United States Patent

[11] 3,575,221

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[73] Assignee **Japan Gas Lighter Association**
Tokyo, Japan
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[33] **Japan**
[31] **43/81677 and 43/81678**

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[54] **GAS LIGHTER FILLING VALVE**
2 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** **141/295,**
251/149.6, 251/154
[51] **Int. Cl.** **F23q 2/52**
[50] **Field of Search** 137/588;
141/285, 291, 292, 295, 296, 301, 348—354;
251/149.6, 153, 154, 347, 349, 350, 353; 137/517
(Cursory)

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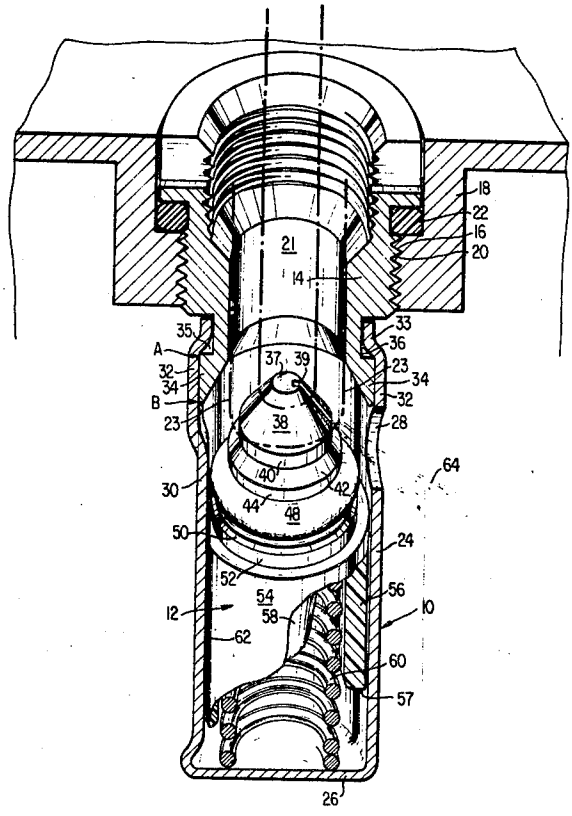
ABSTRACT: A gas lighter filling valve capable of manufacture by mass production techniques and provided with a single passageway through which charging and venting occurs simultaneously, featuring a thermoplastic inner, movable member, characterized by toughness, retention of shape under stress, springiness and longterm stability, and provided with a furrow for jetting charging fuel into the lighter reservoir, together with means for precisely aligning the inner, movable member within its surrounding outer, stationary member.



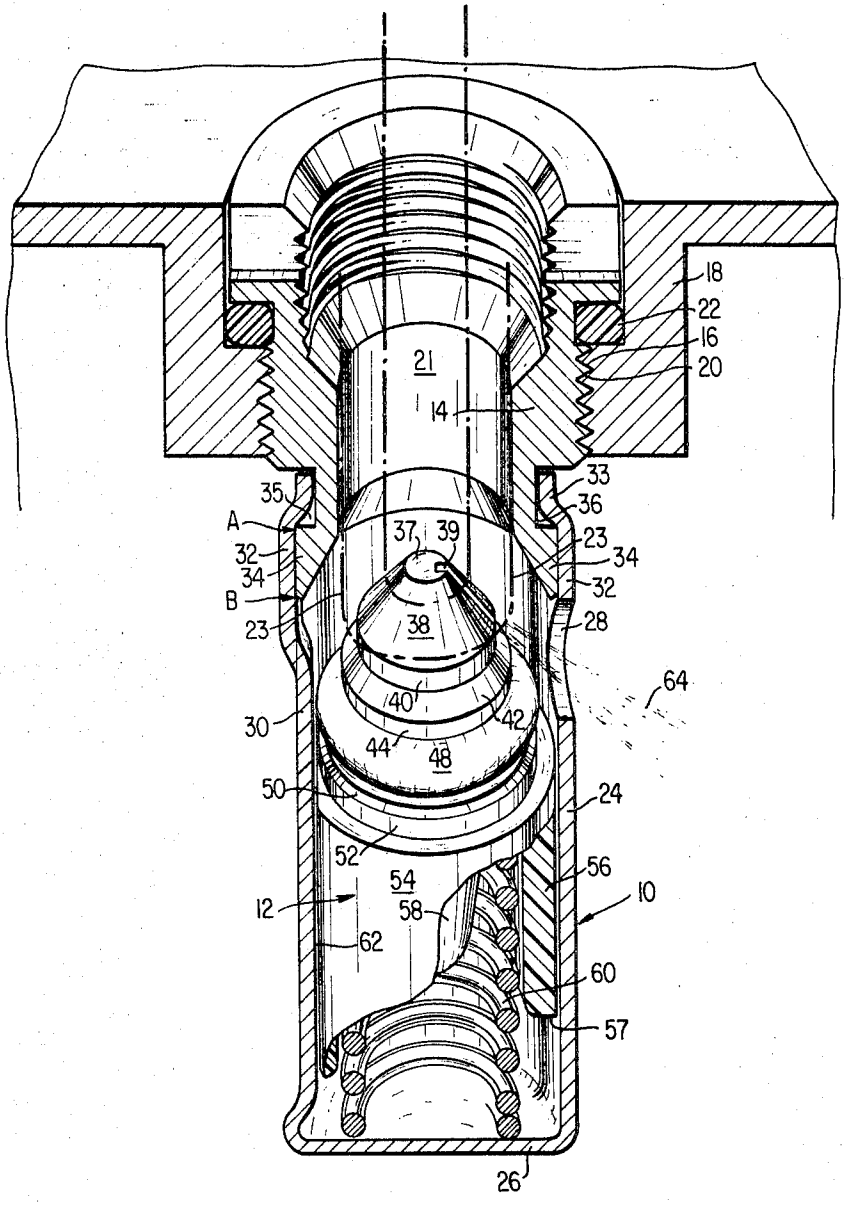


FIG. 1

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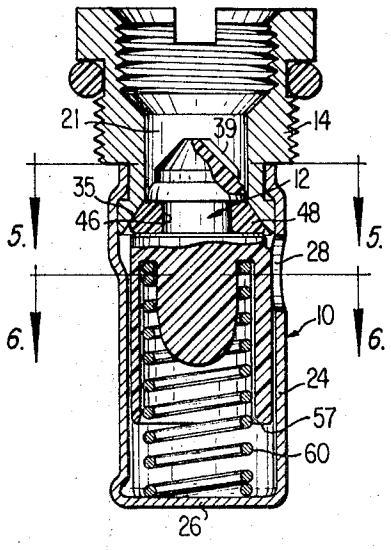

FIG. 2

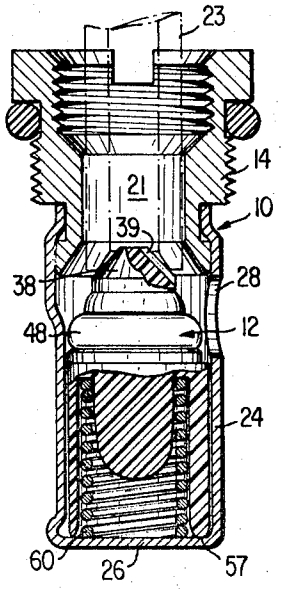

FIG. 3

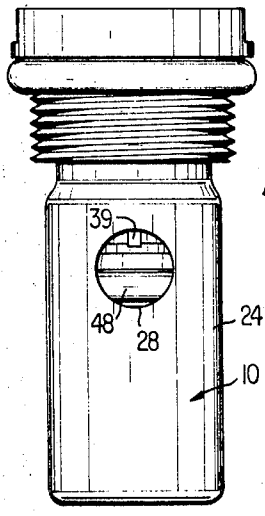

FIG. 4

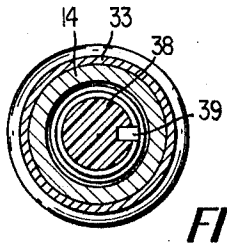

FIG. 5

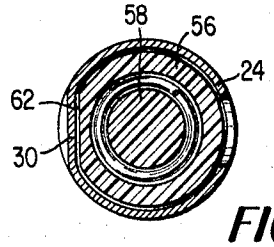

FIG. 6

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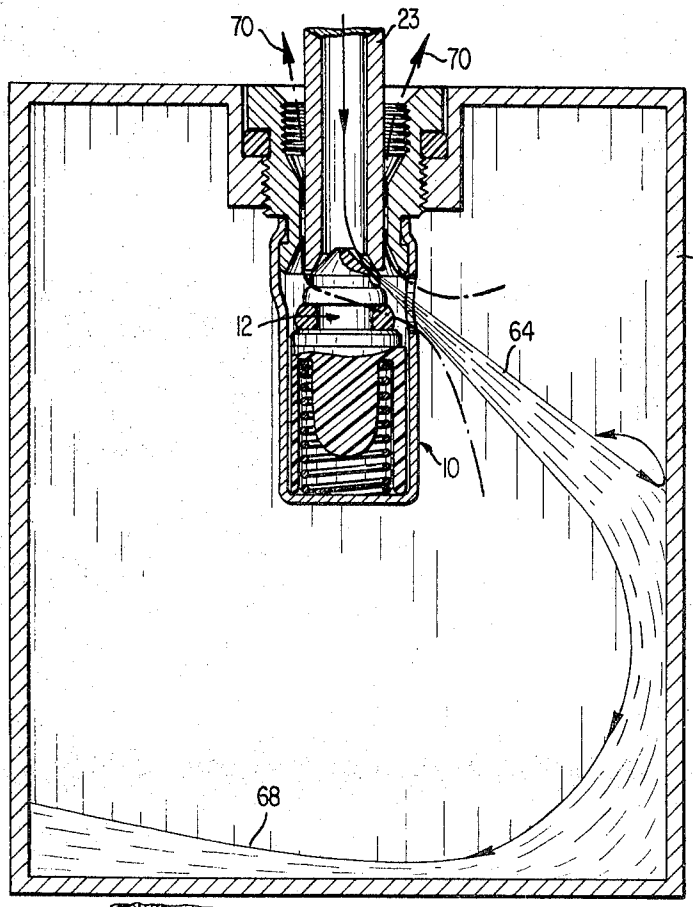


FIG. 7

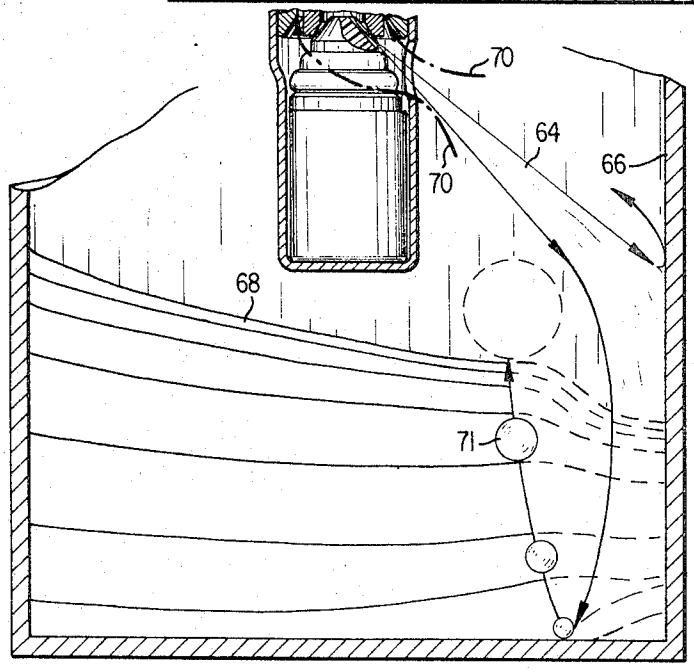
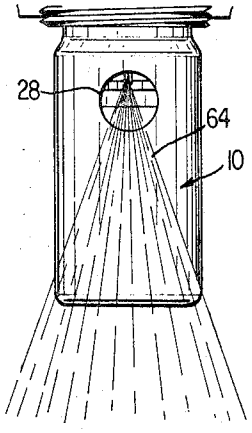


FIG. 9

FIG. 8



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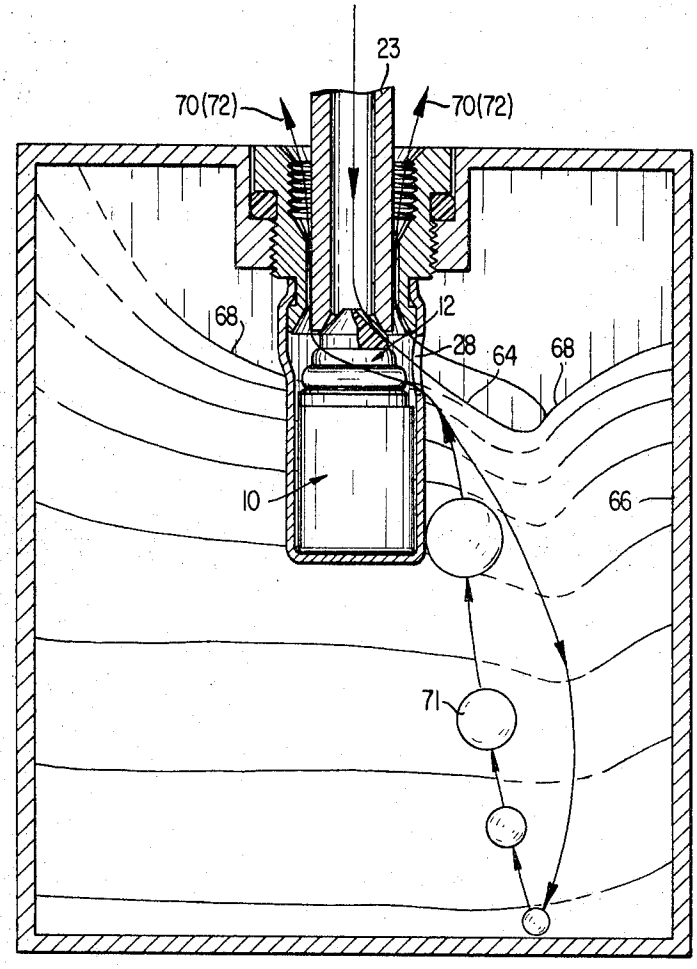

FIG. 10

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GAS LIGHTER FILLING VALVE

BACKGROUND OF THE INVENTION

The present invention relates to a valve located within a cigarette lighter permitting a low-pressure gaseous fuel, such as butane, to be transferred from a storage container to a reservoir located within the lighter.

Many presently marketed gas lighters feature filling valves provided with separate and distinct passageways for the introduction of fuel to the lighter reservoir and the simultaneous escape of fuel and air from the reservoir to the atmosphere. Filling valves featuring simultaneous charging and venting through separate passageways are disclosed in numerous publications, including U.S. Pat. Nos. Re. 24,163; 2,882,940 and 3,146,808.

The feasibility of employing a single passageway for both the aforementioned charging and venting has also been demonstrated and disclosed in U.S. Pat. No. 3,192,971.

SUMMARY OF THE INVENTION

In the construction disclose herein, the design and materials of component parts and their collective structural and functional relationship produce a novel lighter filling valve capable of being produced by modern mass production techniques while insuring optimum performance in simultaneously charging and venting through a single passageway.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view partly in section illustrating the outer, stationary valve member and the inner, movable valve member in its fully open position wherein fuel is jetted into the lighter reservoir;

FIG. 2 is a side elevation in section illustrating the inner, movable valve member in closed position;

FIG. 3 is a side elevation in section illustrating the inner, movable valve member in open position;

FIG. 4 is a side elevation illustrating the inner, movable valve member in open position, particularly the relationship of the jetting furrow to the window of the outer, stationary valve member;

FIG. 5 is a cross-sectional view taken along line 5—5 of FIG. 2;

FIG. 6 is a cross-sectional view taken along line 6—6 of FIG. 2;

FIG. 7 is a side elevation in section illustrating charging of fuel through the valve into the lighter reservoir and simultaneous venting of fuel and air from the lighter reservoir to the atmosphere during the initial filling stage;

FIG. 8 is a side view illustrating the jetting of fuel through the window of the outer, stationary valve member, particularly the clearance between the pattern of jetting fuel and the window through which simultaneous venting occurs;

FIG. 9 is a side elevation in section illustrating simultaneous charging and venting when the lighter reservoir is approximately half filled; and

FIG. 10 is a side elevation in section illustrating overflow of fuel after completion of filling.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The filling valve of the present invention consists generally of an outer stationary member 10 and an inner movable member 12.

The top cylindrical section 14 of the outer stationary member 10 is provided with a threaded portion 16 while the casing 18 of the cigarette lighter is provided with a threaded portion 20, permitting the entire filling valve assembly to be screwed within the lighter casing 18, gasket 22 preventing leakage of fuel. The inner cylindrical wall 21 of the top segment 14 defines an opening or port within which the stem or spout 23 of the fuel-containing refill capsule is inserted. The top segment 14 of the stationary member 10 is preferably metal.

The lower segment 24 of the outer stationary member 10 is cylindrical in configuration terminating downwardly in a bottom 26 which functions as a support, as explained hereinafter. A single window 28 is provided within one side of the lower segment 24 while the other side of the segment 24 includes a flattened portion or abutting surface 30. The lower segment 24 is preferably constructed of metal capable of being cold worked.

The top and bottom segments are connected by cold welding; i.e. the top portion 32, cylindrical as manufactured and having an inner diameter smaller than the outer diameter of the lower portion 34, is forced over the lower portion 34. The cold-welded connection, the extremities of which are designated by reference numerals A—B, is airtight. Finally, the uppermost segment 33 of top portion 32 is compressed within the groove 36 of the lower portion 34.

The inner movable member 12 is a thermoplastic material, for example, DURACON acetal copolymer manufactured by Polyplastics Co., Ltd., Osaka, Japan. Since the inner, movable member 12 is a thermoplastic, for example, a copolymer of trioxane and others produced by polymerization, this most important element of the filling valve possesses many desirable engineering properties such as toughness, retention of shape under stress, springiness and stability under longtime service. Since acetal copolymers such as DURACON can be formed by injection molding, extrusion, blow molding and other established techniques, the cost of manufacturing the inner movable member 12 is reduced.

Further information regarding DURACON acetal copolymer, its chemical, physical, mechanical, electrical and thermal properties, is available in Acetal Copolymer DURACON Product Data Bulletin, Apr. 1965, Second Edition, Polyplastics Co., Ltd., incorporated by specific reference herein. Naturally, the scope of the present invention, particularly the composition of the inner movable member 12, is not restricted to the use of a particular thermoplastic material.

As will be apparent from FIG. 1 of the drawings, the heart of any gas lighter filling valve is the inner, movable member. Ideally, the inner movable valve member 12 should be capable of being produced at low cost by mass production techniques. The inner movable valve member 12 must be designed so as to permit easy installation within the outer stationary member 10. The inner movable member 12 must resist failure under stress and retain its shape during long periods of use. Permitting the introduction of fuel into the lighter reservoir and proper sealing of the reservoir from the outside when the valve is closed. The inner movable member 12 must resist abrasion, particularly from the stem 23 of the refill capsule during the filling operation. It is important that the shape of the furrow 39 be retained throughout the life of the lighter.

The inner movable member 12 is unitary in construction, including from top to bottom a flattened tip 37, a conical section 38 provided with a furrow 39, a cylindrical section 40, a conical section 42, a cylindrical section 44, an inwardly spaced cylindrical section 46 (FIG. 2) around which gasket 48 is fitted, a conical section 50, a cylindrical section 52 and a large generally cylindrical base 54 provided with a hollow portion defined between sidewall 56 and central portion 58 within which a spring 60 is located.

The side wall 56 of the cylindrical section 54 is provided with a flattened portion or abutting surface 62 complimentary in configuration with respect to the flattened portion 30 of the lower segment 24 of the outer stationary member 10. Thus, as the inner, movable member 12 is slidably mounted within the lower segment 24 of the outer stationary member 10, the respective flattened portions 30 and 62 abut (FIG. 6), thus precluding the inner movable member 12 from rotating within the lower segment 24 of the outer stationary member 10 In this manner, furrow 39 is precisely aligned with the center of window 28, as seen in FIG. 4.

Vertical alignment of the axis of furrow 39 and the center of window 28 is accomplished as the bottom 57 of the sidewall 56 abuts the bottom 26 of the lower segment 24, as seen in FIG. 3.

The inner movable member **12** is normally biased upwardly in its closed position (FIG. **2**) by the force of spring **60**. Gasket **48** prevents the leakage of fuel between the top surface of the conical section **50** of the inner movable member **12** and the inclined surface or seat **35** of the upper segment **14** of the outer stationary member **10**.

To fill the lighter reservoir, the stem **23** of the fuel-containing refill capsule is pushed downwardly into the opening or port defined by the inner cylindrical wall **21** of the top segment **14** of the outer stationary member **10**. Continued downward movement of the refill capsule causes the stem **23** to contact the conical section **38** moving the inner member **12** downwardly against the force of spring **60** until the bottom **57** of the sidewall **56** contacts the bottom **26** of the lower segment **24** of the outer stationary member **10**.

Suitable means are provided in the refill capsule permitting fuel to be released through stem **23**. Usually, a valve assembly is provided within the refill capsule for releasing the fuel as the lighter filling valve is opened. Such constructions are well-known in the prior art and need no further explanation.

As the inner movable member **12** is moved downwardly to its fully open position (FIGS. **3—4**), the filling operation begins and liquified gas passes downwardly within the stem **23** and jets outwardly through the furrow **39** into the lighter reservoir along stream **64**. The direction of jet stream **64** is defined by the axis of furrow **39** and, accordingly, the taper of conical section **38**. As will be apparent from FIGS. **1** and **8**, a clearance or space is defined between the window **28** and the area occupied by the jetstream **64** within the window **28**. During the filling operation, liquified gas passes from the lighter reservoir inwardly through this clearance and then upwardly between the outer surface of the stem **23** of the refill capsule and the inner wall **21** of the upper segment **14** of the outer stationary member **10**. The filling operation is explained in detail, as follows:

As the filling operation is initiated (FIG. **7**), the liquified gas jetstream **64** impinges upon the walls of the lighter reservoir **66** and the level **68** of liquified gas begins to rise. Simultaneously, some fuel in gaseous state is exhausted or vented along path **70**.

As the filling operation continues (FIG. **9**), the level **68** of charged liquified gas rises, gas bubbles **71** appear and gaseous fuel continues to vent along path **70**.

As the filling operation is completed (FIG. **10**), the level **68** of charged liquid fuel approximates the window **28** and the jetstream **64** collides against the charged liquid fuel level **68** near the window **28** and rebounds spraying back liquified gas along path **72**, while gas bubbles **71** also begin to spray back. This exhausting of significant quantities of liquified gas along path **72** is easily detected by the user signifying complete filling, at which time the refill capsule is removed and the inner movable member **12** permitted to rise to its closed position (FIG. **2**).

We claim:

1. A valve for filling the reservoir of a cigarette lighter with a low-pressure gaseous fuel from a refill capsule having a spout, comprising:

an outer, stationary member secured within the lighter and having a continuous sidewall generally circular in cross section, means defining a seat within said sidewall of said outer member, a window located within said sidewall of said outer member below said seat providing communication between the reservoir of the lighter and the inside of said outer member, means defining within said sidewall of said outer member a first flat abutting surface interrupting the continuity of said sidewall and means defining in the vicinity of the bottom of said outer member a support;

an inner, movable member provided with a generally conical tip against which the spout of the refill capsule is pressed, a furrow located within the surface of said conical tip through which fuel is jetted as said spout of said refill capsule is pressed against said conical tip, said inner member including below said conical tip a continuous sidewall generally circular in cross section and means defining within said sidewall a second flat abutting surface interrupting the continuity of said sidewall and being generally complementary in configuration with respect to said first abutting surface, said first and second abutting surfaces preventing rotation of said inner member relative to said outer member while permitting said inner member to move vertically relative to said outer member, said furrow located within the surface of said conical tip defining an axis determining the path of jetting fuel, the distance between the center of said window and said support in the vicinity of the bottom of said outer member being equal to the distance between the point of intersection of said axis with said window and that portion of said inner, movable member abutting said support, such that said axis extends substantially through the middle of said window located within said sidewall of said outer member when said inner, movable valve member is in its lowermost position abutting said support within said outer member permitting, when said axis is thus aligned with said window, fuel to be jetted therethrough while defining a clearance between the periphery of said window an the stream of jetting fuel through which fuel and air are simultaneously exhausted from the lighter reservoir through said window in opposite direction to said charging to vent to atmosphere, said continuous sidewall of said inner movable member further including a hollow portion at the bottom thereof; and

spring means normally biasing said inner member in closed position against said seat of said outer, stationary member, said spring means located within said hollow portion of said inner movable member, one end of said spring means resting on said support of said outer, stationary member.

2. A valve as in claim **1**, said continuous sidewall of said outer member including an upper section terminating downwardly in a lower portion and a lower section provided with an upper portion, said upper portion of said lower section having an inner diameter smaller than the outer diameter of said lower portion of said upper section, said upper portion of said lower section forced over said lower portion of said upper section forming a cold weld between said upper and lower portions, said lower portion of said upper section including a groove while said top of said upper portion of said lower segment is compressed within said groove.