May 26, 1964 A. B. GELLMAN 3,134,251

LIGHTER

Filed Dec. 27, 1960

Fig. 1.

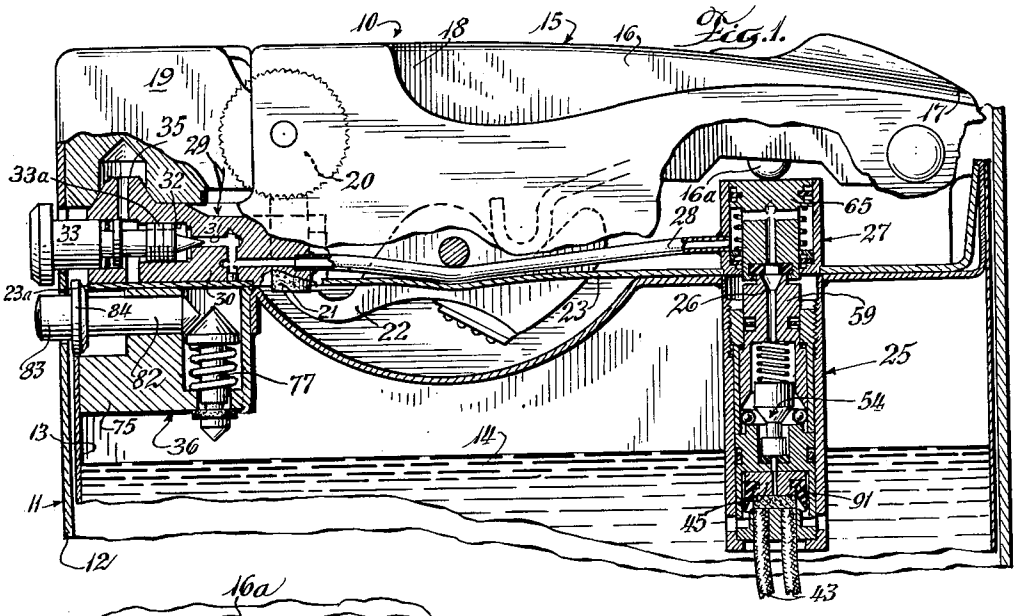


Fig. 2.

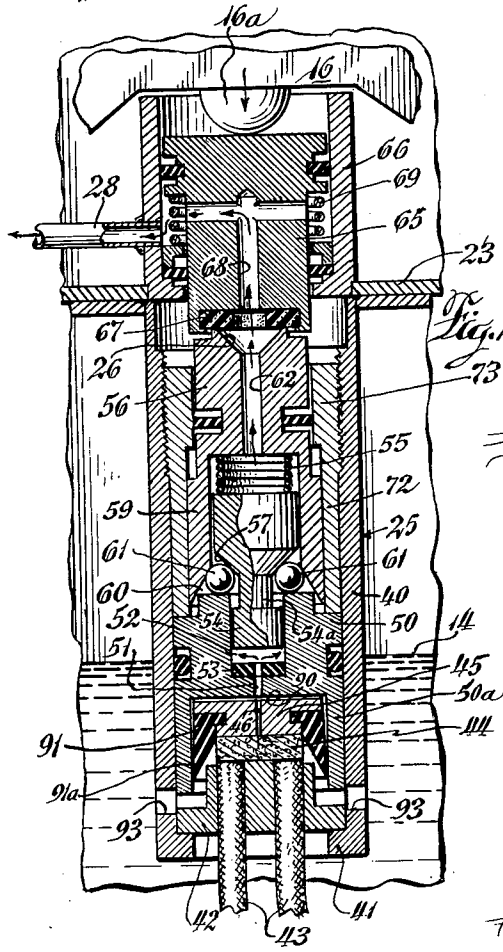


Fig. 3.

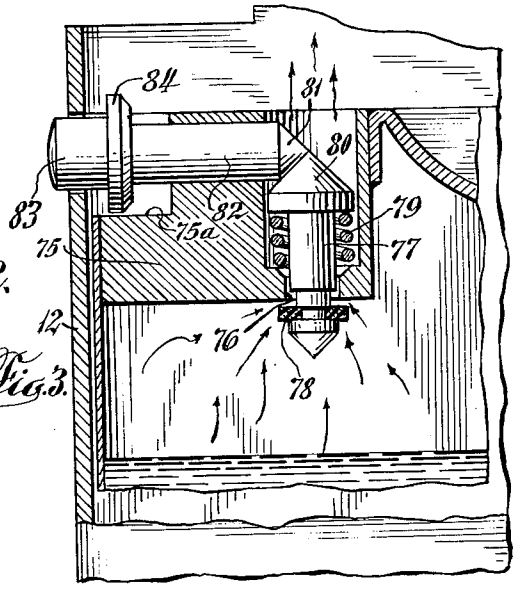
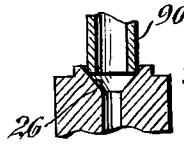


Fig. 4.



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3,134,251

LIGHTER

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8 Claims. (Cl. 67—7.1)

This application relates to a lighter and more particularly to a pyrophoric lighter utilizing a liquified fuel which is maintained in a reservoir of the lighter under substantial pressure.

There are several problems in the construction of a lighter utilizing liquified fuel which is released and burns as a gas, as contrasted with a lighter utilizing a fuel which burns as a liquid. The liquified gaseous fuel must be kept under pressure of the order of twenty-five pounds per square inch, as in a reservoir of the lighter. The fuel is released and must be controlled in its passage from the reservoir to a nozzle at which it is ignited. A pressure reducer control valve and metering valve are correlated to establish the proper fuel pressure and flow rate. A further problem relates to the filling of the storage reservoir, where the lighter does not make use of a disposable cartridge. In filling, fuel from a supply container under pressure must be transferred to the lighter reservoir as rapidly as possible, and without releasing fuel to atmosphere. To achieve a rapid transfer of fuel, a reservoir vent is provided to release air or gas trapped therein, allowing liquid fuel to enter.

In a lighter it is desirable to have a removable operating mechanism which may be assembled with or removed from a body or casing. One or a small number of mechanisms or styles of mechanism may be used with a wide variety of styles and designs of case. For example, one lighter mechanism to be used with both pocket or portable lighters, with heavier models designed for desk or table use and with cigarette cases and the like. This removability and interchangeability permits the manufacturer to maintain a smaller stock of mechanisms, each adapted for use with a variety of cases and further permits the owner to return the mechanism alone for repair, or to replace the mechanism. This is important where the lighter has substantial intrinsic or sentimental value. In my patent, 2,791,110, dated May 7, 1957, a mechanism is illustrated for a lighter with a removable mechanical assembly, utilizing fuel which is consumed in liquid form. This particular mechanical arrangement cannot be translated directly into a lighter utilizing fuel which is maintained in liquified form by pressure, because of the problems discussed above.

An important object of the present invention is the provision of a lighter utilizing liquified fuel maintained under a substantial pressure, having a removable operating mechanism and an improved fuel handling and reservoir vent arrangements.

One feature of the invention is the provision of a pyrophoric lighter comprising a body having a reservoir for maintaining a liquified fuel under pressure, means providing a fuel passageway extending to the reservoir and having an end portion opening outside the reservoir, the fuel passageway including a valve between the reservoir and the end portion, a mechanical assembly including a lighter operating mechanism removably secured to the body, the mechanical assembly including means defining a fuel passageway having an inlet adapted for communication with the outlet of the fuel passageway in the body and having a fuel outlet, and manually operable igniting means for igniting fuel at the fuel outlet and forming a part of the mechanical assembly.

Another feature is that the valve between the reservoir and the end portion of the passageway is provided with a depressable valve-operating element having the fuel passageway outlet therein and the mechanical assembly mechanism includes a movable connector having the inlet of the mechanical assembly fuel passageway therein, the connector being engageable with the valve-operating member to join the fuel outlet of the mechanical assembly with the fuel reservoir, operation of the actuating member of the mechanical assembly acting through such connector of the valve-operating element, to open the fuel control valve.

A further feature is the provision in a lighter utilizing liquified fuel under pressure of a pressure reducer, a fuel control or on-off valve, and a metering valve, as a needle valve, operating at relatively low fuel pressure.

Yet another feature is the provision of a lighter utilizing liquified fuel maintained under pressure, including a body having a reservoir for the fuel, a fuel inlet assembly in the body and communicating with the reservoir, a vent valve in the body and spaced from the inlet assembly, and means for locking the vent valve in closed position. And a further feature is that the lighter is provided with a removable operating mechanism, removal of which exposes the fuel inlet, and permits operation of the vent valve.

Still another feature is the provision of such lighter including a valve having a valve seat, a movable valve member having a tapered surface and valve-operating means operable against the tapered surface to unseat the valve member.

Yet a further feature is the provision in a lighter of a body having a reservoir for maintaining liquified fuel under pressure, means defining a fuel flow passageway connected with the reservoir and including a pressure reducer, the passageway having a fuel inlet, means defining an auxiliary passageway bypassing the pressure reducer, the auxiliary passageway including a resilient member subject to the pressure in the interior of the reservoir, sealing the auxiliary passageway and subject to the pressure of a fuel supply connected with the fuel inlet during filling, to open the auxiliary passageway.

Further features and advantages will be readily apparent from the following specification and from the drawings in which:

FIGURE 1 is an enlarged fragmentary section through a lighter embodying the invention;

FIGURE 2 is an enlarged fragmentary section through the fuel control valve;

FIGURE 3 is an enlarged fragmentary section through the reservoir vent valve; and

FIGURE 4 is a fragmentary section illustrating filling of the reservoir.

Lighters utilizing fuel maintained in liquified form under pressure and released in a controlled manner to be consumed as a gas have a substantial advantage over lighters using a straight liquid fuel. The liquified fuel escapes and is burned as a gas and requires no wick at the combustion point. The fuel control valve action is positive, reducing the loss of fuel through leakage or evaporation over a period of time. A liquid fuel lighter has a substantial loss factor, depending on the specific type of the lighter.

Turning now to the drawings, and particularly to FIGURE 1, a lighter 10 embodying the invention is illustrated. The lighter has a body 11 including an outer casing 12 and an inner reservoir 13 for fuel 14. The reservoir could be formed by the casing with a cover plate secured across the open mouth. The lighter is provided with a removable mechanical assembly 15 including a lighter-operating mechanism comprising a manually operable actuating member 16 which is pivoted at one end 17. The opposite end 18 of the actuating member is depressible and has

mechanically coupled thereto a snuffer cap 19 and with an abradant flint wheel 20. A flint element 21 is urged upwardly against wheel 20 by a spring-biased flint follower 22. The mechanical assembly 15 is carried by a cradle 23 removably secured within the top of the lighter casing 11. With respect to these elements, the lighting mechanism and mechanical assembly mounting of the lighter is similar to that shown in my aforementioned patent. A fuel control valve assembly 25 is provided in reservoir 13 and has a fuel passageway which will be described in detail below, with an end portion opening outside the reservoir and defined by an annular surface or seat 26. A fuel passageway in the mechanical assembly 15 is provided with an inlet connector indicated generally at 27, from which the fuel is conducted through a tube 28 to a metering valve assembly indicated generally at 29. The metering valve assembly includes a block 30 with a passageway 31 therethrough opening into an enlarged chamber 32. A needle valve 33 has a threaded portion received in the chamber 32 permitting the adjustment of the orifice between passage 31 and chamber 32, to meter accurately the flow of fuel to the fuel outlet or burner 35. The fuel passes from chamber 32 to burner 35 through a slot 33*a* through the threaded portion of needle valve 33.

A vent valve assembly 36 is provided in the reservoir at a point spaced from the fuel control valve assembly 25. As will be explained in some detail below, the vent valve cannot be opened while the mechanical assembly 15 is in the place within the lighter casing, but may be opened when the assembly is removed, releasing the pressure in the reservoir and so the reservoir may be filled.

As will appear, when the actuating member or thumb piece 16 is depressed, a valve in the fuel control valve assembly 25 is opened permitting the escape of fuel in gaseous form through a pressure reducer to the fuel passageway of the mechanical assembly, through which it passes under the control of metering valve 33 to the fuel outlet 35. As pointed out above, depression of the actuating member 16 causes operation of flint wheel 20, striking a spark which ignites the fuel.

The fuel control valve assembly 25 (FIGURE 2) includes an outer body 40 having an inturned lower lip 41 on which a wick supporting plate 42 rests. Wick members 43 are frictionally held in plate 42 and have upper ends contacting a disk 44 of absorbent material as blotter paper. The lower ends of wicks 43 extend into the fuel 14 within the reservoir and conduct the fuel in liquid form by capillary action to absorbent disk 44. Disposed immediately above the absorbent disk 44 is an orifice plate 45 having a small orifice 46 therethrough. The liquid fuel in the absorbent disk 44 evaporates and passes out through the orifice 46, at a greatly reduced pressure.

A valve block 50 is located above orifice plate 45 and has a centrally located fuel passageway 51 therethrough, extending into a valve chamber 52 at the bottom of which is a resilient valve seat 53. A vertically movable valve member 54 is disposed in valve chamber 52 and is urged downwardly by spring 55 to seat on resilient disk 53 (FIGURE 1). Valve 54 has a tapered surface 57 which extends upwardly and outwardly from a point on the valve stem 54*a* slightly above the valve chamber 52. Valve-operating element 56 has a depending skirt portion 59 which surrounds the upper portion of valve member 54 and tapered valve surface 57, and has an oppositely tapered lower surface 60. Interposed between tapered surfaces 57 and 60 are a plurality of balls 61 which form a motion-transmitting means interconnecting the valve-operating element 56 and valve 54. As the valve-operating element 56 is depressed against the action of spring 55, the balls 61 are forced inwardly by tapered surface 60 against tapered surface 57, lifting the valve from its seat 53 and permitting the fuel to pass through passageway 51 around the valve member 54 and through a passageway 62 centrally located in the valve-operating element 56 to the fuel passageway outlet. The fuel passageway of fuel control valve 25 may include wick 43, absorbent disk 44, orifice 46, valve chamber 52 and passageway 62.

The connector portion 27 of the mechanical assembly 15 includes a movable connector member 65 slidably carried in a sleeve 66 mounted on the cradle 23. The lower surface of connector 65 is provided with a resilient sealing member 67 which is engageable with the annular rim 26 surrounding the fuel passageway outlet of the control valve assembly 25. A passageway 68 through the connector 65 conducts the fuel to tube 28, from which it passes through metering valve 33 to the fuel outlet 35. Connector 65 is urged upwardly by a spring 69 and in its unoperated position is spaced slightly above the top of valve-operating element 56.

Upon actuation of the lighter by depression of the manual actuating member or thumb piece 16, a projection 16*a* extending downwardly from the thumb piece engages the top of movable connector 65 and forces it downwardly into engagement with the valve-operating element 56, the resilient washer 67 forming a tight seal with the annular lip 26 about the fuel passageway outlet of the control valve assembly 25. Continued downward movement of the thumb piece 16 forces valve-operating element 56 downwardly moving balls 61 inwardly against the tapered surface 57 of the fuel control valve member 54, opening fuel control valve 54, as described above. The same movement of actuating member 16 lifts snuffer cap 19 and rotates abradant wheel 20 to strike a spark igniting the fuel at the fuel outlet 35. Upon release of the actuating member 16, snuffer cap 19, connector 65, valve-operating element 56 and fuel control valve 54 return to the position shown in FIGURE 1. It will be noted that valve 54 closes before connector 65 is separated from surface 26.

Supported above valve block 50 and in engagement with an upper surface thereof is a tubular spacer 72, slidable within valve assembly body 40. An annular threaded member 73 is received in a threaded portion of valve assembly body 40, above spacer 72, and may be positioned to adjust the compression applied to resilient disk 44, providing a basic control of the escape pressure of the fuel through orifice 46.

Reservoir vent valve assembly 36 includes a block 75 located in the reservoir at a point spaced from the fuel control valve assembly 25 immediately beneath metering valve block 30. Vent passage 76 has a valve 77 mounted therein with a resilient sealing member 78. A spring 79 urges vent valve 77 to a closed position, FIGURE 1. The upper end of valve 77 has a conical surface 80 which may be engaged by the conical end portion 81 of vent valve actuator 82, slidably mounted in block 75 at right angles to vent valve 77. The outer end 83 of vent valve actuator 82 extends through an opening in outer casing 12, below metering valve 33, for manipulation by the user. An outwardly extending shoulder 84 is formed on vent valve actuator 82 and moves in a recess 75*a* in the upper portion of block 75. As illustrated in FIGURE 1, a surface 23*a* of the cradle of mechanical assembly 15 extends into the path of shoulder 84 and stops the movement of vent valve actuator 82 at a point short of the point where actuator surface 81 engages valve surface 80. Thus, when mechanical assembly 15 is located in lighter casing 11, reservoir vent valve 77 cannot be opened.

The lighter reservoir is filled through the fuel control valve assembly 25 in much the same manner that fuel is permitted to escape during use. With the mechanical assembly 15 removed, the outer end 26 of the fuel passageway of fuel control valve assembly 25 is exposed and accessible. A container of liquified fuel as a filling spout 90*a* that is brought into engagement with the annular surface 26 (FIGURE 4) and is utilized to depress valve-operating element 56, opening fuel control valve 54. At the same time, vent valve 77 is opened by inward pressure on valve actuator 82.

Reservoir 13 could be filled by causing the fuel to flow under the pressure in the supply can through the absorbent disk 44. However, this would take an unduly long time.

An auxiliary fuel passageway is provided, bypassing the orifice passageway 46, resilient disk 44 and wicks 43, to facilitate rapid filling. Orifice plate 45 has a transverse groove 90 formed in the upper surface thereof, and extending from the passageway 51 to the outer edges of the orifice plate, which are spaced inwardly of the depending skirt 50*a* of valve block 50. A resilient cup member 91 is fitted into a groove in the outer surface of orifice plate 45 and has a depending skirt portion 91*a* which is normally forced against the inner wall of valve block skirt 50*a* by the pressure of fuel in the reservoir. During the filling operation, with the vent valve 77 open and a supply container of fuel sealingly engaged with the outer end 26 of the fuel passageway, the pressure of the fuel in the fuel control valve assembly overcomes the pressure in the reservoir and the fuel flows through groove 90 around orifice plate 45 and past the skirt 91*a* of resilient cup member 91, to reservoir 13 through ports 93 in the wall of the outer valve body 40. As the filling operation continues, the gas or air within the reservoir is expelled through the vent. The user can sense when the reservoir is substantially filled, as some of the liquified fuel escapes and rapidly evaporates, greatly reducing the temperature of the vent valve portion of the apparatus. The vent valve is then closed by releasing actuator 82 and the filling container is removed from the valve-operating element 56, allowing the valve 54 to close. As was the situation with regard to the movable connector 65, valve 54 closes before contact is broken between the filler can nozzle 90 and valve-operating element 56.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. A pyrophoric lighter of the character described utilizing a liquified fuel under pressure, comprising: a body having a reservoir for maintaining a liquified fuel under pressure; a burner valve assembly; a fuel inlet assembly on said body and communicating with said reservoir; a mechanical assembly including a lighter operating mechanism covering said inlet assembly removably secured to said body; a manually actuable vent valve communicating with said reservoir and spaced from said burner valve assembly and from said inlet assembly, said vent valve being movable to vent said reservoir, said vent valve being operable independently of said inlet assembly, a portion of said mechanical assembly engaging said vent valve and blocking actuation thereof when said mechanical assembly is in position covering said inlet assembly.

2. The lighter of claim 1 wherein said vent valve includes a movable operating member having a shoulder, and a surface of said removable mechanical assembly engages said shoulder and stops movement of said valve-operating member.

3. In a pyrophoric lighter of the character described utilizing a liquified fuel under pressure, a fuel valve comprising: a valve seat; a valve member movable toward and away from said valve seat and having a surface tapered toward said valve seat; spring means urging said valve member into engagement with said valve seat; a movable valve-operating member having a surface tapered oppositely to the taper of said valve member; motion transmitting means interconnecting said tapered surfaces; and means supporting said motion transmitting means.

4. The lighter of claim 3 wherein said movable valve-operating member comprises a sleeve surrounding said valve member and said motion transmitting means comprises a plurality of balls interposed between the tapered surfaces of said valve and operating member.

5. A pyrophoric lighter of the character described utilizing a liquified fuel under pressure, comprising: a body having a reservoir for maintaining liquified fuel under pressure; means defining a fuel flow passageway connected with said reservoir and including a pressure reducer, said passageway having a fuel inlet; a valve block having a depending wall portion defining a recess; a resilient member within said recess, said resilient member and said depending wall portion defining an auxiliary passageway bypassing said pressure reducer, said resilient member exposed to the pressure in the interior of said reservoir sealing said resilient member against said wall portion, closing said auxiliary passageway and exposed to the pressure of a fuel supply connected with said inlet during filling, moving said resilient member from said wall portion to open said auxiliary passageway.

6. The lighter of claim 5 wherein said resilient member comprises a cup of resilient material disposed within said recess and having a depending flange seated against said depending wall portion.

7. A pyrophoric lighter of the character described, using a liquified fuel under pressure, comprising: a body having a reservoir for maintaining a liquified fuel under pressure; a burner; a mechanical assembly removably secured to said body and including means defining a portion of a fuel passageway to said burner; means defining a filling passage for said reservoir; a combined filling and outlet valve including a first member fixed to said body and a second member movable in telescopic relation therewith from an unactuated position with both the filler and outlet valves closed to a second position with only said outlet valve open and to a third position for filling; means forming a part of said mechanical assembly engageable with said valve on actuation of the mechanical assembly to move said second valve member to the second position thereof, said second valve member being exposed on removal of said mechanism for engagement by a spout of a fuel filler can, said second valve member being movable by said filler can spout to said third position for filling said reservoir.

8. A pyrophoric lighter of the character described utilizing a liquified fuel under pressure, comprising: a body having a reservoir for maintaining a liquified fuel under pressure; means defining a fuel passageway having an end portion in communication with said reservoir and including a fuel control valve in said passageway, said valve having an operating element extending outside said body and having a portion of said fuel passageway therethrough; a mechanical assembly removably secured to said body including means defining a fuel passageway having a fuel inlet and outlet, and said mechanical assembly including a movable connector means having the inlet of said fuel passageway therein, said connector means being engageable with said valve-operating element to join said fuel inlet with said fuel reservoir, said movable connector comprising a slidably mounted block with the inlet to said fuel passageway in the bottom thereof, said valve-operating element being slidable and having the fuel passageway outlet in the top thereof, said connector sealingly engaging the top of the valve-operating element; and manually operable igniting means for igniting fuel at said fuel outlet forming a part of said mechanical assembly, including an actuating member operably associated through said connector means with the operating element of said valve, actuation of said member operating said igniting means and effecting engagement of said connector means with the valve-operating element, and said actuating member being movable into engagement with said block, moving it into engagement with said valve-operating element.

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