July 30, 1957 V. BOHDAL 2,800,785

PYROPHORIC LIGHTER

Filed May 21, 1956

Fig. 1

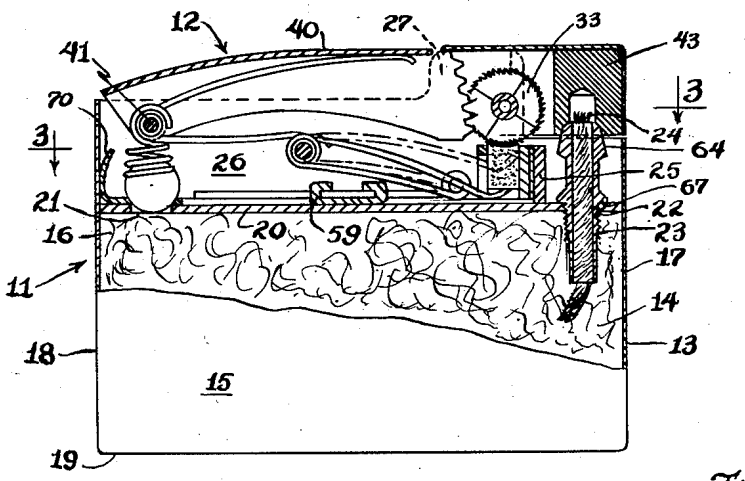


Fig. 2

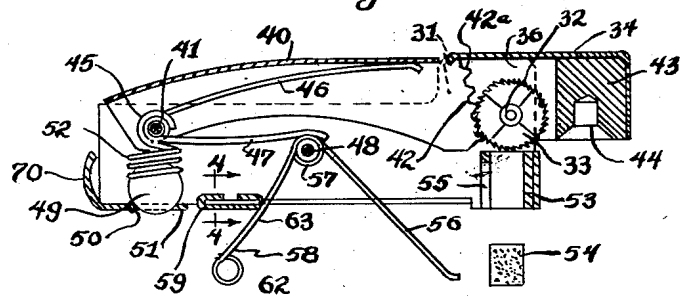


Fig. 6

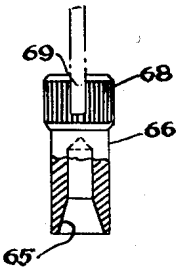


Fig. 7

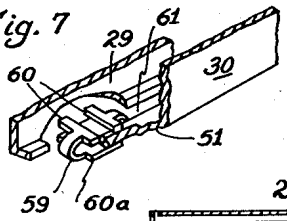


Fig. 4

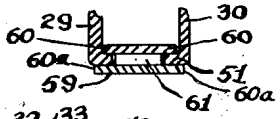


Fig. 3

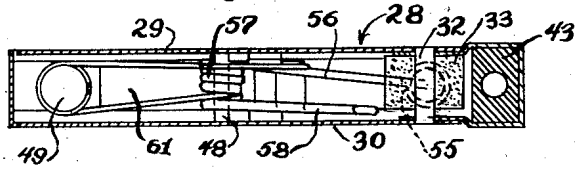
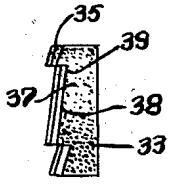


Fig. 5



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United States Patent Office 2,800,785 Patented July 30, 1957

2,800,785

PYROPHORIC LIGHTER

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Application May 21, 1956, Serial No. 586,005

5 Claims. (Cl. 67—7.1)

This invention relates to pyrophoric lighters; and to a pyrophoric flame-producing mechanism of novel structure which is readily mountable to, detachable from, and carries a seal for, its fuel reservoir. More particularly, this invention relates to a novel pyrophoric element feed and retention device which allows easy removal and replacement of the element, and which is readily adjustable whereby a substantially uniform pressure may be retained between the element and its abrasive wheel as the element experiences wear.

In known pyrophoric lighters it is difficult and time consuming both to replenish the fuel supply and to replace the pyrophoric element as it wears. Both generally require much turning of screws or other intricate operations. Further, as the pyrophoric element wears with use, it is generally found that its biasing spring becomes less effective. The result is that, with element wear, pressure between the element and its spark-producing wheel drops rapidly, ultimately resulting in little or no sparks being produced by the wheel as it rotates.

Another defect in known lighter mechanisms is the fact that stress in the spring which provides bias for the pyrophoric element is directly related to the size of the element. Thus, for any given size element, there is no simple way to take its hardness and other physical qualities into account when biasing it against its abrasive wheel. Consequently, it is often found that a particularly hard element causes undue wear of the abrasive wheel, or may even lock the wheel when the spring biasing means is unnecessarily strong, causing stripping and breakdown of the spark-producing working parts.

Accordingly, it is an object of this invention to overcome these and other failings of prior known pyrophoric lighters.

A principal object of this invention is to provide a lighter which allows easy access to the fuel and pyrophoric element reservoirs.

Another object of this invention is to provide a spark-producing mechanism which is readily mountable to and detachable from its fuel reservoir, and which further carries means on its underside for effectively sealing the fuel reservoir.

A still further object of the present invention is to provide a simple and effective feed and retention device for the pyrophoric element, one which is readily adjustable to cause the desired pressure between the element and its abrasive wheel as the element wears, and one which allows easy and rapid access to the element reservoir.

And, a still further object of this invention is to provide means for biasing the pyrophoric element against its abrasive wheel, said biasing means being effective independent of element size, yet being adjustable to take into account the physical qualities of the element.

A still further feature of this invention is to provide a simple and compact pyrophoric lighter which can be readily carried in a pocket or purse without being obtrusive and which comprises a minimum number of working parts.

The foregoing and other objects, advantages and features of construction of the invention will become apparent from a consideration of the following description and the appended drawing.

In the drawing:

Figure 1 is an elevation view, partly in cross-section, of the present lighter, showing the pyrophoric element retention structure positioned for a long flint in solid lines, and positioned for a short flint in phantom lines;

Figure 2 is a side elevation sectional view of the striker mechanism casing showing the pyrophoric element retention structure in refill position;

Figure 3 is a plan sectional view taken along line 3—3 in Figure 1;

Figure 4 is a partial sectional view taken along line 4—4 in Figure 2;

Figure 5 is a partial view of the striker wheel actuating structure;

Figure 6 is an elevational view, partly in section, of a tool for removing the lighter wick; and

Figure 7 is a fragmentary perspective view of a slidable stop forming a portion of the pyrophoric element retention structure.

Referring to the drawing, the lighter comprises a fuel receptacle 11 and an ignition or striker mechanism carrier 12 removably mounted above receptacle 11. When assembled, the lighter is of generally rectangular shape in elevation, flat and of very thin width in order that it may conveniently be carried in a purse or pocket without being obtrusive. In practice, it has been found that an over-all size of approximately two inches in length, one and one-half inches in height, and one-quarter inch in width, is sufficient for housing the fuel compartment and working mechanisms, while storing an adequate fuel supply for ordinary use and providing ample surface for convenient handling and operating purposes.

The receptacle 11 includes a fuel reservoir 13 which may be filled with cotton 14 or other known absorbent materials. Receptacle 11 comprises side walls 15, 16, end walls 17, 18, and bottom 19, all of which form the outer surfaces of the lighter, and has at its top a cover partition 20. Adjacent one end of partition 20 is a circular opening 21 which provides access to the receptacle's interior. Adjacent its other end, partition 20 has an opening 22 through which an open end wick carrier or tube 23 is threaded. A wick 24, carried within tube 23, extends to within the fuel reservoir 13 and cotton 14 to absorb fuel, and at its other end is positioned sufficiently above the outer end of tube 23 to intercept the flying sparks when the striker mechanism is actuated. A small wall 25 projects upwardly from partition 20 adjacent tube 23, but not thereabove, to partition the fuel burning area and to furnish a guide wall for receiving the striker mechanism.

Side walls 15, 16 and end walls 17, 18, extend above partition cover 20 to form, together with wall 25, an open top compartment 26 for receiving and holding the striker mechanism carrier 12 therein. An ear 27 atop each of walls 15, 16, provides a continuous finished outer surface to cover the working parts of the striker mechanism. The ears 27 are sprung slightly toward each other to yieldably receive and hold the mechanism therebetween.

The striker mechanism carrier 12 includes a casing 28 having side walls 29, 30 for nestingly resting between the upper portions of walls 15, 16. An ear 31 on each side wall 29, 30 is positioned near the forward portion of casing 28 to be yieldably held between the ears 27, and further provides a support for a shaft 32. An abrasive striker wheel 33, capping member 34, and ratchet 35 are rotatably carried on shaft 32. Ratchet 35 is fixed to one of the arms 36 of member 34 for movement therewith, and has a series of spring teeth 37 which press against a

series of cooperating ramps 38 on the side of striker wheel 33. As member 34 is rotated upwardly, the teeth 37 engage the ends 39 of ramps 38 to rotate wheel 33 therewith. As member 34 moves downwardly, however, the teeth 37 slide up and over the ramps 38, leaving the striker wheel stationary. The cooperating ratchet teeth 37 and ramps 38 thus form a simple and efficient one way clutch system for rotating the striker wheel 33.

Movement of capping member 34 is effected by means of a depresser bar 40 which is rotatably mounted at one end on a shaft 41 held between walls 29, 30. At its forward end, bar 40, on each side, carries a gear segment 42 which meshes with a gear segment 42*a* carried by each arm 36 of member 34. As bar 40 is pressed downwardly, its movement causes member 34 to rotate upwardly, turning striker wheel 33. Movement of bar 40 towards its normal position, shown in Figures 1 and 2, returns member 34 to its closed position. At this position, a block 43, carried within member 34 and having an extinguishing well 44, is positioned directly above wick 24 to extinguish any flame. A spring 45, anchored around shaft 41 and having one arm 46 pressing against the underside of bar 40, and a second arm 47 pressing against the shaft 48 held between walls 29, 30, yieldably retains bar 40 in its upper or normal position.

A sealing sphere 49, carried adjacent the back end and bottom of casing 28, protrudes sufficiently through an opening 50 in the casing bottom 51 to extend to and seal the opening 21 and cover partition 20. Sphere 49 is yieldably held in position by means of a compressed spiral spring 52, one end of which abuts sphere 49, while the other end is anchored against shaft 41. As casing 28 is placed in position atop receptacle 11, spring 52 urges sphere 49 tightly across opening 21 to provide an effective seal for fuel reservoir 13. In practice, it has been found that an ordinary steel ball or bearing performs ideally when used as a sealing sphere.

Directly below pyrophoric element striker wheel 33 and leading thereto is a tube 53 for holding the element 54. A slot 55 in tube 53 provides access means whereby an arm 56 of spiral spring 57, rotatably wrapped about shaft 48, urges the element against striker wheel 33. Stressing of spring 57 is accomplished by positioning its second arm 58 within casing 28. Slidable stop 59, guided by fingers 60, 60*a*, in a slot 61 in casing bottom 51, provides a stop for retaining arm 58 within casing 28.

The foregoing construction thus provides means for easy and rapid removal and replacement of the pyrophoric element. To remove element 54 and allow access to within tube 53, stop 59 is moved rearwardly, thereby relieving the stress on spring 57 and allowing it and its arms to rotate freely to a position as shown in Figure 2. After the element is inserted into tube 53, spring arm 56 is swung back to support the element and arm 58 is urged to within casing 28. For this purpose, arm 58 has a round loop 62 to prevent injury to the fingers. Thereafter stop 59 is moved to a position whereat it retains spring 57 stressed and the element pressed against striker wheel 33. The greater portion of the force exerted by spring 57 on stop 59, when the stop is in the position shown in Figure 1, is downward, while that portion of the force exerted laterally on stop 59 by spring 57 is resisted by the frictional engagement of the fingers 60, 60*a* with the casing bottom 51.

The pyrophoric element retention apparatus, moreover, is capable of maintaining a near constant pressure on the element 54 regardless of the element length or the fact that the element wears. To maintain approximately constant pressure on the element, the spring 57, of course, must experience the same stress when the element is short as well as when it is new or long. This stress may be measured by the angular displacement between arms 56, 58. Assuming that stop 59 remains fixed, it is seen that as the pyrophoric element becomes shorter, arm 56 moves upwardly, increasing the angular displacement between

arms 56, 58 and reducing the stress in spring 57. This, in turn, decreases the pressure urging pyrophoric element 54 against striker wheel 33, and ultimately results in little or no sparks being produced as wheel 33 rotates. However, by means of stop 59, which may be moved forward (to the right as seen in Figure 1), arm 58 may be moved towards arm 56 to return the stress on spring 57 to the desired normal, thus compensating for wear on the pyrophoric element 54. Arm 58 is bowed slightly at its mid-portion 63 so that as stop 59 moves forward, stress in spring 57 increases rapidly. In this manner, element wear may be easily compensated for by slight movement of stop 59.

As is evident from the drawing and the foregoing description, for any given element length, the more forward stop 59 is pushed, the greater the stress is in spring 57, and the greater the force is which urges the element against its striker wheel 33. Thus, while between different elements there may be varying degrees of hardness, the present element retention mechanism provides means for creating the desired necessary element pressure against its striker wheel, independent of the element length. For example, with a hard element less pressure may be desired, since too great an element pressure against the striker wheel results in rapid wheel deterioration. Moreover, the greater than necessary pressure may cause the wheel 33 to lock against the pyrophoric element 54, consequently causing stripping of the operating gear segments 42 and 42*a*. By positioning stop 59 more rearwardly and thus decreasing element pressure when using a hard element, these undesirable defects are easily overcome. In contradistinction, with a softer element, a greater pressure is permissible to achieve the desired sparking for igniting the wick. Stop 59, thus, may be moved more forwardly to create a greater element pressure against striker wheel 33. In either case, once the desired pressure is achieved, it may be maintained by moving stop 59 forward as the element wears.

The present lighter further provides means for easy replacement of wick 24. As seen in Figure 1, tube 23 has a frusto-conical top surface 64 which is frictionally engageable with a coinciding frusto-conical surface 65 of a wick replacement tool 66. Pressure on the tool when it is placed over tube 23 causes the surfaces 64, 65 to engage, and turning of the tool correspondingly threads the tube to and from its position in partition cover 20. When threading the tube into position, advantageously the frusto-conical surfaces provide means for preventing overturning of tube 23, since frusto-conical surface 65 of tool 66 will slip over surface 64 once tube shoulder 67 abuts cover partition 20. As a consequence, the threads on tube 23 are retained intact. To facilitate turning, tool 66 at its top has a knurled portion 68 and a slot 69 in which a coin or screwdriver may be inserted.

To replace a wick, tube 23 is removed and a new wick is threaded therethrough. Thereafter, the tail portion of the new wick is pushed through opening 22 and into fuel reservoir 13, and the tube is turned into place with the aid of tool 66.

An upwardly directed curved spring arm 70, extending from casing bottom 51, is provided as means additional to cooperating ears 27, 31 to yieldably retain casing 28 atop receptacle 11. Spring arm 70 acts to urge casing 28 forward and into abutting relationship with wall 25, whereby the casing experiences retention pressure along its longitudinal axis as well as along its transverse axis across its ears 31. Removal of casing 28 is achieved by applying a slight prying pressure adjacent cap member 34. To replace the striker mechanism, spring arm 59 is brought into abutting engagement with end wall 18, and a slight downward pressure snaps the casing into position.

Operation of the lighter is achieved by pressing bar 40 down, thereby raising capping member 34 from wick

24 and rotating striker wheel 33 to throw sparks toward wick 24. To extinguish the flame, bar 40 is released and urged upwardly to its normal position while capping member 34 is lowered over wick 24 which is encompassed within well 44 to snuff out the flame. The one-way clutch arrangement of ratchet 35 and ramps 38 allow wheel 33 to remain stationary during the return movement of member 34. Periodically after a certain amount of lighter use, carrier 12 is detached from receptacle 11 to allow resetting of stop 59 and increase the stress in spring 57 to the desired amount. If necessary, fuel reservoir 13 may be refilled at this time, after which carrier 12 is remounted atop receptacle 11.

While the structure described forms a satisfactory pyrophoric lighter, it is to be understood that other forms may be utilized, and that the embodiment herein enumerated and described is for the purpose of illustration only and not intended to limit and define the invention. Other forms readily suggest themselves; namely the pyrophoric element retention mechanism is adaptable to those forms of lighters wherein finger or thumb pressure is applied directly to the abrasive wheel to effect its rotation, or it is adaptable to use with lighters containing liquified compressed petroleum fuel.

What is claimed is:

1. A pyrophoric lighter, comprising: a fuel reservoir, a flame-producing burner connected therewith, a carrier mounted on said reservoir, spark generating means adapted to throw sparks to said burner, and structure for retaining and biasing a pyrophoric element against said means, including a stop slidably mounted on said carrier, a stressable spring mounted on said carrier, having a first arm adapted to engage and hold said element against said means, and a second arm angularly displaced from said first arm and engageable with and positionable by said stop to control the stress in said spring, thereby to effect a substantially uniform angular displacement between said arms and a substantially uniform biasing of said element against said means as said element wears.

2. A pyrophoric lighter, comprising: a fuel reservoir, a wick extending therefrom, a carrier mounted atop said reservoir and having a longitudinally slotted bottom wall, a striker wheel rotatably mounted on said carrier and adapted to throw sparks to said wick, a pyrophoric element, and means for retaining and biasing said element against said wheel, including a stop slidably mounted in said slotted bottom wall, a stressable spring mounted to said carrier and having a first arm adapted to engage and hold said element against said wheel, and a second arm angularly displaced from said first arm and engageable with and positionable by said stop, whereby as said element wears with use and said first arm moves, said stop is movable to maintain a substantially uniform angular displacement between said arms and uniform stress in said spring, thereby to maintain a substantially uniform biasing of said element against said wheel.

3. A lighter as described in claim 2 wherein said spring has a coiled portion and said arms extend one from each end thereof, and additionally including a shaft mounted on said carrier and around which the spring coiled portion is rotatably wrapped, whereby movement of said stop from said second arm permits said spring to rotate freely about said shaft to allow said element to drop from contact with said wheel.

4. A pyrophoric lighter characterized by the fact that biasing of a pyrophoric element against the striker wheel is achieved independent of element length and is adjustable to remain constant throughout element wear, comprising: a casing to carry said wheel, a longitudinal slotted track in said casing, a stop slidably mounted to said casing track, a shaft in said casing, a stressable spring including a central coiled portion rotatably mounted on said shaft, a first arm extending from one end of said coiled portion and adapted to engage and retain said element against said wheel, and a second arm extending from the other end of said coiled portion, angularly displaced from said first arm, and engageable with and positionable by said stop to effect a substantially uniform angular displacement between said arms and uniform stress in said spring as said element wears, said stop being slidably movable from engagement with said second arm to release the stress in said spring and allow rotation thereof to a position whereat said element is removable.

5. A pyrophoric lighter, comprising: a fuel receptacle having at its top a wick protruding therefrom, a pyrophoric spark-producing carrier at the top of said receptacle, cooperable means on said receptacle and said carrier for detachably retaining said carrier on said receptacle, a bottom wall on said carrier, said wall having a longitudinal slot therein, an abrasive wheel rotatably mounted on said carrier, a capping member pivotally mounted on said carrier and adapted to cover said wick when in inoperative position, a one way clutch connecting said capping member with said abrasive wheel, a depresser bar pivotally mounted at one end to said carrier and operatively connected at its other end with said capping member, whereby as said bar is depressed said capping member pivots upwardly away from said wick and said abrasive wheel rotates, and mechanism for retaining and biasing a pyrophoric element against said abrasive wheel, including a stop in said casing bottom wall and having fingers slidably engaging the bottom and top surfaces thereof whereby said stop is positionable in said slot, a coil spring rotatably anchored to said carrier, said spring having a first arm adapted to engage and hold said element against said wheel, and a second arm angularly displaced from said first arm and engageable with and positionable by said stop to control the stress in said spring, thereby to effect a substantially uniform angular displacement between said arms and a substantially uniform biasing of said element against said wheel as said element wears.

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