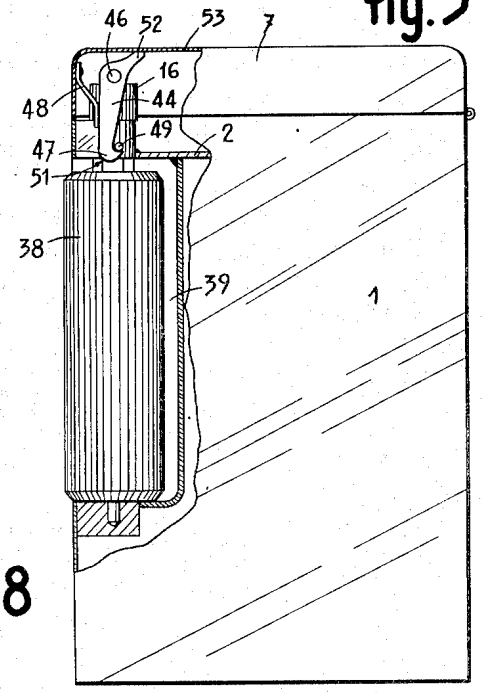
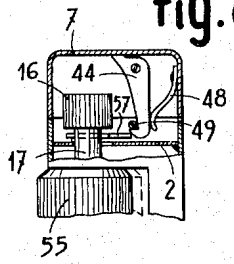



Fig.8



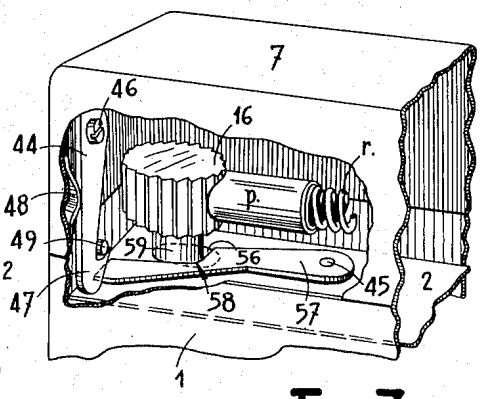




Fig.7

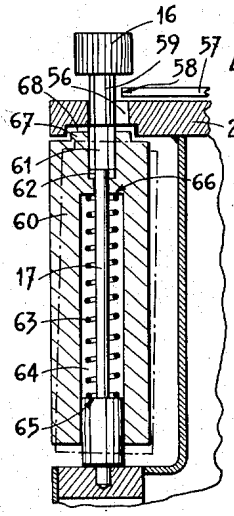



Fig.9

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## PYROPHORIC LIGHTER

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Application January 25, 1950, Serial No. 140,383
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12 Claims. (Cl. 67—7.1)

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All lighters with a spring actuated cover are more or less liable to open accidentally in a pocket and even though such an opening does not produce lighting (as is the case with lighters having a friction wheel actuated by hand), it does not reduce the inconvenience of allowing the petrol (benzene) to evaporate in the pocket and distributing a disagreeable odour therein.

A number of devices have been proposed which use a single movement of the actuating member for applying to the lock, which retains the spring cover in its closed position, the necessary action for opening the lighter. In lighters, for example in which the friction wheel is secured to a driving knob, there is used a slight transverse movement, or a slight rotation of the driving knob for releasing the cover from its locking device. Of these two solutions it is obviously the second which affords the greatest security relatively to accidental opening of the cover in the pocket by reason of the fact:

1. That it is more difficult to produce accidentally the rotation of the driving wheel than its transverse movements obtained by simple compression of the lighter in a pocket, and

2. That the friction applied by the pyrophoric element to the friction wheel opposes quite naturally a predetermined resistance to rotation of the said driving wheel. Meanwhile, it occurs that when placing a lighter of this latter type, for example, in the pocket of a waistcoat the driving wheel is caused to turn accidentally thus producing the opening of the cover without noticing this.

The present invention has for its subject a lighter with a spring actuated cover, comprising a locking device retaining the cover in the closed position against the action of its spring, an actuating member adapted to actuate the friction wheel on the one hand and a movable element of the locking device on the other hand. This lighter tends to obviate the disadvantage referred to by the fact that the actuating member actuates the movable part of the locking device by means of a coupling of which the two parts are separated when the actuating member is in the position of rest and actuated solely in rotation about its axis, and by the fact that one of the parts of the said coupling is moved for the purpose of its engagement with the other by at least a movement of the actuating member distinct from a simple rotation about its axis, the said other part being secured to an element movable by rotation of the actuating member when the latter has first been subjected to a movement producing the engagement of the two parts of

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the coupling, and by the fact that the movement of this element produces the movement against a resilient action of the movable part of the unlocking device, in such a manner as to produce the release of the cover.

Some forms of construction of the lighter are shown diagrammatically and by way of example in the accompanying drawings wherein:

Fig. 1 is a partial view of a lighter according to a first form of construction, some parts of its walls being broken away so as to show the mechanical connection connecting the actuating member to the movable part of the locking device of the cover.

Fig. 2 is a partial view of the lighter shown in Fig. 1, some parts of its walls being broken away, so as to show the mechanical connection connecting the actuating member to the friction wheel.

Fig. 3 is a view in section on the line III—III of Fig. 1, the actuating member being omitted.

Fig. 4 is a partial view with parts broken away of a second form of construction of the lighter.

Fig. 5 is a view with parts broken away of a third form of construction of the lighter.

Fig. 6 is a partial view in section.

Fig. 7 is a partial perspective view, with parts broken away, of the lighter according to a fourth form of construction.

Fig. 8 is a partial profile view, one of the walls of the lighter being broken away.

Fig. 9 is a partial view in section of a modified form of construction of the lighter according to Figs. 7 and 8.

In the form of construction according to Figs. 1 to 3, the lighter is provided with a body 1 enclosing a receptacle R. The upper wall 2 of the receptacle is surmounted by two walls 3 extending the two wide side faces of the receptacle and between which are mounted the mechanical members of the lighter. On a spindle 5 is pivoted an arm 6 carrying a cover 7 provided with an extinguisher 8 which fits over the end of the burner 9. This arm is subjected to the action of a spring 10 tending to maintain the cover in the open position. A locking device holds the cover in the closed position (position shown in the drawing) against the action of the spring 10. The locking device is provided with a locking member or pin 11 secured to the cover and with a latch lever 12 oscillating on a pivot 14 and subjected to the action of a spring 13. The lever 12 is provided with a beak 15 held in engagement with the pin 11 by the action of the spring 13.

A friction wheel 16, against which is applied a

pyrophoric element (not shown) by a pressure device of known type, is pivoted on a spindle 17. The friction wheel is connected by a gear train 18, 19, 20 to a rotatable actuating or control member 21. The latter is fixed rigidly to a spindle 22 of which the ends each engage with an opening 23, each provided in one of the wings of a support S located between the lateral walls 3. These openings are inclined relatively to the upper face 2 of the receptacle R. A spring 24 tends to hold the spindle 22 in contact with the ends of the openings 23 the most remote from the burner 9. The actuating member 21 is connected mechanically to the lever 12 by transmission members comprising:

*a*. an intermediate lever 25 pivoted on a spindle 26 and of which one of the ends co-operates with a heel 27 of the lever 12.

*b*. a coupling of which one of the parts is formed by a milled portion 29 of the spindle 22, whilst the second part is formed by the front face 28 of the second end of the intermediate lever 25.

As shown in the drawing, the gear train 18, 19, 20 is located in a space $C_1$ provided between one of the wings of the support S and one of the walls 3, whilst the mechanical members connecting the actuating member to the movable part of the locking device are located in a space $C_2$ provided between the second wing of the support S and the second wall 3.

Thus these mechanical members are located in casings closed in all parts, and are thus protected from dust.

The operation of the lighter described is as follows:

In the closed position of the cover, the members occupy the positions shown in Figs. 1 to 3. In order to effect the opening of the cover and the lighting of the lighter, it suffices to apply a push on the actuating member and to impart to the latter a movement of rotation in a counter-clockwise direction. In fact the push applied to the actuating member produces a movement of the spindle 22 along the openings 23 against the action of the spring 24 and the engagement of the two parts of the coupling 28, 29. The rotation of the actuating member then produces:

1. An angular movement of the intermediate lever 25 driven by friction. The latter acts on the lever 12 against the action of its spring 13 and produces the disengagement of the two parts of the locking device and the release of the cover 7 which opens under the action of its spring 10.

2. The setting in rotation of the friction wheel by means of the gear train 18, 19, 20 and the projection of sparks which ignite the gases escaping from the burner.

The opening position of the cover is defined by a finger 30 secured to the arm of this, coming into contact with a stop 31 secured to the intermediate lever 25 of which the amplitude of oscillation is limited by the face 32 of the lever 12 coming into contact with the wall 2 of the receptacle R. For this latter position of the intermediate lever 25, the two parts 28 and 29 of the coupling are no longer in contact with one another, so that the spindle 22 may turn freely in the bottom of the inclined opening 23, whereby premature wear of the surfaces 28 and 29 is obviated.

From the foregoing and examination of the drawing it will be seen readily that the risk of accidental opening of the cover is rendered very improbable and practically impossible by reason of the fact that for producing this opening it is necessary to apply two distinct actions on the actuating members.

Nevertheless the control of the functioning of the lighter depends on great simplicity, because these two actions can be applied by the thumb.

In the form of construction shown in Fig. 4, the mechanical connection connecting the actuating member to the movable part of the locking device for the cover is similar to that described with reference to Figs. 1 to 3.

On the contrary, the operating member is formed by a lever 33 secured to the spindle 22. The mechanical connection between the actuating member and the friction wheel 16 comprises a link 34 hinged at one end to the said actuating member and at the other end to a driving member 35 pivoted freely on the spindle 17 of the friction wheel. This driving member 35 carries a resilient actuating member 36 co-operating with teeth 37 cut into one of the front faces of the friction wheel. This finger 36 and the teeth 37 constitute the two parts of a coupling with a one way drive.

The arm 6 carrying the cover 7 is pivoted on the spindle 5 and subjected to the action of the spring 10 tending to produce opening of the cover.

The operation of this second form of construction of lighter is similar to that described with reference to the lighter shown in Figs. 1 to 3. In fact a push applied to the actuating member imparts to the latter:

1. a first movement which produces the engagement of the two parts of the coupling 28, 29;

2. then a rotation about the spindle 22, a rotation which, by means of this coupling, produces actuation of the lever 25 releasing the cover, and the actuation of the friction wheel through the medium of the link 34, the driving member 35 and the coupling 36, 37.

In this case again it is necessary to impart two separate movements to the actuating member for producing the opening of the cover 7.

The lighter shown in Figs. 5 and 6 is provided with an actuating member formed by a vertical milled wheel 38 placed into a recess 39 provided in the body of the lighter. The friction wheel 16 is secured to a spindle 17 passing through the milled wheel along its axis of rotation. The spindle 17 has a trunnion 40 having a cross section of polygonal shape engaging with an axial bore 41 of corresponding shape. A spring 54 seated in the said bore 41 and bearing against a shoulder 42 of this seating at one end and against a shoulder 43 of the spindle 17 at the other end, tends to hold the milled member in the position shown in Fig. 6.

The cover 7 is held in the closed position by a lever 44 hinged at 45 on the cover and provided with a beak 47 held, by a spring 48, in engagement with a pin 49 secured to the body of the lighter. The mechanical connection connecting the actuating member to the movable part of this locking device is provided with a coupling of which one of the parts is formed by a washer 50, for example of resilient material and having a high co-efficient of friction, located in a hollow provided in the front upper face of the milled member. The second part of this coupling is formed by the rear face 51 of the beak 47.

A heel 52 of the lever 44 coming into contact with the bottom wall 53 of the cover limits the amplitude of the angular movement of this lever.

The operation of the lighter shown in Figs. 5 and 6 of the accompanying drawing is extremely

simple. In fact for producing the opening of the cover and the lighting of the lighter, it suffices to set the milled wheel in rotation by applying to this an axial thrust producing the engagement of the two parts of the coupling **50, 51** against the action of the spring **54**. On examination of the drawing it will be seen readily that these two actions applied to the milled wheel produce on the one hand the actuation of the lever **44** against the action of its spring and the release of the two parts of the locking device, and on the other hand the actuation of the milled wheel.

In the form of construction of the lighter shown in Figs. 7 and 8, a vertical milled wheel **55** is movable radially. For this purpose, the milled wheel is secured rigidly to the spindle **17** of the friction wheel which is pivoted with clearance in the wall **2**. In fact, as shown in Fig. 7, the bore **56** provided in the wall **2** and traversed by the spindle **17**, has an ovalised cross section allowing of movements of the spindle along one of its diametral planes.

As in the form of construction shown in Figs. 5 and 6, the cover **7** is held in the closed position by a beak **47** secured to a lever **44** hinged to the cover at **46** and held in engagement with a pin **49** by a spring **48**.

The mechanical connection connecting the actuating member to the movable part of the locking device is provided with an arm **57** hinged at **45** to a wall **2** and of which the ends act on the lever **44** against the action of the spring **48**. The arm is provided with a notch **58** which forms one of the parts of the coupling inserted in the mechanical connection connecting the actuating member to the lever **44**. The second part of the coupling is formed by a milled section **59** of the spindle **17**.

Thus, when the user applies a push to the actuating member enabling a movement of rotation to be imparted thereto, it produces the engagement of the two parts of the coupling **58, 59**. Then, the rotation of the actuating member produces an angular movement of the arm **57** and the actuation of the lever **44** against the action of its spring **48** and the release of the cover. Normally, when the user does not apply a push to the actuating member, this is returned to the position shown in the drawing by the push applied by the pyrophoric element *p* on the friction wheel **16**, this element being subjected to the action of a spring *r* and the push applied by the pyrophoric element tending to hold the two parts of the coupling in the disengaged position shown in the drawing.

Fig. 9 shows a modified form of construction of the lighter shown in Figs. 7 and 8, in which the actuating member is formed by a milled member **60** movable axially along the spindle **17** of the milled member. The spindle is provided with a section **61** of polygonal cross section engaging with a seating **62** of corresponding shape provided axially in the milled member. A spring **63** located in an axial housing **64** of the milled member bears at one end against a shoulder **65** of the spindle **17** and at the other end against the bottom **66** of the said housing **64**. This spring tends to hold the milled member **60** in the position shown in the drawing, for which a projection **67** of the milled member is engaged in a recess **68** of the wall **2**.

In this modified form of construction, the mechanical connection connecting the actuating member to the movable part of the locking device



for the cover is in all respects similar to that described with reference to Figs. 7 and 8.

In order to effect the opening of the cover, it is necessary to impart three separate movements to the actuating member:

1. To move the milled member **60** axially against the action of the spring **63**, in order to disengage the projection **67** from the recess **68**.

2. To produce the oscillation of the milled member **60** up to the position shown in chain dotted lines in Fig. 9, in order to bring the two parts of the coupling **58, 59** into engagement.

3. To impart a movement of rotation to the milled member **30**, in order to actuate the arm **57** and to provoke the disengagement of the two parts of the locking device and the release of the cover.

In this modification, the projection **67** engaging with the recess **68** constitutes a bolt preventing the engagement of the two parts of the coupling **58, 59**.

From the foregoing and by examination of the drawing, it is easy to see that the accidental opening of the cover is rendered practically impossible, by reason of the fact that for producing the opening of the cover, it is necessary to impart to the actuating member three separate successive movements.

I claim:

1. In a lighter, the combination, comprising, a body element having an opening at the top, a cover element hinged to the body element and movable from a closing to an open position, a spring urging the cover to open position, a locking member mounted on one of the elements, another locking member movably mounted on the other element and engageable with the first locking member and then holding the cover closed, a second spring urging the other locking member to a certain position, a friction wheel rotatable in the body element, a control member driving the friction wheel and mounted on the body element from movement from an inoperative to operative position, coupling means mounted on the body element in a position disengaged from the control member when in operative position and engageable by the control member after movement of same to its operative position and upon rotation of the control member disengaging the locking members to move the cover element to open position.

2. The combination according to claim 1 and also comprising resilient means urging the control member to inoperative position.

3. The combination according to claim 2 and wherein the control member includes a spindle actuating the coupling means by its rotation.

4. The combination according to claim 3 and wherein the other locking member constitutes a latch lever fulcrumed on the body element and the first locking member is a pin on the cover element and engaged by the latch lever.

5. In a lighter, the combination, comprising, a body element having an opening at the top, a cover element hinged to the body element and movable from a closing to an open position, a spring urging the cover to open position, a locking member mounted on one of the elements, another locking member movably mounted on the other element and engageable with the first locking member and then holding the cover closed, a second spring urging the other locking member to a certain position, a friction wheel rotatable in the body element, a gear train driving the friction wheels, a control member driving

the gear train and mounted in the body element for movement from inoperative to operative position, coupling means engageable by the control member after movement of same to its operative position and upon rotation of the control member disengaging the locking members to move the cover element to open position.

6. In a lighter, the combination, comprising, a body element having an opening at the top, a cover element hinged to the body element and movable from a closing to an open position, a spring urging the cover to open position, a locking member mounted on one of the elements, another locking member movably mounted on the other element and engageable with the first locking member and then holding the cover closed, a second spring urging the other locking member to a certain position, a friction wheel rotatable in the body element, a vertically disposed control member coaxial with and driving the friction wheel and mounted in the body element for movement from inoperative position, coupling means mounted on the body element in a position disengaged from the control member when in operative position and engageable by the control member after movement of same to its operative position and upon rotation of the control member disengaging the locking members to move the cover element to open position.

7. The combination according to claim 6 and wherein the control member is axially movable and further comprising a spring urging the control member to inoperative position.

8. The combination according to claim 7 and wherein the coupling means is constituted by a washer on the control member having a high coefficient of friction and engaging the other locking member to disengage same from the first locking member.

9. In a lighter, the combination, comprising, a body element having an opening at the top, a cover element hinged to the body element and movable from a closing to an open position, a spring urging the cover to open position, a locking member mounted on one of the elements, another locking member movably mounted on the other element and engageable with the first locking member and then holding the cover closed, a second spring urging the other locking member to a certain position, a friction wheel rotatable in the body element, a vertically disposed control member rigid with the friction wheel and movable at right angles to its longitudinal axis in the body element from inoperative to operative position, a coupling arm fulcrumed upon the body element and engageable by the control member and swung by the rotation thereof, said arm on being swung engaging the locking member movably mounted on the other element to disengage the locking members.

10. In a lighter the combination comprising, a body element having an opening at the top, a cover element hinged to the body element and movable from a closing to an open position, a spring urging the cover to open position, a locking



pin mounted on one of the elements, a locking latch lever movably mounted on the other element and engageable with the locking pin and then holding the cover closed, a second spring urging the locking latch lever to a certain position, a friction wheel rotatable in the body element, a control member driving the friction wheel and mounted on the body element for movement from an inoperative to operative position and including a spindle, a coupling lever fulcrumed on the body element and including a part engaged by the spindle of the control member after movement thereof to its operative position and another part engaging the latch lever and upon rotation of the control member disengaging the latch lever to move the cover element to open position, and resilient means urging the control member to inoperative position.

11. In a lighter, the combination, comprising, a body open at the top and having side openings, a cover hinged to the body and movable from a closed to an open position, a spring urging the cover to open position, a fixed locking member mounted on the cover, a movable locking member pivotally supported on the body and engageable with the fixed locking member to hold the cover closed, a second spring urging the movable locking member normally to locked position with reference to said pin, a friction wheel rotatable on the body, a control member for rotating the friction wheel and having horizontal axis slidable in said side openings in the body, a third spring normally urging the axis of the control member into engagement with one end of the side openings of the body, and a coupling arm fulcrumed on the body and engageable at one end with the axis of the control member after the latter has been shifted in said side openings, whereby upon completion of the shifting and rotation of the control member the said arm may be swung to cause the disengagement of the said fixed and movable locking members.

12. The combination according to claim 11, wherein, the body element has a recess and the control member has a reduced portion fitting the recess under the force of said third spring.

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