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FUEL INJECTION VALVE FOR USE IN A LIQUEFIED GAS LIGHTER

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Fig. 1

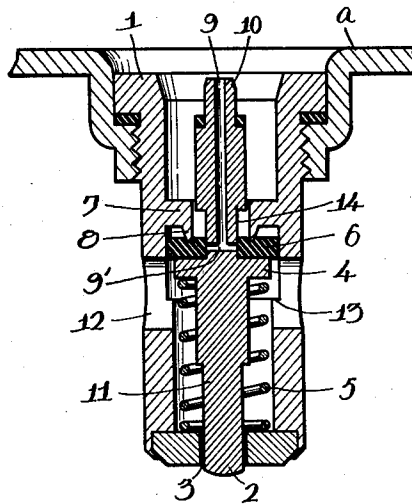
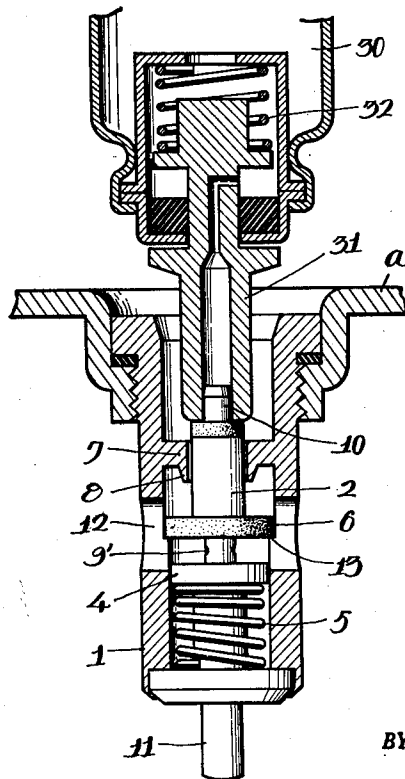


Fig. 2



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FUEL INJECTION VALVE FOR USE IN A LIQUEFIED GAS LIGHTER

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1 Claim. (Cl. 141-293)

The present invention relates to an improvement of a fuel injection valve mounted on a fuel tank of a liquefied gas lighter. That is, in the present invention, an opening to the fuel tank of the injection valve is divided into upper and lower sections by means of a floating packing ring of an annular form when the fuel is to be injected. Accordingly, the fuel is injected from its first passage or its lower section of the opening into the tank and the air in the tank escapes into the open air through the upper section of the opening.

Further, when a predetermined quantity of the fuel has been injected into the tank, the fuel is injected from the second passage or the upper section of the opening into the open air, so as not to inject any fuel into the tank, beyond the predetermined quantity, whereby a danger of surplus injection of fuel into the tank is entirely avoided.

In the injection valve of the prior liquefied gas lighter, a fuel injection valve and an air escape valve, which serves the purpose of discharging air present in the fuel tank into the open air and also to overflow any fuel beyond the predetermined quantity to be injected into the fuel tank, have been individually provided for. However, the provision of the fuel injection opening and the air escape opening in the relatively small valve part requires not only a skilled technique, but also makes it very difficult to manufacture and to assemble.

It is, therefore, the main object of the present invention to provide a fuel injection valve for use in a liquefied gas lighter in which a fuel injection opening and an air escape opening are not made separately, but only one opening or a window, formed in an outer sleeve, is divided into a fuel injection opening section and an air escape opening section by means of a floating packing ring of an annular form cooperating with the outer sleeve, so as to simplify its manufacturing difficulties.

With this and other objects in view, which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawing, in which:

FIGURE 1 is a longitudinal sectional view of a liquefied gas lighter designed according to the present invention;

FIG. 2 is a longitudinal sectional view of a liquefied gas lighter designed according to the present invention in the position of fuel injection.

Referring now to the drawing, a fuel tank *a* of a gas lighter of the present invention comprises a sleeve 1 mounted on a wall of the fuel tank *a* at its open end and a valve element 2 is movably fixed through an axial hole 3 perforated in a blind bottom plate of the sleeve 1. The valve element 2 has an annular flange 4 at its intermediate length and is forced upwardly by means of a coil spring 5 engaging the bottom surface of the flange 4 and the upper surface of the bottom of the sleeve 1. An annular packing ring 6, which is fitted on the valve element 2, is urged to be pressed upwardly by the upper surface of the flange 4 when the valve element 2 is forced resiliently upwardly, and abuts an annular edge 8 formed on a downward projection of an annular wall 7 which is formed at the inner circumference of the sleeve 1.

An inlet opening 9 is formed axially through the valve element 2, the open end of which is disposed at the top 10 of the valve element 2. The other end of the inlet

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opening 9 leads into radial bores 9' at the intermediate length of the valve element 2. This horizontal radial bore 9' is directed against the inner annular circumference of the packing ring 6, when the valve element 2 is raised upwardly, as above described. Accordingly, the fuel tank *a* is fully closed from the open air by the engagement of the packing ring 6 at the annular edge 8.

A top part 10 of the valve element 2 has a reduced diameter, which top part 10 is adapted to be received in an inner bore of an injection nozzle 31 of a preliminary fuel tank 30 (FIG. 2). When fuel is to be injected into the tank *a*, the injection nozzle 31 of the preliminary fuel tank is fitted on the top part 10 of the valve element 2, as shown in FIG. 2, and is pressed down against the action of the coil spring 5, the valve element 2 being lowered until a shoulder formed on a lower part 11 of the valve element 2 having a reduced diameter, abuts the blind bottom surface.

In this state, the horizontal radial bore 9' is disposed opposite the lower part of a window 12 formed on the peripheral side of the sleeve 1. In order to put the horizontal radial bore 9' of the inlet opening 9 correctly for the window 12, it is desirable that a hole 3, provided in the blind bottom plate of the sleeve 2, is made of an angular shape and the part 11 of the valve element 2 is of correspondingly slightly smaller shape than that of the hole 3. In this case the floating packing ring 6 is lowered by the lowering of the valve element 2 to the intermediate height of that of the window 12, so as to divide the window 12 into an upper part and a lower part in the sleeve 2. For this purpose, a shoulder 13 is formed in an inner circumference of the sleeve 2 at the intermediate height of the window 12, so as to stop the lowering of the floating packing ring 6, which is lowered while sitting on the upper surface of the flange 4 simultaneously with the lowering of the valve element 2. Thus, the floating packing ring 6 is held on the shoulder 13 in such position, that it assumes a given position dividing the upper part from the lower part of the sleeve 2 corresponding to those of the window 12. By such arrangement, the horizontal radial bore 9' opens up in the sleeve 1, below the packing ring 6.

Since the floating packing ring 6 is fitted on the reduced neck portion 14 of the valve element 2 above the upper surface of the flange 4, the valve element 2 only is further lowered and when the shoulder on the reduced part 11 abuts the blind bottom plate, the valve element 2 is prevented from a further lowering movement. In this state, the floating packing ring 6 is pressed by the upper shoulder of the reduced part 14 on the shoulder 13 at the inner circumference of the sleeve 1, so that a floating of the packing ring 6 is entirely avoided.

Consequently, when the pressing by the preliminary fuel injection tank 30 is further continued, the nozzle 31 is withdrawn into the fuel injection tank 30 against the action of a coil spring 32 and fuel in the fuel injection tank 30 is injected from the nozzle 31 through the inlet opening 9, the horizontal radial bores 9' and the lower part of the window 12 into the tank *a*, while air escapes through the upper part of the window 12 to the atmosphere.

For this arrangement, the injection of fuel is effected rapidly and at the same time, the escape of air from the tank is not prevented by the injection of fuel, rather the injection of fuel and the escape of air are effected simultaneously. Further, the pressing of the packing ring 6 by means of the upper shoulder of the reduced neck portion 14 against the shoulder 13 of the sleeve 1 ensures that a floating of the packing ring during the injection of fuel and the escape of air is entirely avoided.

When the level of fuel in the tank *a* reaches that of the packing ring 6, the fuel overflows through the upper

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part of the window 12 above the packing ring 6 to the open air, and the valve element 2 is raised by the action of the coil spring 5 upon pulling out of the nozzle 31 of the preliminary fuel tank 30 from the valve element 2, and thus, all the parts are restored to their original positions, so as to restore the lighter to its closed state. Further, as a variation, the packing ring 6 may be closely fitted to the inner circumference of the sleeve 1 and also be loosely fitted to the valve element 2.

Also, the packing ring 6 may be loosely fitted for the inner circumference of the sleeve 1 and be closely fitted for the outer circumference of the valve element 2.

Further, in the sleeve 1, two windows may be formed if desired opposite to each other, and also two opposite horizontal radial bores 9' may be formed in communication with the axial inlet opening 9.

In brief, the present invention may be modified suitably without departing from the essential feature thereof.

While I have disclosed one embodiment of the present invention, it is to be understood that this embodiment is given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claim.

I claim:

A fuel injection valve for use in a liquefied gas lighter comprising

- a sleeve having an open end adapted to be mounted on the wall surface of a fuel tank of a gas lighter and having a blind bottom plate at its opposite end,
- said sleeve having at least one single window disposed intermediate its ends in its peripheral wall to provide communication between said fuel tank and the inner space of said sleeve,
- said sleeve having further an annular wall terminating into an axially directed projection pointing towards said blind bottom plate and defining an aperture in its center,
- said annular wall extending substantially radially inwardly from a point of said sleeve disposed between its open end and said window,
- said sleeve having also a shoulder at about the center of said window,
- a resiliently biased valve element disposed in and axially movable relative to said sleeve between closed and open positions and having in its outer portion an

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axially disposed inlet bore terminating in at least one radially disposed bore terminating at the periphery of said valve element,

said valve element having a neck portion extending axially outwardly from about said radial bore for an axial length shorter than the axial length of said window,

said valve element having further an annular flange disposed axially inwardly from said radial bore,

a floating packing ring surrounding said neck portion of said valve element to close said radial bore of said valve element in the closed position of the latter and axially movable along said neck portion relative to said valve element as well as relative to said sleeve, and

said valve element having its inner end portion a shoulder adapted to limit the axial inward movement of said valve element from its closed to its open position,

said floating packing ring being moved axially from its closing position simultaneously with the axial movement of said valve member upon engagement of the latter with a filling container until said floating packing ring is stopped by engagement with said shoulder of said sleeve, thereby dividing said window into an upper part and a lower part, and

said valve element continuing its axial movement until its shoulder engages said blind bottom plate, thereby exposing the emerging end of said radial bore of said valve element to the lower part of said window, while the upper part of said window communicates with the free air, and

said floating packing ring engaging the outer face of said annular flange of said valve element and said axially directed projection of said annular wall of the sleeve, in the closed position of said valve element.

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