Nov. 22, 1955 T. H. MORGAN 2,724,253

BUTANE CIGARETTE LIGHTER

Filed Feb. 10, 1954

Fig. 1

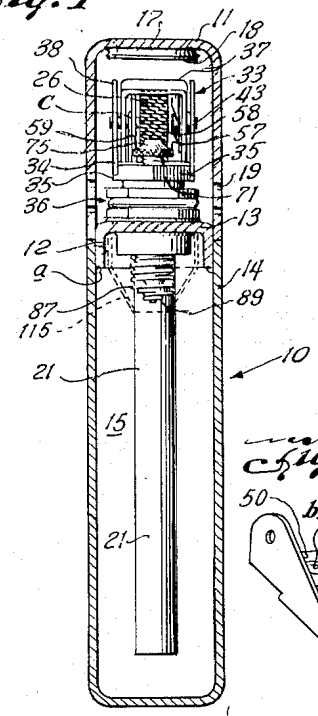

Fig. 2

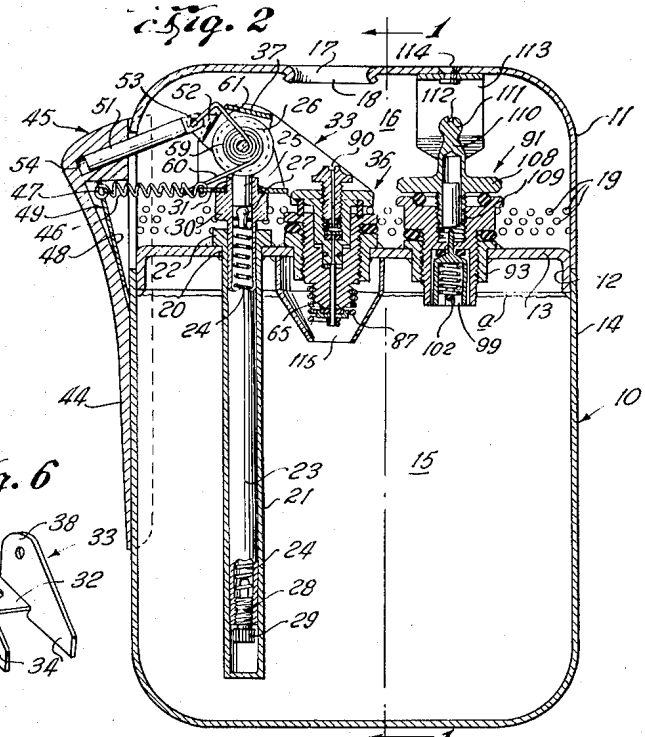

Fig. 6

Fig. 3

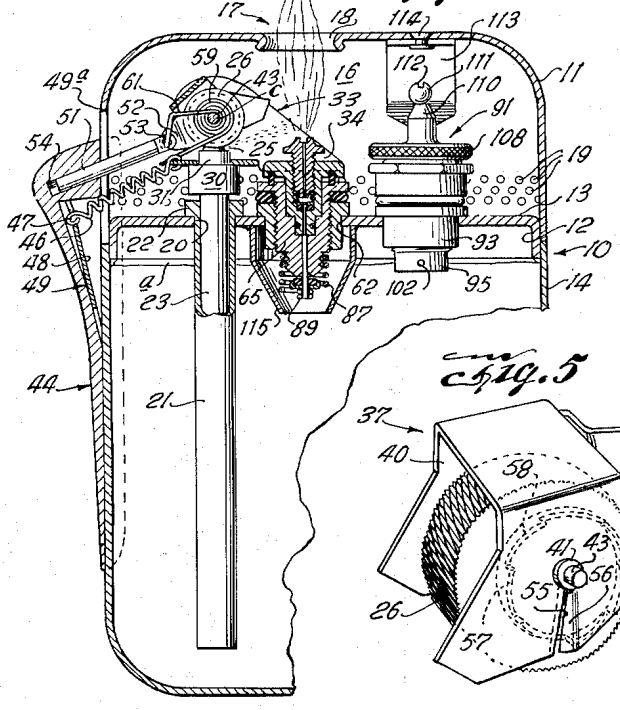

Fig. 7

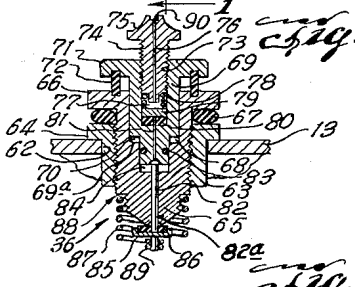

Fig. 4

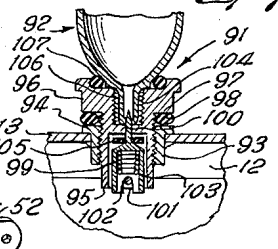

Fig. 5

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BUTANE CIGARETTE LIGHTER

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10 Claims. (Cl. 67—7.1)

This invention relates to lighters for smokers and it has particular reference to lighters in which commercial butane, propane and the like are used as fuel.

Lighters in which butane or other gaseous fluid is employed have proven to be popular with smokers chiefly for the reason that this type of fuel lends itself to storage for long periods as a liquid under pressure and readily vaporizes when released to atmosphere, producing a smokeless flame through a valve which can be conveniently adjusted to govern the height of the flame in relation to the flame tip of the lighter. Further advantages of butane as a lighter fuel over the hydro-carbon liquid employed in the wick-type lighters resides in the fact that the former is virtually odorless and presents no hazard when filling a lighter from pressurized containers, provided suitable valve mechanism is provided in the lighter to control pressure within the fuel reservoir of the lighter. In general, conventional butane lighters have not been altogether successful due to certain inefficiencies in valve mechanisms designed to control release of the vaporized liquid and which, because of the nature of the fuel, usually consist of many parts tending to complicate the mechanism to the extent that absolute control in the release of the gas is virtually impossible. Moreover, valves made of resilient material in an effort to simplify construction without sacrificing efficiency have been found to bend under reservoir pressure, either holding the valve closely entirely or making impossible any consistent control of gas release.

It is the principal object of the present invention to overcome the inadequacies obvious in conventional butane lighters by providing a valve whose peculiar design and construction permits a positive and constant flow of fuel issuing from the reservoir in open position of the valve and which includes a primary and a secondary restrictor necessary in this type of valve to insure such constant flow.

Another object of the invention is to provide butane lighter valve having a flame tip or burner which is spring biased against the secondary resistor and constitutes an adjustment for predetermining the height of the flame.

Still another object of the invention is to provide a butane lighter valve in which a closing booster chamber is incorporated between the primary and secondary restrictors whose function is to insure speedy and positive closing action of the valve under reservoir pressure.

Yet another object of the invention is to provide a filler valve equipped with a piercing pin for penetrating the seal in the nozzle of a conventional refill container, which nozzle is compressedly or threadedly receivable in a bore in the filler plug containing the valve to transfer liquid fuel from the container to the lighter reservoir without spilling or escape of pressure.

Broadly, an improved butane lighter is provided having a minimum number of parts needed for positively controlling and igniting the gaseous fuel, said parts being designed and assembled in such manner that they are readily accessible to the user of the lighter for adjustment of flame height, replacement of flints and replenishing fuel. Furthermore, the organization of parts lend themselves to incorporation in a hand-fitting case of pleasing appearance, devoid of unsightly protrusions.

Other objects will appear as the description proceeds when considered with the annexed drawing, wherein:

Figure 1 is a vertical sectional view of a lighter constructed according to the invention and taken on line 1—1 of Figure 2.

Figure 2 is a vertical sectional view of the lighter rotated 90° from the showing in Figure 1.

Figure 3 is a view similar to Figure 1 but showing the valve and sparking wheel actuating lever in depressed position for opening the valve and igniting the fuel.

Figure 4 is a fragmentary view showing the operation of filling the lighter fuel reservoir from a fuel container.

Figure 5 is a detail perspective view of the sparking wheel and ratchet pawl on a larger scale.

Figure 6 is an enlarged perspective view of a yoke employed in the valve operating mechanism.

Figure 7 is an enlarged view of the fuel release valve.

Continuing with a more detailed description of the drawing, reference numeral **10** denotes generally the lighter case which is suitably drawn or molded in a norrow ellipsoidal shape in transverse section without sharp edges, corners or projecting parts. The case includes a removable top or cap **11** whose lower edges frictionally engage the upper half of a peripheral flange **12** formed about a transverse partition **13** which is solder-sealed at *a* into the top of the lower portion **14** of the case. The lower portion **14** of the case constitutes a chamber or reservoir **15** for a gaseous lighter fuel such as commercial butane. The cap **11** and partition **13** provide an ignition and combustion chamber **16**, the cap being provided with a flame opening **17** having a downwardly and outwardly finish flange **18**. To admit air into the chamber **16** necessary to proper combustion of fuel to produce a flame, any suitable opening or openings may be provided in the cap **11** but in the present case, a plurality of rows of apertures **19** are formed in the skirt of the cap **11**, spaced upwardly from the bottom thereof and extending around the cap.

The partition **13** has an opening **20** therein adjacent one end thereof through which extends a guide wall **21** having an annular flange **22** formed on its upper end which seats upon and is welded or soldered to the top of the partition **13**. Extending downwardly into the guide well **21** is a flint tube **23** which is axially displaceable and contains a coil spring **24** which biases a flint **25** against a sparking wheel **26** through the medium of a soft metal plug **27** which is attached to the upper end of the spring **24**. Tensional adjustment on the spring **24** is accomplished through the medium of a screw **28** threaded into the bottom of the flint tube **23** to bear against the lower end of the spring. A knurled end **29** is formed on the screw **28** to facilitate its manipulation.

An annular boss **30** is formed on the upper end of the flint tube **23** having a reduced upper end **31** which receives an opening *b* in the web **32** of a yoke **33**, the latter being shown in detail in Figure 6. The yoke **33** is affixed to the boss **30** by welding or soldering and is formed with parallel, relatively spaced arms **34** which engage in diametrically opposed recesses **35** in the top of a fuel release valve **36** which will be again referred to in more detail presently.

A clevis **37** (Figure 5) is disposed to oscillate between the upstanding sides **38** of the yoke **33** and is of substantially U-shape, having sides **39** and **40** which have aligned apertures, one of which has a bushing **41** extending therethrough, whose aperture is adapted to register with the aligned apertures **42** (Figure 6) of the yoke to receive

a shaft 43, on which the clevis oscillates. Mounted also on the shaft 43 is the sparking wheel 26 which is embraced by the clevis 37 whose function is to actuate the sparking wheel in the manner to be presently explained. The bushing 41 serves to center the sparking wheel 26 on the shaft 43.

Slidable longitudinally on one edge of the case 10 is an operating lever 44. This operating lever is formed with a radius conforming to that of the edge of the case and merges into the curvate design of the latter. The top 45 of the lever 44 is slightly inclined and convexed, as shown and is engaged by the thumb of the hand holding the case which exerts a downward thrust on the lever against the resistance of a coil spring 46 which biases the lever upwardly. The outer end of the spring 46 is engaged in an aperture 47 made in the top of a metal leaf insert 48 which lies in a longitudinal channel or recess 49 in the inner surface of the operating lever 44. The spring 46 extends through a slot 49*a* in the cover or cap 11 and the opposite or inner end of the spring engages in an aperture 50 (Figure 6) in an adjacent edge of the web 32 of the yoke 33.

It is apparent from the foregoing that the yoke 33, flint tube 23, clevis 37 and the sparking wheel 26 are held in floating suspension by the spring 46 when the operating lever 44 is in raised position.

To actuate the sparking wheel 26, a link 51 is connected at its inner end between a pair of ears 52 of the clevis 37 by means of a pin 53. The opposite or outer end of the link 51 extends through the slot 49*a* and is slidably received in a bore 54 in the top of the operating lever 44. Therefore, when the lever 44 is depressed, the clevis 37 is rocked on the shaft 43 by the link 51, the latter being permitted to slide in the bore 54 to compensate for the arc described by the ears 52 of the clevis as the latter rotates.

In order to impart rotation to the sparking wheel 26, the clevis 37, which is made of thin resilient material, is provided with a pawl which is formed by a slit 55 (Figure 5) made in the side 39 thereof, one edge 56 of the slit being turned inwardly at an angle to the plane of the side 39 and adapted to successively engage the teeth 57 of a circular ratchet 58 which is affixed to or made integral with the side of the sparking wheel next adjacent the side 39 of the clevis 37, as borne out in Figure 5. Therefore, each time the lever 44 is depressed, the link 51 will rotate the clevis 37 on its shaft 43, causing engagement of the pawl 56 with a tooth 57 of ratchet 58, thereby producing a spark by reason of the engagement between the sparking wheel 26 and the flint 25, the frictional relationship between the wheel and flint being maintained by the spring 46 until such time as the operating lever is fully depressed.

To return the clevis 37 to its original position, a torsion spring 59 is provided which has two of its convolutions tightly engaging the shaft 43 as at *c* while the ends 60 and 61 engage the web 32 of yoke 33 and the top of the clevis 37, respectively. The end 61 of the spring 59 is bent at right angles to extend downwardly and overlie one end of the pin 53 to hold the same against longitudinal movement. The thrust, therefore, of the torsion spring 59 is to raise the clevis on its pivot while at the same time clamping the shaft 43 by its inner convolutions, tending to rotate the shaft to which the sparking wheel 26 is affixed and to preclude longitudinal displacement of the shaft, making it unnecessary to peen the ends of the latter.

Referring again to the fuel release valve 36; an opening 62 is made in the partition 13 to receive an interiorly threaded sleeve 63 having a flange 64 on its upper end which is welded to the upper surface of the partition 13. Threaded into and extending below the sleeve 63 is the body 65 of the valve which has an annular flange 66 about its upper end which is spaced above the

flange 64 of the sleeve 63. An O-ring seal 67 is interposed between the flanges 64 and 66.

Reciprocably disposed in an axial bore 68 in the valve body 65 is a core 69, the bore having a reduced lower portion defining an annular shoulder 69*a* against which a shoulder 70, formed on the core 69, is adapted to engage as a stop to limit downward displacement of the core which is accomplished in a manner to be explained presently. The core 69 is also provided with a flange 71, spaced above the flange 66 of the valve body 65 and a resilient protector seal 72 is embedded in confronting grooves in the adjacent faces of these flanges.

The valve core 69 has an axial bore 73 extending partially therethrough, the upper portion of which is threaded to receive the threaded shank 74 of a flame tip or burner 75. The burner and shank 74 has an axial fuel passage 76 which communicates with the bottom of the bore 73 in which the upper end of a coil spring 77 engages a shoulder 78 formed on the shank 74, the lower end of the spring bearing against a blank disc 79 which latter is in flush engagement with a resilient washer 80. Washer 80 has a restricted opening which is in register with the upper end of a fuel passage 81 in the core 69, the latter being held normally closed by a valve stem 82 which reciprocates in an axial bore 82*a* which extends through the lower portion of the valve body 65. Repeated longitudinal reciprocable movements of the stem 82 in the orifice or passage 82*a* will prevent accumulation therein of impurities in the fuel used in the lighter. An O-ring 83 forms a seal about that portion of the core 69 which reciprocates in the reduced lower end of the bore 68 and, below the lower end of core 69, a space 84 is provided, serving as valve closing booster chamber. Pressure of gas entering the chamber from the reservoir 15 of the case through passage 82, tends to exert a force against washers 79 and 80 counter to the action of spring 77, the washer 80 being compressible to close off further passage of gas upward through the burner shank 74.

The stem 82 of the valve extends downwardly through the fuel passage 82*a* in the valve body 65 and carries on its lower end a cup 85. A sealing washer 86 of resilient material is interposed between the cup and the lower end of the passage in which the stem 82 reciprocates to keep this passage closed except when the stem is displaced downwardly to open the valve. A valve closing spring 87 is threaded onto the threaded and reduced lower end of the valve body, its upper end engaging a shoulder 88 formed by the reduced diameter of the lower end of the valve body. The valve closing spring 87 must resist the energy of the spring 46 which biases the operating lever 44 to raised position, the energy of the torsion spring 59, the friction between the flint tube 23 and the well 21 as well as the tendency of the resilient seal 72 to hold the valve open. This can be accomplished by adjusting the spring 87 on the threaded portion on the lower end of the valve body 65. Moreover, such adjustment is made to adapt the valve to various vapor pressures developed by different types of fuels. The lower end of the spring has smaller convolutions 89 which embrace the extended end of the valve stem 82 below the cup 85. Energy tending to collapse the spring 87, combined with pressure of gas within the chamber 15, maintains closed position of the valve by exerting an upward force on the stem 82, whose upper end closes the lower end of fuel passage 81 in the core 69.

The relative diameters of the valve stem 82 and its passage determines the primary rate of flow of fuel gas through the valve and constitutes the primary restrictor referred to in the preamble. A secondary restrictor is formed by the contiguous washers 79 and 80 which, as pointed out above, are biased together by the coil spring 77, the expansible washer holding back any gas rising into the booster chamber 84 until the valve is opened.

Opening of the valve 36 is accomplished by downward

pressure imposed by the yoke arms **34** which, as stated previously, are disposed in recesses **35** in opposite sides of the flange **71** of the core **69**. When the operating lever **44** is depressed, a downward force will be transmitted to the yoke **33** through the link **51** and clevis **37**. Such force will compress the resilient annular sealing member **72** below the core flange **71**, permitting the core to move downwardly in the bore of the valve body **65**. When this occurs, the valve stem **82** will be moved in like manner, causing the sealing washer **86** to be displaced from its seal, allowing pressure to pass upwardly through the passage in which the stem **82** operates, entering chamber **84**, thence upward through the passage **81** of the core **69**, past the washers **79** and **80** and to the burner tip **75** through the passage **76** in the shank **74**.

The height of the flame ignited above the burner tip by sparks cast from the flint **25** by the sparking wheel **26** is controlled by rotating the tip **75**. A slot **90** is made in the tip **75** for a screw driver, coin or other instrument and by screwing in the shank **74** of the tip, the spring **77** is brought under increased tension, imposing greater pressure on the washers **79** and **80**, thus further restricting the gas and lowering the flame. The flame is increased in height by reverse rotation of the flame tip **75** to relieve pressure on the secondary restrictor, that is, the washers **79** and **80**.

To fill the reservoir **15** with commercial liquid butane fuel, reference is made primarily to Figure 4 which shows a detail view of the filler valve **91** in receiving the nozzle of a conventional butane fuel container **92**, shown partly broken away. These fuel containers are well known and can be purchased on open market.

The filler valve **91** consists of an interiorly threaded sleeve **93** having a flange **94** on its upper end which is welded or soldered to the top of the partition **13**, as shown. Threaded into and through the sleeve **93** is the tubular shank **95** of a filler plug **96** whose upper portion is of greater diameter than its shank **95** to define an annular shoulder **97** spaced upwardly from the flange **94** of the sleeve **93**. Between the shoulder **97** and the flange **94** is an O-ring seal **98**.

Slidable longitudinally within the hollow shank **95** of the plug **96** is a hollow tubular member **99** on the upper end of which is formed a sharpened pin **100**. The lower end of the tubular member **99** is provided with diametrically opposed slots **101** which receive a transverse pin **102**. A coil spring **103** is arranged within the tubular member **99** with its upper end engaged with the top of the bore of the member and its lower end bearing on the transverse pin **102**. Thus, the spring normally biases the tubular member **99** upwardly so that its pin **102** will extend into an internally threaded bore **104** in the plug **96**. A sealing washer **105** is affixed to the top of the tubular member **99** and embraces the pin **102** extending upwardly therefrom.

The conventional bottle or container **92** has an exteriorly threaded nozzle **106** which is threaded into the bore **104** of the plug **96** so that the pin **100** will engage the seal in the nozzle **106** of the container **92**. Continued movement of the nozzle into the bore will cause the tubular valve member **99** to be moved inwardly until it is stopped by the transverse pin **102**, whereupon the pin will pierce the seal of the container and permit its contents to flow into the fuel chamber **15** of the lighter. As a further precaution against escape of fuel as the lighter is being filled, a resilient seal **107** is secured in an annular recess in the top of the plug **96** to be engaged by the shoulders of the container **92** as the lighter is being filled.

When the fuel reservoir **15** has been filled, as described, the container **92** is unthreaded from the bore or socket **104**, whereupon the spring **103** will instantly return the tubular valve member to closed position, which action is aided by internal pressure in the reservoir **15**.

A cap **108** (Figures 2 and 3) forms both a closure for the filler plug as well as a seal. The cap has a threaded shank **109** which enters the bore **104** of the plug **96** and formed on the cap is an upwardly projecting stem **110** on the top of which is formed a spherical knob **111** having a slot **112** for the reception of a screw driver, coin or the like for applying and removing the cap. The cap serves the further purpose of holding in place the cover **11** of the case **10**. A pair of resilient arms **113** form a clamp which is riveted at **114** to the top of the cover **11**, the arms depending into clamping engagement with the knob **111** when the cover **11** is applied to the case **10**, thus resisting removal of the cover.

In some cases, it is preferred that the fuel chamber **15** of the lighter be packed with an absorbent material, such as cotton, only about the corners of the chamber **15** adjacent the partition **13** in order to prevent surging of the flame. However, it is considered more practical and economical to pack the entire chamber **15** with cotton or other suitable material to prevent "jetting" as well as sloshing of the fuel within the chamber. In order to prevent fouling of the fuel release valve **36**, a funnel shaped shield **115** engages the underside of the partition **13** to enclose the valve parts which extend below this partition.

Manifestly, the construction as shown and described is capable of some modification and such modification as may be construed to fall within the scope and meaning of the appended claims is also considered to be within the spirit and intent of the invention.

What is claimed is:

1. A butane lighter mechanism comprising a case of ellipsoidal cross-section having a sealed fuel chamber and a cover defining a combustion chamber, a valve body having an axial bore extending partially therethrough and an axial passage effecting communication between said fuel chamber and said bore, a core reciprocable in said bore having an axial bore and an axial fuel passage effecting communication between its axial bore and the axial bore of said valve body; a valve spring normally biased to closing position over the axial passage of said valve body, a valve stem carried by said valve and reciprocable in the axial passage of said valve body, one end of said stem being engageable by said core upon downward movement of the latter in the bore of said valve body to open said valve, a flame tip threaded into the axial bore of said core and having an axial fuel passage entering the bore of said core, spring biased and expansible fuel restricting means in the axial bore of said core below said flame tip, a spring suspended yoke engaging said core, a sparking wheel adjacent said flame tip, an operating handle slidable on said case effective to depress said yoke against resistance of its spring suspension means to actuate said valve stem to open said valve and means connecting said operating handle and said sparking wheel to actuate the latter simultaneously with the opening of said valve.

2. A butane lighter mechanism, a fuel reservoir, a valve body having an axial bore and an axial fuel passage effecting communication between said bore and said fuel reservoir, a spring biased valve normally closing said fuel passage, a valve stem connected to said valve and reciprocable in said fuel passage, a depressible core in the bore of said valve body and engageable with said valve stem to open said valve, said core having an axial bore and an axial fuel passage, spring biased fuel restricting means in the bore of said core, a flame tip threaded in the bore of said core above said fuel restricting means, a spring suspended yoke bearing on said valve core, a sparking wheel stationary with said yoke and disposed adjacent said flame tip, an operating lever biased to raised position by the spring suspension means of said yoke and means interconnecting said operating lever and said yoke to depress said valve core to open said valve,

said means being effective to actuate said sparking wheel simultaneously with the opening of said valve.

3. In a lighter mechanism, a butane reservoir, a valve body entering said reservoir having an axial fuel passage communicating with said reservoir, a valve spring biased to closed position over said passage within said reservoir, a valve stem connected to said valve and reciprocable in said fuel passage, a core having an axial passage and reciprocable in said valve body and adapted to engage said stem to displace said valve, a flame tip having an axial fuel passage threaded in said core, a spring suspended yoke engaging said valve core, a sparking wheel stationary with said yoke adjacent said flame tip, an operating lever and means interconnecting said operating lever and yoke to depress the same to open said valve and effective to actuate said sparking wheel simultaneously with the opening of said valve.

4. The structure of claim 3, and a spring biased fuel restricting means in said core below said flame tip effective to vary the volume of fuel passing from said reservoir to said flame tip.

5. The structure of claim 3 in which said interconnecting means is comprised of a clevis oscillatable on an axis common to said sparking wheel and spring biased in one direction, a link connecting said clevis and said operating lever for actuating said clevis in an opposite direction upon depression of said operating lever and ratchet means carried jointly by said clevis and said sparking wheel for actuating the latter in one direction when said clevis is oscillated.

6. In a lighter mechanism, a butane reservoir, a combustion chamber, a valve body in sealed engagement with said reservoir and having a fuel passage effecting communication between said combustion chamber and said reservoir, a valve normally spring biased to closed position over said fuel passage within said reservoir, a valve stem attached to said valve and reciprocable in said fuel passage, a depressible core in said valve body and engageable with said valve stem to open said valve, said core having a fuel passage communicating with the fuel passage of said valve body, fuel restricting means in the fuel passage of said core, a flame tip in said core above said fuel restricting means and movable to adjust said fuel restricting means to vary the quantity of fuel passing said restricting means, a depressible yoke engaging said core, a sparking wheel and a clevis operating on a common axis adjacent said flame tip, an operating lever and means connecting said operating lever and said clevis for depressing said yoke to depress said core to open said valve simultaneously with the operation of said sparking wheel.

7. The structure of claim 6, and spring means normally suspending said yoke, said clevis and said sparking wheel and effective to hold said operating lever in elevated position.

8. The structure of claim 6, said fuel restricting means comprising a resilient washer and a disc of normally equal diameter within the fuel passage of said core about which said fuel passes in its course through said fuel passage, said resilient washer being expandible to vary the effective size of said fuel passage.

9. The structure of claim 8 in which said washer and said disc are normally biased into juxtaposition by spring means in the fuel passage or said core.

10. In a lighter mechanism, a butane fuel reservoir and a combustion chamber, a partition separating said reservoir and said combustion chamber, a valve composed of an internally threaded sleeve disposed in an opening in said partition and having a flange in sealing engagement therewith, flanged valve body extending threadedly through said sleeve into said reservoir and having an axial bore in portions of different diameters extending partially therethrough, an axial fuel passage effecting communication between said bore and said reservoir, a core reciprocable in the bore of said body having a portion of reduced diameter extending into a reduced portion of the bore of said body, sealing means between said core and said body within said bore, said core having a flange overlying the flange of said valve body and provided with an axial bore and an axial fuel passage communicating with the bore of said valve body, compressible sealing means between the flanges of said core and said valve body, a flame tip having a shank threaded into the bore of said core and provided with an axial fuel passage communicating with the bore of said core, a valve normally biased to closed position over the axial fuel passage of said valve body within said reservoir, a valve stem attached to said valve and reciprocable in the axial fuel passage of said valve body and engageable by the bottom of said core, adjustable fuel restricting means in the bore of said core, an operating lever, spring suspended fuel ignition means adjacent said flame tip and means interconnecting said operating lever and said valve core effective to depress the same to open said valve and to simultaneously actuate said ignition means.

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