Oct. 11, 1955 W. F. WAGNER 2,720,098

LIGHTER MECHANISMS

Filed Oct. 1, 1953 3 Sheets-Sheet 1

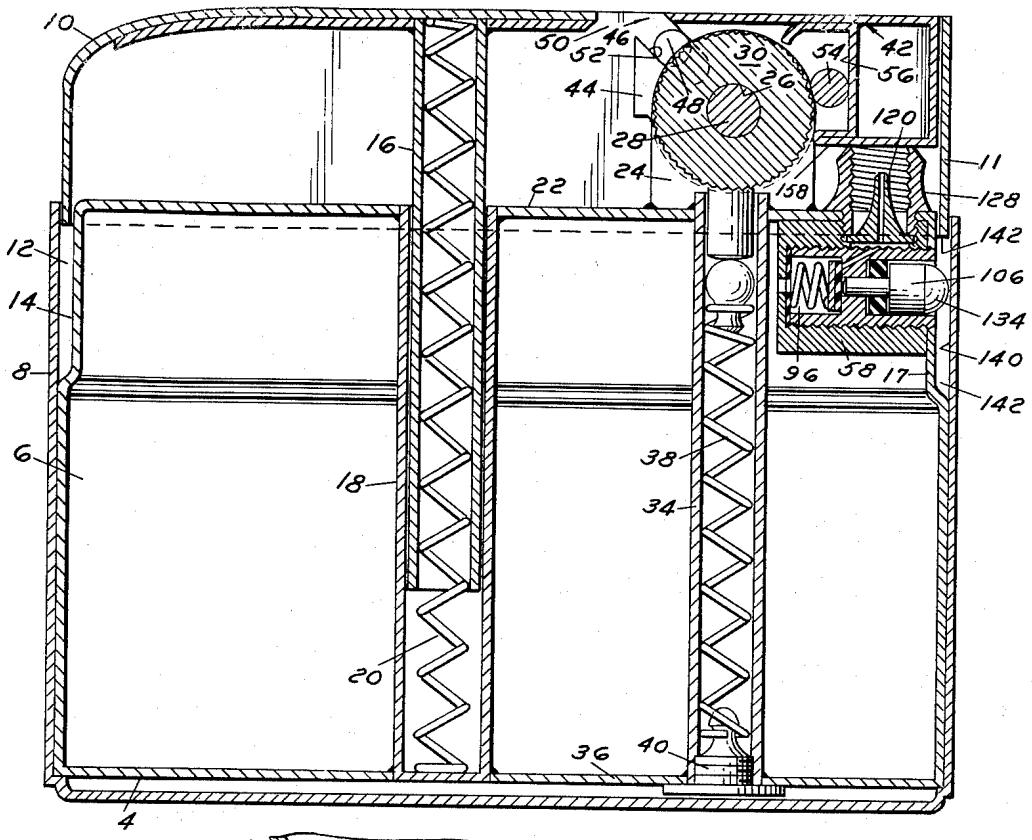

FIG. 1

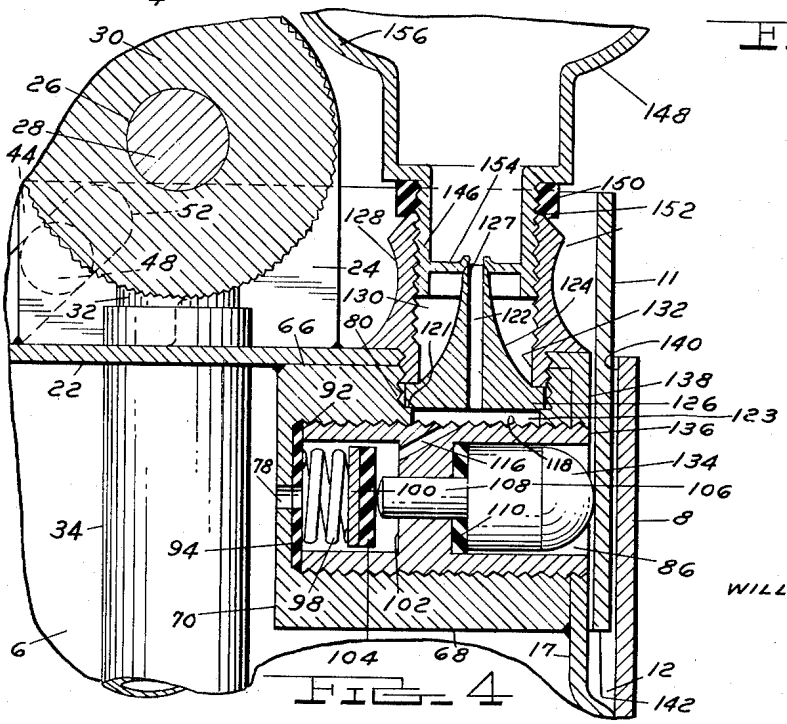

FIG. 4

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FIG. 2

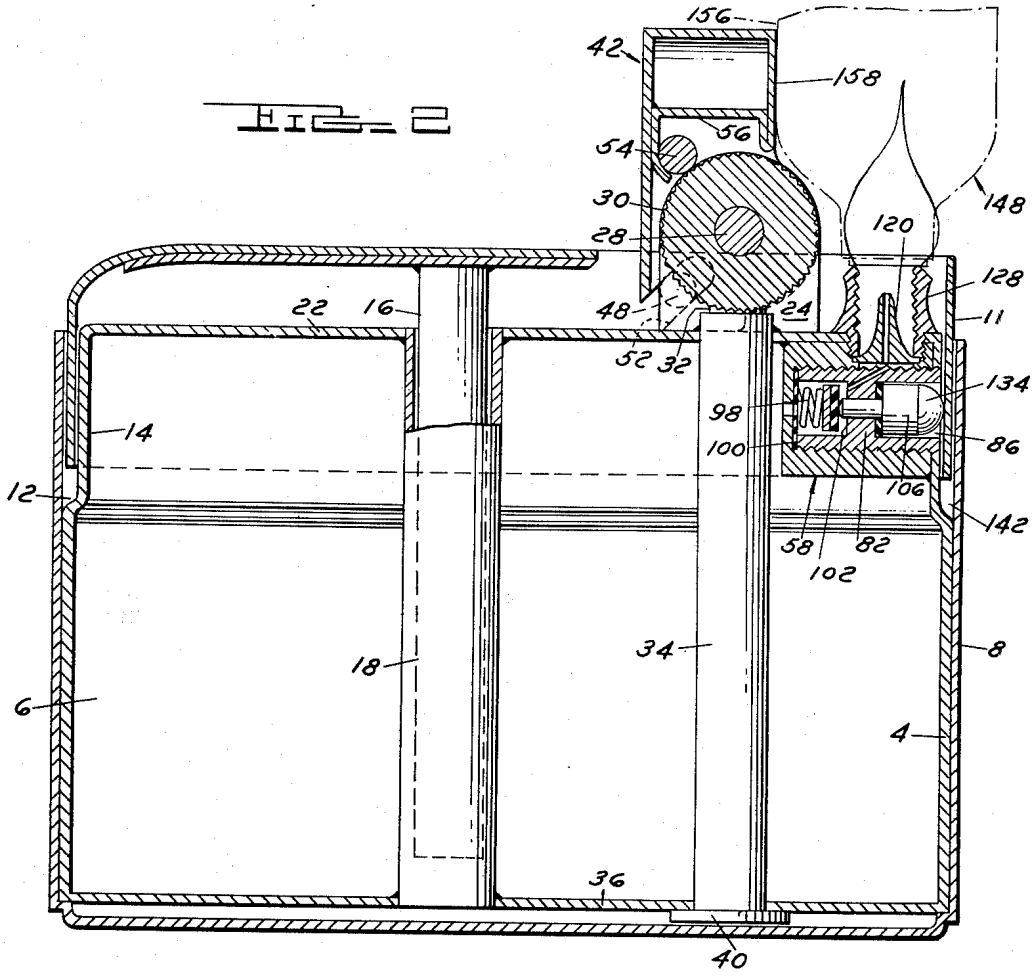
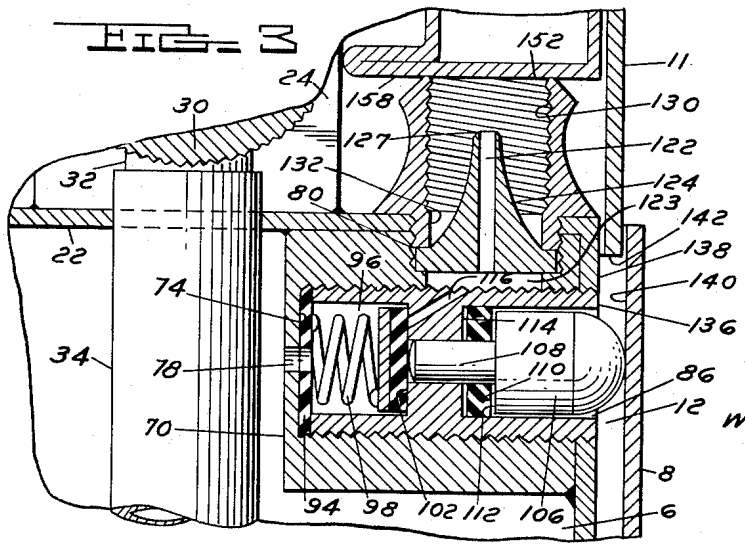


FIG. 3



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LIGHTER MECHANISMS

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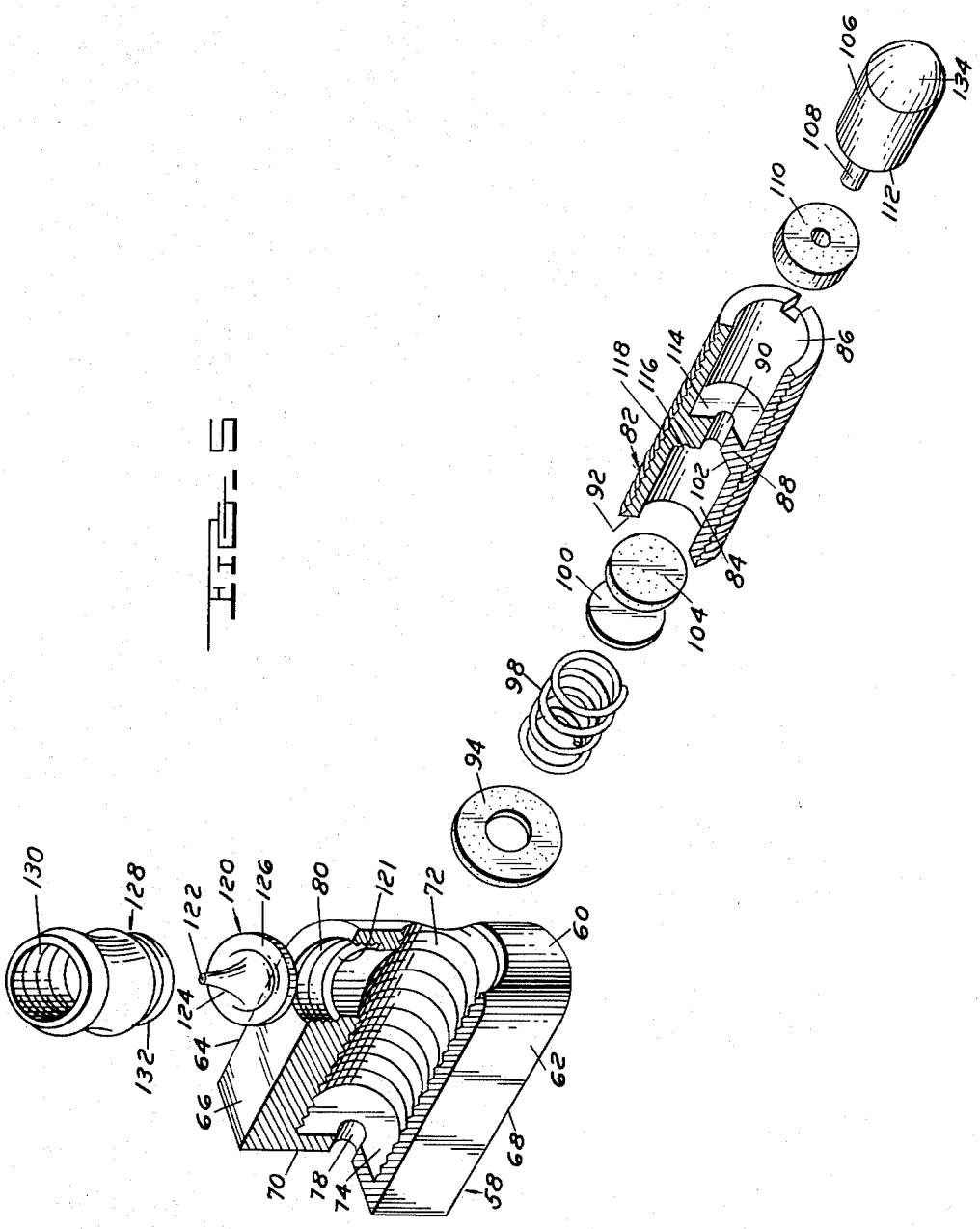

FIG. 5

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LIGHTER MECHANISMS

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Application October 1, 1953, Serial No. 383,505

7 Claims. (Cl. 67—7.1)

The present invention relates to pyrophoric lighters. More particularly, although not exclusively, the invention relates to novel and simplified means for accomplishing injection and emission of fuel in automatic lighters of the type employing compressed gas fuel.

As applied in the present instance, the term automatic is intended to define, generally, pyrophoric lighters of the type requiring manual pressure to operate, but which automatically extinguish the flame and return to the inoperative position upon release of manual pressure. However, the invention is particularly adaptable to the structure and arrangement of the lighter mechanism disclosed in my co-pending application, Serial No. 177,293, filed August 2, 1950, now Patent No. 2,660,042.

Heretofore compressed gas fueled lighters of the type referred to have generally required one valve assembly cooperable with a disposable refill cartridge for recharging the fuel chamber and a second valve assembly mechanically interconnected with the spark producing mechanism to provide metered discharge of fuel in timed relation therewith. Because of the duplication of valve assemblies, both the cost of component parts and assembly time has been greatly increased as compared to comparable liquid fueled lighters. In addition, the mechanical complexity of multiple valve mechanisms greatly increases the possibility of pressure leakage and attendant loss of fuel. Further, since the valve assemblies are disposed interiorly of the fuel chamber, the volumetric capacity of the fuel chamber is severely reduced thereby necessitating substantially increased overall size of the lighter in order to provide adequate fuel capacity.

With reference to the fuel discharge mechanism particularly, it has been virtually universal in gas fueled automatic lighters to employ a construction wherein a slidable valve member is spring urged to seat in opposition to the gas pressure, rather than with gas pressure. While the latter type is more desirable and efficient since the gas pressure tends to assist the valve in seating, such valves have not heretofore been readily and economically adaptable to the mechanical construction and mode of operation of automatic lighters. Consequently, the former type of valve has generally been utilized because of the relative ease of adaptability to interconnection with the spark producing mechanism. However, because of the relative inefficiency of this type of valve, gas tends to escape even when the mechanism is in the inoperative position, thus necessitating recharging of the fuel chamber at more frequent intervals than theoretically required.

A principal object of the present invention is to provide a compressed gas fueled automatic lighter having a synchronously operable fuel emission control valve which is pressure assisted to closed position.

Another object is to provide a lighter of the stated character having a unitary injection-emission valve mechanism adapted for selectively recharging the fuel chamber and controlling the emission of fuel therefrom.

Still another object is to provide a lighter of the type described having common injection-emission valve means

adapted for slightly delayed positive response to movement of the fuel igniting mechanism.

A further object is to provide a lighter of the type described having a common injection-emission valve mechanism which is adapted for displacement to a predetermined open position upon initial movement of the spark producing mechanism and is thereafter maintained in the predetermined open position throughout the remaining sequence of operation of the mechanism.

A still further object is to provide a lighter mechanism of the stated character which is readily assembled and disassembled.

These and other objects and advantages of the invention will become more fully apparent from the following specification, appended claims and accompanying drawings wherein:

Fig. 1 is a sectional elevational view of the lighter mechanism showing the structure and relationship of parts in the inoperative closed position.

Fig. 2 is an elevational view, partly in section, similar to Fig. 1 showing the relationship of the parts when the mechanism is in operative open position.

Fig. 3 is an enlarged fragmentary view illustrating the structure and arrangement of the valve assembly in closed position.

Fig. 4 is an enlarged fragmentary view similar to Fig. 3 illustrating the mode of cooperation between the valve assembly and recharge cartridge, and

Fig. 5 is an enlarged exploded view of the valve assembly, certain parts being broken away to more clearly illustrate the construction thereof.

Referring now to the drawings and particularly Figs. 1 and 2, there is illustrated a lighter mechanism comprising a generally hollow inner shell 4, which constitutes the compressed fuel chamber 6; an outer casing member 8 which frictionally embraces shell 4, and a depressible cover member 10. Cover member 10 is formed with a depending peripheral wall 11 which forms a part of the casing of the lighter and in the illustrated construction telescopingly interfits in the annular cavity 12 formed between the stepped upper end 14 of shell 4 and an upper portion of outer casing member 8 and in normal position projects thereabove. In order to assure smooth reciprocating movement of depressible member 10, a depending tubular column 16 is secured interiorly thereof and is adapted for slidable movement in a fixed tubular well 18 which, in turn, is secured in shell 4. A coil spring 20 carried interiorly of column 16 normally urges member 10 to its upward projecting position. Shell 4, outer casing 8 and cover member 10 are preferably elongated in horizontal cross section to form a relatively thin, convenient pocket article and may be slightly tapered from the midportion thereof toward the rear to aid in distinguishing between the front and rear by the sense touch.

Secured near one end of the closed upper horizontally extending wall 22 of shell 4 are a pair of vertically projecting spaced apart journal portions 24 having transversely aligned apertures 26 formed therein. Journal portions 24 are adapted to support spark generating means comprising certain parts which are conventionally employed on lighters of this character. However, the arrangement and relationship of the parts to one another and to the other major components of the device lends itself particularly to utilization of the present invention. Extending through and slightly beyond apertures 26 of journals 24 is a shaft 28 upon which is rotatably mounted an axially bored abradant wheel 30. Wheel 30 is adapted to rotatably frictionally engage a pyrophoric element 32, which is slidably disposed in a vertical tubular column 34 extending interiorly of shell 4 between upper wall 22 and lower wall 36. Pyrophoric

element 32 is maintained in resilient frictional engagement with the periphery of abradant wheel 30 by means of a coil spring 38 which, in turn, is maintained in compression by a spring cap 40 threadably disposed in the lower end of tubular column 34. Coaxially mounted with abradant wheel 30 on shaft 28 is a rotatable hood member 42. Hood member 42 is formed with depending parallel wall portions 44 which are adapted for overlapping straddling relation with journal portions 24 and are provided with transversely aligned apertures through which the outer end portions of shaft 28 extend. By means of a driving connection 46, hood 42 is adapted for rotatable movement from a normal horizontally extending closed position to a vertically extending operative position in response to downward movement of depressible cover member 10. Driving connection 46 preferably comprises transversely aligned pins 48 secured in the side walls 50 of depressible member 10 and cooperating inclined slots 52 formed in the depending walls 44 of hood 42. For a detailed description of the form and arrangement of driving connection 46, reference may be had to my co-pending application entitled Lighter, Serial No. 177,293, filed August 7, 1950.

To impart uni-directional movement to abradant wheel 30 in response to rotary movement of hood member 42, any suitable one-way clutch or ratchet device may be employed. In the illustrated embodiment, the clutch takes the form of a transversely disposed roller 54 adapted for up and down sliding and rolling movement along a generally vertical ramp 56 formed interiorly of hood 42. It will be apparent that roller 54 will wedge between ramp 56 and the periphery of wheel 30 when hood 42 is rotated in one direction while rolling free when hood 42 is rotated in the opposite direction.

In order to discharge compressed fuel from chamber 6 at a suitable pressure and control the emission thereof for ignition by the spark producing mechanism in accordance with the preesnt invention, there is provided a block-like valve body 58 which is secured in gas tight relation against the inner surface of top wall 22 and the inner surface of curved end wall 17 of shell 4 at the upper interior forward portion thereof. As seen best in Fig. 5, valve body 58 takes the form of a generally hollow rectangular block having a semi-circular forward end 60, flat parallel side walls 62 and 64, flat parallel top and bottom walls 66 and 68 and a flat rear surface 70. Centrally thereof, valve body 58 is provided with a longitudinally extending threaded bore 72 terminating in a flat bottom end wall 74 having a reduced opening 78 communicating with the interior of chamber 6. A second threaded bore 80 extends vertically through the upper wall 66 of valve body 58 and communicates with longitudinally extending bore 72. Threadably disposed in longitudinal bore 72 is a generally hollow externally threaded tubular core 82. Core 82 is provided at either end with axially aligned smooth internal bores 84 and 86 which are separated by a central circular partition 88 having a reduced aperture 90 formed therein in concentric relation with bores 84 and 86. When threadably disposed in bore 72, the inner peripheral edge 92 of core 82 tightly compresses an annular gasket 94 against the flat bottom end wall 74 of valve body 58 to form a cylindrical chamber 96. Disposed interiorly of chamber 96 is a coil spring 98 which resiliently urges a disc-like plate valve or closure member 100 against the flat rear surface 102 of partition 88 to prevent the passage of compressed gas from chamber 96 into reduced aperture 90. To compensate for any surface irregularities in valve 100 and surface 102 and assure positive gas tight seating engagement, a resilient disc 104 is preferably interposed therebetween. It will, of course, be apparent that disc 104 may, if desired, be bonded to plate valve 100 to form an integral closure member. To permit axial displacement of valve 100, when desired, a rod-like valve actuating member 106 is slidably disposed in bore 86. At its inner end, member 106 is formed with a reduced stub portion 108 which extends through reduced aperture 90 in partition 88 and is adapted for abutting engagement with disc 104 and valve 100. Surroundingly embracing stub portion 108 is a resilient gasket 110 which is adapted to be compressed between shoulder 112 of member 106 and outer face 114 of partition 88 when member 106 is moved axially inwardly. It will be seen that upon axial inward movement of actuating member 106, gasket 110 will be progressively compressed as valve 100 is axially displaced. Upon displacement of valve 100, compressed gas passes from chamber 96 around valve 100 and travels through a diagonal drilled passage 116, which extends between the flat rear surface 102 of partition 88, and the outer wall 118 of core 82. Since gasket 110 is compressed when valve 100 is displaced, reduced aperture 90 remains sealed and compressed gas still may not pass from chamber 96 into bore 86; consequently diagonally directed passage 116 affords the only outlet for the gas. Conversely, when member 106 is released, spring 98 returns valve 100 to seating engagement with flat rear surface 102 before gasket 110 is sufficiently relaxed to permit escape of gas through reduced aperture 90 into bore 86.

In order to direct the discharge of compressed gas from diagonal passage 116 into the area immediately forwardly adjacent the spark producing mechanism, a fuel discharge nozzle 120 is positioned against the annular shoulder 121 at the lower end of vertically threaded bore 80. Centrally thereof, nozzle 120 is provided with a vertical bore 122. Discharge nozzle 120 is preferably formed of hardened steel and comprises a cone portion 124 having an integral circular base flange 126 adapted for gas tight seating engagement with annular shoulder 121. Cone portion 124 is generally curved in cross section and at its upper end converges with bore 122 to form a circular puncturing element 127. To retain discharge nozzle 120 in firm engagement with shoulder 121 and complete the burner assembly, there is provided a sleeve member 128 having internal threads 130 throughout its substantial axial extent and an externally threaded base portion 132 which is adapted for mounting in threaded bore 80 to force flange 126 of nozzle 120 into seating engagement with shoulder 121. When flange 126 is seated against shoulder 121, it will be seen that there is formed a chamber 123 providing communication between passage 116 and bore 122. It should be noted that the successive reduced passages 78, 116 and 122 and expansion chambers 96 and 123 formed in valve assembly and burner assembly cooperate to provide multiple, successive stages of pressure reduction, whereby the gas pressure in chamber 6 may be reduced for discharge from nozzle 120 at the most suitable pressure for combustion. It will be understood however, that both the sizes and relative proportions of passages 78, 116 and 122 are illustrative only. Each passage may, for example, be identical in size.

In order to accomplish the operation of valve actuating member 106 in timed relation with downward movement of depressible member 10, actuating member 106 is formed with a semi-spherical outer end portion 134. When in normal inoperative position, member 106 is longitudinally positioned in bore 86 such that semi-spherical end 134 extends slightly outwardly of the outer surface 136 of stepped upper portion 14 of shell 4. Since the depending peripheral wall 11 of depressible member 10 is adapted for telescoping interfitting movement in the annular cavity 12 formed between wall 138 of stepped portion 14 and wall 140 of casing 8, depressible movement of member 10 causes the lower edge portion 142 of wall 11 to slidably engage semi-spherical end 134 of valve actuating member 106. Further downward movement of wall 11 cams valve actuating member 106 axially inward-

ly in bore **86** to displace plate valve **100** from inner surface **102** of partition **88**, as shown in Figs. 2 and 4. It will be apparent that the amount of delay between initial movement of depressible member **10** and operation of valve actuating member **106** may be initially established by providing suitable vertical clearance between lower edge portion **142** of wall **11** and semi-spherical end **134** of member **106**. It will also be seen that after initial axial displacement thereof, valve actuating member **106** is maintained in a fixed position axially of bore **86** during the remaining downward depressible movement of cover member **10** and return thereof.

It should be especially noted that when the mechanism is in assembled relation, inner wall **140** of outer casing **8** serves to cage actuating member **106** and limits the free outward movement thereof so that the semi-spherical end **134** is at all times in ideal vertical alignment for camming cooperating with the lower edge portion **142** of wall **11**, and may not extend outwardly sufficient to obstruct the vertical path of movement thereof. It will, therefore, be seen that the form and arrangement of the exterior parts of the lighter mechanism which are responsible for its streamline appearance also function to retain other parts in assembled relation.

In addition to the foregoing, the functional inter-relation of the parts is particularly advantageous in accomplishing refueling of chamber **6** in accordance with the present invention. As seen best in Fig. 4, sleeve **128** and nozzle **120** are adapted to cooperate with a refill cartridge **148** of conventional type for refueling chamber **6**. To recharge fuel chamber **6**, it is only necessary to place the lighter mechanism in the operative position, shown in Fig. 2 to expose sleeve **128** and nozzle **120**. The lighter mechanism is then, preferably, inverted and the threaded end **146** of recharge cartridge **148** turned into internal threads **130** of sleeve **128**. When cartridge **148** has been turned down sufficiently to compress gasket **150** against the peripheral edge **152** of sleeve **128**, the circular cutting edge of puncturing element **127** punctures the diaphragm **154** recessed in threaded end **146** of cartridge **148** and permits the escape of gas therefrom. Immediately thereafter, the cartridge **148** and lighter mechanism are inverted so that the gaseous fraction of fuel in cartridge **148** forces the liquid fraction through bore **122** into diagonal passage **116**, around plate valve **100** into chamber **96** and through reduced opening **78** into fuel chamber **6**. It is especially important to note that during the refueling operation, the cylindrical wall **156** of cartridge **148** bears against the bottom wall **158** of hood **42** to retain the lighter mechanism in the open position. Thus, valve actuating member **106** is positively retained in an axially inwardly displaced position by lower edge portion **142** of wall **11** whereby gasket **110** is maintained in compression between front surface **114** of partition **88** and shoulder **112** of actuating member **106** to prevent bleeding of gas into bore **86**, while plate valve **100** is maintained in open position, permitting passage of gas through chamber **96** into chamber **6**. It will, therefore, be seen that the functional inter-relation between valve **100**, valve actuating member **106**, depressible member **10** and hood **42** is such that regardless of whether the mechanism is being recharged or being used in normal operation, reduced aperture **90** in partition **88** is always sealed by gasket **110** when plate valve **100** is open, thereby assuring unobstructed passage between chamber **6** and nozzle **120** while virtually eliminating pressure leakage through reduced aperture **90** into bore **86**.

Since the duplication of valve mechanisms previously required in lighters of this type has been largely responsible for the substantially higher cost of production thereof, it will be seen that the dual function of the present valve mechanism provides a substantially less expensive as well as greatly simplified mechanism. In addition to the obvious simplification of structure accomplished by the invention, manifestly superior pressure retaining characteristics are achieved with a valve closure adapted to seat in the direction of flow of pressure.

While but one embodiment has been shown and described, it will be apparent to those skilled in the art that other changes and modifications may be made therein. It is, therefore, to be understood that it is not intended to limit the invention to the embodiment shown but only by the scope of the claims which follow.

I claim:

1. In a lighter mechanism, an elongated hollow body adapted to receive liquified gas from a disposable cartridge, a rotatable abradent wheel journalled on a wall of said body, a pyrophoric member frictionally engaging said wheel, a hood member coaxially journalled with said abradant wheel, uni-directional drive means connecting said wheel and said hood, a depressible member slidably disposed on said body and normally surrounding said hood means, means interconnecting said depressible member and said hood member, valve means engageable by said depressible member for discharging said compressed gas synchronously with the operation of said mechanism, and means associated with said valve means adapted to permit recharging of said hollow body through said valve means.

2. In a lighter mechanism, an elongated hollow body adapted to receive liquified gas from a disposable cartridge, a rotatable abradant wheel journalled on a wall of said body, a pyrophoric member frictionally engaging said wheel, hood means coaxially journalled with said abradant wheel, unidirectional drive means connecting said wheel and said hood, a depressible member slidably disposed on said body, means interconnecting said depressible member and said hood means, valve means disposed in a wall of said body, a discharge nozzle associated with said valve means, said valve means being responsive to movement of said depressible member for discharging said gas through said nozzle, and cartridge connector means associated with said discharge nozzle, said nozzle and said connector means being cooperable to simultaneously couple and puncture said cartridge to permit recharging of said hollow body through said valve means.

3. In a compressed gas fueled lighter employing disposable cartridge refueling means, the combination of a rotatable spark producing mechanism, means movable to a depressed position for actuating said mechanism, a unitary injection-emission valve assembly having means responsive to said movable means for controlling emission of fuel from said lighter in synchronous relation with the operation of said spark producing mechanism, a coupling member associated with said valve assembly for connection with said cartridge to permit charging said lighter with fuel when said first mentioned means is in depressed position, and means on said spark producing mechanism engageable with said cartridge to retain said movable means in said depressed position.

4. In a lighter mechanism, a closed receptacle adapted to contain gas under pressure, rotatable spark producing means mounted on said receptacle, manually operable means for actuating said spark producing means, a valve assembly mounted in said receptacle and having a closure movable to open position responsive to operation of said manually operable means to provide a flow of gas simultaneous therewith, a burner nozzle associated with said valve assembly for directing the flow of said gas, and a sleeve surrounding said nozzle, said sleeve and said nozzle being adapted for cooperation with a gas supply cartridge whereby said cartridge may be coupled in gas-tight communicating relation with said receptacle.

5. A reversible flow control valve assembly for a compressed gas container comprising, in combination, a valve body having a threaded longitudinal bore and a threaded vertical bore communicating therewith, means forming a reduced opening at one end of said first mentioned bore, a core member threadably disposed in said longitudinal

bore, said core having a central partition and oppositely extending axially aligned bores, said partition being formed with a reduced aperture axially aligned with said bores, one of said bores cooperating with said body to form a cylindrical chamber, means forming an orifice extending through said partition to provide communication between said chamber and said threaded vertical bore, and a closure assembly slidably disposed in said bore, said closure assembly being adapted to seal said orifice when moved in one direction and to seal said reduced aperture when moved in either direction, a nozzle secured in said vertical bore and communication with said orifice, a sleeve surrounding said nozzle and threaded means on said sleeve for coupling an external source of compressed gas.

6. In a lighter, a compressed fuel receptacle having a single opening communicating with atmosphere, a flame producing mechanism mounted on the upper end of said receptacle, an exterior shell embracing said receptacle and having the upper end portion thereof spaced from the receptacle to form a clearance therearound, a sleeve-like member embracing the upper end of the receptacle and surroundingly enclosing the flame producing mechanism, said sleeve-like member telescopingly slidingly fitting the clearance between said shell and said receptacle and being yieldably depressible thereinto, means responsive to depressible movement of said member into said clearance for actuating said flame producing mechanism, valve means disposed in said opening for controlling flow of said fuel, and valve actuating means normally extending into said clearance, said actuating means being slidably engageable by said sleeve-like member upon depressible movement thereof.

7. In a lighter mechanism having a hollow body adapted to contain compressed liquified fuel, a spark producing mechanism mounted on said body, sleeve-like depressible means normally surrounding said spark producing mechanism and movable to actuate the same, a socket formed in a wall of said hollow body and adapted to provide communication between said body and atmosphere, a normally closed valve slidably disposed in said socket, means on said depressible means operable to open said valve to control emission of gas from said body, a disposable gas-filled cartridge having a connector portion, cartridge coupling means associated with said socket and adapted to provide gas-tight communication between said cartridge and said hollow body, and means on said spark producing mechanism cooperating with said cartridge in coupled position to retain said depressible means in depressed position whereby said valve is maintained in open position to permit passage of gas from said cartridge into said hollow body.

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