

1

2,804,763

METERING VALVE FOR POCKET LIGHTERS

Obed M. Russell, Glenview, and Charles T. Breitenstein, Chicago, Ill., assignors to Raymond T. Moloney, Chicago, Ill.

Application August 16, 1954, Serial No. 450,087

6 Claims. (Cl. 67—7.1)

This invention has as its principal object the provision of a metering valve for cigarette lighters of the type using compressed gaseous fuel, Butane gas, for example.

Great difficulty has been encountered in providing a satisfactory orifice for such gases in the relatively small scale to which pocket lighters must be designed, and some manufacturers have adopted a fixed orifice and been obliged to resort to special production expediences even to procure a moderately trouble-free and effective orifice which will not clog too frequently or permit erratic changes in flame size when the gas charge begins to fall off or atmospheric conditions change, for example.

One of the peculiarities of the liquified gas commonly used for these so-called gas lighters is its unflinching tendency to escape through the minutest of openings, on the one hand, and the troublesome capability of minute quantities of moisture to block passage of the gas through otherwise satisfactory orifices and thereby cause annoying and erratic failures in operation even for the fixed orifice.

The present disclosures afford an adjustable valve, called a metering valve, which is commercially feasible and gives very satisfactory and remarkably consistent results and allows the user to regulate the size of flame desired as well as in accordance with existing atmospheric conditions and pressures in the reservoir, and which further permits manipulations to easily correct possible failures resulting from moisture clogs, for which no otherwise guaranteed preventive has yet been devised.

A further object is the provision of control means for pocket lighters and the like using liquified gaseous fuel such as Butane, the control means including a stopper or plug interposed between the fuel supply and the burner or the metering valve, and having a filamentary filter arranged to provide a by-pass path around the plug whereby to impede the passage of moisture to the valve and burner system.

A further object is a forming method and provision of improvement in construction for metering valves by forming a fine orifice in a soft metal head and deforming the entrance to the orifice by threadedly forcing a fine steel ball somewhat larger than the hole into the entrance thereby to form a seat of spheroidal shape while at the same time crowding the soft metal at the entrance inwardly of the hole to close the latter down still more, and optionally making a shallow, radial scratch in the seat whereby extra sensitive control of the gas flow by the ball is desired.

Other aspects of novelty and utility characterizing the invention relate to details of the construction and operation of the embodiment described hereinafter in view of the annexed drawing in which:

Fig. 1 is a side elevational view, partly in section, of a lighter of the class described showing in section the new metering valve and orifice structure;

Fig. 2 is a fragmentary detail of the metering valve head, partly in elevation and partly in section, drawn to a greatly enlarged illustrative scale;

2

Fig. 3 is a cross-sectional detail to enlarged scale through the valve stem and housing assembly as seen in the direction of lines 3—3 of Fig. 1;

Fig. 4 is a fragmentary plan detail of a modification showing to greatly enlarged scale the spherically-deformed entrance to the metering orifice with scribed grooving;

Fig. 5 is a fragmentary vertical sectional detail of the valve seat illustrating the manner in which the modification of Fig. 4 is made.

The novel valve means is illustrated in conjunction with a gas lighter of the type generally indicated at 10 in Fig. 1 and including the usual flint sparking mechanism (not shown) which operates automatically upon depressing a main sparking lever 11 of the combination snuffer hood and lever means to throw flint sparks toward the burner jet 12 in the well-known manner, while at the same time rocking the snuffer cap section 13 into elevated or open condition to expose the burner jet and raise the shut-off stem 12A against the normalizing tension of its spring 14. These operations, or some analogous variation thereof, are usual in lighters of this type and further details in that connection are deemed unnecessary to an understanding of the present improvements, it being further noted, however, that the lifting of the shut-off valve stem 12A is automatically achieved as aforesaid by the action of a lifter lever 15, which is rocked upwardly by the sparking lever to raise the combination jet and cut-off valve stem means 12, 12A when the lever 11 is pressed downwardly.

As a result of the lifting of the valve stem 12A, as aforesaid, a shut-off valve in the form of a resilient plug 16 attached to the lower end of the stem 12A, is lifted from the orifice in the plug or wall 17 formed at the closed upper end of a cylindrical housing sleeve 18, and the gas is allowed to escape for ignition by the flint sparks as aforesaid.

The orifice plug and sleeve member 17—18 is part of the novel metering valve, and fits up into the bore of a threaded insert 19, which bore is reduced to provide a chamber in which the shut-off valve stem and its plug 16 and closing spring 14 are disposed. The upper end of the insert is turned to provide a nipple 20 in which the stem 12A is slidably seated for sliding valve action as aforesaid.

The lower part of the housing sleeve 18 is closed by a rubber cork plug 21, and a stack of filter discs F fills most of the space between this plug and the top of the sleeve in which the metering orifice 17A is situated, there being a perforated metal guide washer 22 at the top of said stack to serve as a locator for centering the head of metering valve stem 23 which passes upwardly through the cork 21 and stack of filter discs from the threaded bore of a bottom casting 24 in which the threaded part 23A of said stem is seated.

At its lower end 23B the metering valve stem is headed and slotted to receive a small coin such as a one-cent piece or dime to act as a screw driver, and a tight-fitting sealing washer 25 of resilient material further guards the threading.

The metering valve head and seat are of such small dimensions that they must be shown to greatly exaggerated scale, as in Fig. 2, wherein the finely narrow metering orifice 17a is seen to be deformed and nearly closed at its lower end 17X, which terminates in a further spherical concavity 17Y resulting from deformation imparted to the member 17 by the spherical valve head 26, the latter being a very small steel ball gripped in the swaged or spun upper end 23 of the stem.

The metering valve is formed by drilling the smallest possible hole through the head wall 17 of the sleeve 18 to initially form the escape passage for orifice 17A, a No.

80 drill being found to be about the smallest feasible for production purposes. After this fine hole is drilled, the valve stem 23 is turned up to thrust its ball head 26 into the body of the underside of the orifice wall 17 and against the lower mouth of the orifice passage to deform the latter and flow the metal inwardly to substantially close the entrance end of the orifice. This closure leaves no opening discernible under magnification of considerable power and is sufficient to prevent detectable escape of air under pressure of 75 lbs. or so by water-bubble test when the ball is withdrawn; nevertheless, Butane gas under the usual tank pressures (about 80 lbs.) will freely pass into and through the orifice when the valve head or ball is backed off a very slight amount.

In conjunction with a hole drilled as above to provide the orifice 17A, the diameter of the valve ball should be 1 millimeter and the material of the valve seat or plug wall at 17 should be deformable, for instance brass.

It is possible for moisture to plug at least the constricted or deformed entrance to the orifice 17A; but the stack of filtering discs F, and other novel means to be described, very effectively reduce the likelihood of failures due to this cause, and the adjustability of the new valve makes it a simple matter to correct this trouble if it should occur.

A further moisture safeguard is depicted in Figs. 1 and 3 in the form of a novel filamentary filter means consisting of an elongated, continuous filamentary filtering duct 30, an efficient form of which is found to be a loop of ordinary cotton wrapping string, the bight 31 of which passes over the top of the rubber cork 21 and around the valve stem 23 with the two opposite trailing ends 31A of the string dangling beyond the meeting margins of the cork and the housing sleeve 18 (as in Fig. 1). The gas chamber of the lighter is packed rather tightly with absorbent cotton C, and the ends of the string terminate within this packing and the gas works into these parts of the string and thence by-passes the rubber cork.

This filamentary filtering duct is the principal filter for eliminating the major amounts of moisture from the metering valve and orifice, the filter discs F further guarding against moisture which might appear by condensation about the valve stem due to the cooling effects which can accompany initial expansion of gas before the jet warms up.

Balls have been used in valves heretofore, and a method is disclosed in U. S. Letters Patent No. 2,674,032 employing a ball and driving screw to collapse the sidewall of a preformed hole to permanently constrict the same laterally and make what is known in the art as a fixed orifice, meaning one which can neither be enlarged nor diminished and which therefore affords no possibility of regulation of the size of the flame by the user of the lighter.

The present disclosures are the first, so far as known, to teach the formation of a controllable fine orifice and valving means therefor by employing the valve head initially to flow the metal at the mouth of the orifice in a direction axially back into the bore to form a closely conforming matrix seat for the ball and achieve a microscopic passage of the type essential to successful control of a gas such as Butane in small-scale applications, for example pocket lighters.

The described metering valve has been found to perform with satisfactory consistency over long periods by careful tests under the conditions commonly encountered in the individual use of pocket lighters by people not otherwise familiar with the peculiarities of butane gas and the come common causes of trouble in lighters using this type of fuel.

However, an even more satisfactory valve is afforded in accordance with the modified structure shown to greatly magnified scale in Fig. 4, wherein the mouth of the orifice passage 17A, formed as heretofore described, is count-

ersunk (as at 39) preferably with a 1 mm. countersink at 90° and a fine scratch or groove 40 (Fig. 4) is scribed or formed by inserting (Fig. 5) a special tool 41 having a knife-edge 42 and pressing same home, in the manner illustrated in Fig. 5.

The "groove" 40 is in fact more closely analogous to a shallow scratch, but it affords a greater and less critical range of adjustment, and very nearly eliminates all troubles from moisture.

Tests have established that, by employing the scribed metering valve seat, satisfactory and consistent operation can be had even though all filters are removed.

A theory evolved in this connection postulates that where the scribed seat is not used moisture reaching the ball head forms a fine film at this point which persists and blocks all gas passage around the ball; whereas, in the presence of the scribed groove, a pressure differential exists in the region of the lesser resistance at the groove and the gas forces past the moisture film in this region.

It is to be understood that this theory is not intended to be limiting or conclusive and is merely suggested as a possibility accounting for the marked difference in behavior of the metering valves with and without the scribed groove.

The scribed seat, in production models of the lighter, is preferably safeguarded nevertheless by the presence of the filamentary and disc filters 31 and F for the reason that no fool-proof and feasible means has been contrived at the small working scale involved for preventing the users of these lighters from screwing up the valves so tightly that the scribed groove is obliterated, and the seat rendered the equivalent of the first-mentioned form of Fig. 2. When this occurs, the valve continues to operate satisfactorily for metering purposes, but in the absence of filters would be more subject to moisture clogging. Moreover, the extremely fine adjustment of flame height characteristic of the scribed seat reverts to the more critical adjustment of the non-scribed type, meaning that the user may be obliged to make the screw-adjustment with greater deliberation.

More than one scribed groove 40 may be made in the seat, but a single groove has been found preferable.

We claim:

1. In a gaseous fuel lighter of the class described, a metering valve comprising a deformable metal seat having a fine orifice formed therein, a valve stem threadably seated to move axially toward and away from the mouth of said orifice, and a small steel ball fixed in the end of said stem to press against the seat at said mouth and forcibly flow the seat metal in a direction inwardly of the orifice to deform and further constrict the same.

2. In a metering valve for Butane gas lighters of pocket size, a valve seat of deformable metal of the type of brass, said seat having an orifice initially formed therein by passage of a fine drill, about No. 80; a valve stem threadably seated opposite the mouth of said orifice to thread axially toward and away from the latter and said mouth; a very small metal ball of about 1 millimeter diameter secured in the end of said stem to bear into said mouth by threadably turning said stem toward same and press said ball into the mouth and forcibly flow adjoining portions of the metal of the seat in a direction generally back into, and radially outward of, the orifice to impress a conforming seat for the ball therein, the gas flow being restricted or increased to desired extent by threadably adjusting said stem to advance or retract the ball relative to said seat and orifice therein.

3. In a pocket lighter of the type employing liquified gaseous fuel, fuel-control means comprising a metering valve having a seat of deformable metal such as brass with a fine orifice of about .013 inch diameter initially formed therein; a steel ball about 1 millimeter diameter fixed in a stem, said stem being threadably seated beneath said orifice for adjustment to thrust said ball

5

into, or withdraw it from, the entrance region of said orifice, said threaded seating of the stem affording sufficient mechanical advantage to force the ball into said seat to conform said entrance region of said orifice by crowding the seat metal at that region in a sense into, and radially outward of, the orifice to form a matrix seat for the ball affording an optimum tight fit with further conforming and reseating action by said ball each time the same is turned into said matrix seat.

4. In a metering valve, a valve head of deformable metal such as brass and having a fine hole formed there-through; a valve stem threadedly mounted for movement axially toward and away from said head and entrance to the hole therein; a ball, small in size, but substantially larger in diameter than the hole, disposed between the adjacent end of the stem and said entrance; the entrance to said hole being deformed in shape complementary to the sphericity of the entering portion of the ball upon thrusting said ball forcibly into the hole entrance by threadably turning said stem accordingly to form a seat and deform the hole entrance as aforesaid; said seat having a fine scratch line formed therein to extend in a radial direction from said hole.

5. In a fuel metering valve, a body of substantially solid material having a fuel passage including a fine orifice emergent therefrom; a screw member threadably mounted for axial movement toward and away from the mouth of said orifice; a relatively hard valve member fixed at the end of said threaded member and confronting said orifice mouth, said valve member having a curved contour the radius of curvature of which is substantially greater than the diameter of said orifice; said material of

6

the plug being relatively softer than that of said hard valve member and capable of being deformed by said valve member when the latter is forced against the orifice mouth of the plug by screw action of the threaded member, whereby the valve member seats into said body of solid material and into said orifice mouth.

6. In a cigarette lighter employing liquid, gasifying fuel under compression of the type of Butane, a fuel metering valve including a throttle screw having a small, hard, ball-shaped end, a valve body opposite said end and having a fine bore opposite and aligned with said end and communicating with a supply of said fuel, the diameter of said bore being of the order of fineness at least of a No. 80 drill, and the material of said valve body being a metallic solid which is relatively softer in the hardness scale than the material of said ball-shaped end such that the latter, on being screwed-up against said valve body can be pressed substantially into the latter by displacement of the material thereof adjacent the mouth of said fine bore conformably with the curvature of said ball-shaped end whereby said end is capable of repeatedly reforming its seat in said body and mouth by screwing-up the throttle screw as aforesaid.

References Cited in the file of this patent

UNITED STATES PATENTS

254,130	Harrison	Feb. 28, 1882
2,695,508	Gruber	Nov. 30, 1954

FOREIGN PATENTS

157,429	Austria	Nov. 25, 1939
---------	---------	---------------