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FUEL CHARGE VALVE ASSEMBLY IN GAS-FUELED CIGARETTE LIGHTER

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**Fig. 1**

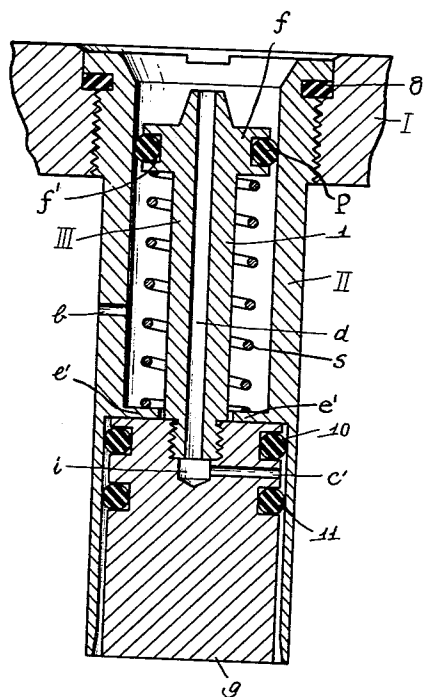


**Fig. 2**

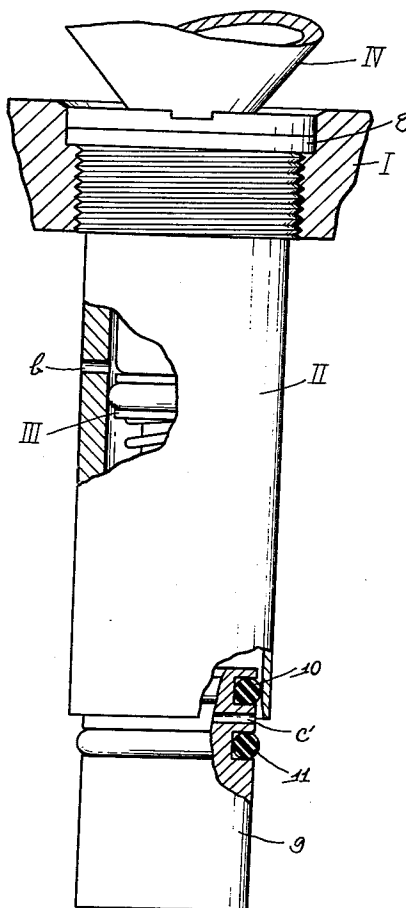
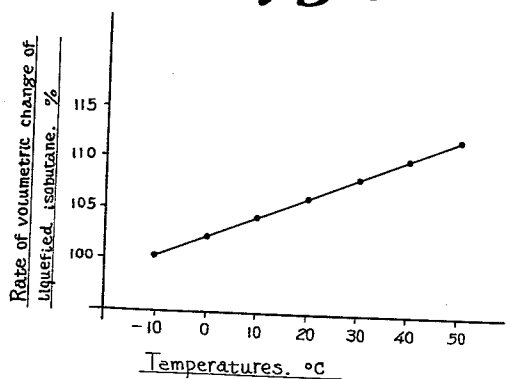


**Fig. 3**



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## FUEL CHARGE VALVE ASSEMBLY IN GAS-FUELED CIGARETTE LIGHTER

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1 Claim. (Cl. 141-293)

The present invention generally relates to improvements in and relating to a gas lighter, or more specifically to a charge or injection valve assembly built in a gas-fueled cigarette lighter of such type, that it is provided with a container for preserving compressed gas, the container being constructed and arranged such that liquefied fuel, such as liquid isobutane, can be injected into the container at any time, when it may be required, from a disposable fuel cartridge.

With the above kind of charge valve, it is a requisite requirement to provide such possibility for charging a predetermined, maximum allowable quantity of liquefied fuel accurately and efficiently into the related container, thus obviating possible damage or breakage thereof, which may occur, should the liquefied fuel be overcharged beyond a predetermined safety limit, on account of thermal expansion of the charged fuel. Another important requirement for the charge valve of the kind, referred to above, is to provide only a minimum loss of fuel, which is inevitable in the course of such fuel charging operation.

Most of the conventional charge or injection valves of this kind are provided with such a closable valve having a connection controllable thereby and connecting a disposable fuel cartridge with the interior of a fuel container or reservoir of the lighter. With such simpler charge valve, however, the liquefied fuel can be injected into the container only to such a degree, that the vapor pressure prevailing within the container is brought into balance with the cartridge pressure. Such a balanced condition can be easily attained, even when a relatively small quantity of liquefied fuel has been transferred from the cartridge into the lighter reservoir. Thus, it will be seen that with such conventional means a satisfactory quantity of liquefied fuel can not be practically injected into the lighter reservoir.

In order to obviate the above mentioned drawbacks and disadvantages as met with conventional gas lighters, it has already been proposed to construct the gas lighter in such a manner that the fuel charging is carried out, while relieving the internal gas pressure at the same time, thus avoiding possible balancing of the internal pressure with the cartridge pressure. Such arrangement has found its utility to some degree. Injection while exhausting in the manner as above described means, in other words, that the internal pressure prevailing within the lighter reservoir is kept lower than the cartridge pressure during the entire period of the charging operation. In this case, the exhausting will cause naturally part of the already injected liquid fuel to evaporate and the thus vaporized gaseous fuel will be discharged from the fuel container. Such evaporation will consume the corresponding quantity of latent heat supplied from the ambient, thus the container being cooled to a corresponding degree. On account of this cooling effect, the difference between the reservoir pressure and the cartridge pressure will be still further accentuated, which means that the injection can be more effectively carried into effect than in the former case as described hereinabove. A danger may be created in this case, however, by the possible occurrence of over or full charge of liquefied fuel into the reservoir. Should this occur, the aforementioned possible breakage or damage of the container may arise under circumstances.

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It is, therefore, one object of the present invention, to provide a charge valve assembly of the kind mentioned hereinabove, which prevents the over and full charging of liquefied fuel, which provides such possibility for charging an accurately predetermined, safety allowable quantity of that kind of fuel under accurate control, which reduces the possible loss of fuel by the exhausting, as described above, to a minimum, and further which prevents any over or full charging of the liquid fuel, even when a user, for instance by his carelessness, should bring about such mishandling in connection with the prescribed charging quantity for a safety charge.

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 drawings, in which:

FIGURE 1 is an axial section of a charge valve assembly designed according to the present invention, and shown in inoperative position;

FIG. 2 is an elevation, partly in section, of the assembly illustrated in FIG. 1, and a portion of the fuel cartridge being shown additionally attached to the valve assembly, the latter being shown in its operative charging position; and

FIG. 3 shows a temperature-volume curve of liquefied isobutane.

Referring now to the drawing, and in particular to FIG. 1, a charge valve assembly is disclosed, in which the respective elements are shown in the non-working position, while FIG. 2 discloses the same valve assembly in its operative or charging position. Incidentally, a somewhat modified form of the connection between the fuel charging cartridge and the charge valve is also illustrated in FIGS. 1 and 2.

Referring now again to FIG. 1, the movable assembly or stem member III is shown as formed at its inner portion with a displacement member 9 of relatively larger volume and of larger diameter than that of its outer portion, the inner portion being detachably attached to the bottom end of the outer portion in a suitable manner, as by a screw connection, as shown. The displacement member 9, when it is in its outermost inoperative position, is completely contained in the lower chamber provided in the immovable skirt member II below its internal intermediate wall or flange *e'*, the latter having a central opening. The member 9 is equipped at its outer portion of its cylindrical face with parallel circumferential grooves, in which the sealing rings 10 and 11, preferably of circular cross-section, are inserted. A radial passage *c'* is formed between the two circumferential grooves in the member 9, leading from the peripheral surface thereof to a small chamber *i* formed centrally in the member 9. As shown clearly in FIG. 1, the lateral passage *c'* communicates through the space *i* with an axial passage *d* extending completely through the stem member 1, which passages *c'* and *d* are adapted to operate as charging inlets to the lighter container, which is now shown in this case for clarity of the presentation, when the movable valve assembly III is in its charging position, as illustrated in FIG. 2.

As the charging operation is carried out in a manner similar to that described hereinbefore in connection with FIG. 2, the movable assembly III is moved inwardly by pushing the charging cartridge IV by the user and thus the radial charging passage *c'* will be exposed to the interior of the lighter container I after the displacement member 9 has been fully moved into the interior thereof, while in this position a discharge passage *b*, provided in the side wall of the skirt member II, communicates with the ambient atmosphere. Under these conditions, as shown in FIG. 2, the charging of the liquefied fuel can be effectively carried out as described hereinbefore.

It is now assumed, that an erroneous charging operation beyond the prescribed safety limit has been carried out by a careless user. It will be seen from the drawing, that, in this case, the displacement member 9, which is of a relatively large volume, occupies the corresponding space within the container I. The member 9 will return to its normal, inoperative position shown in FIG. 1, simultaneously with the restoring movement of the movable assembly III, upon termination of the charging operation. Thus, a space corresponding with the volume formerly occupied by the displacement member 9, is gained, so that an ample gaseous space necessary for the required safety charging will always remain within the lighter container, regardless of the degree of continued surplus charging operation as above described.

The stem member 1 forms a flange *f* adjacent its outer end and the flange *f* has at its periphery an annular groove *f'* which receives a packing ring *p*, the latter engaging the inner cylindrical face of the skirt member II in the inoperative position of, as well as during the axial movement of the stem member 1. The valve assembly III includes a coil spring *s* which engages the flange *f* of the stem 1 and the flange *e'* of the skirt member II and which urges the stem member 1 into its outermost position.

Referring now again to the drawing, and in particular to FIG. 3, a curve is disclosed in terms of the rate of volumetric change of liquefied isobutane, one of preferable fuels employable for the gas lighter of the type described herein, plotted against the temperatures thereof. It will be noted, that upon increase of each range of 10° C. in the illustrated temperature range, the liquefied fuel will increase its volume by about 2%. Since the boiling point of liquefied isobutane is at -10° C. the injected liquid fuel may be considered to be cooled at that time to this temperature. Further, it can be assumed, that the highest temperature attainable during the service period of the gas lighter is about 40° C., so that the maximum temperature difference which may be encountered during service is 50° C. With this possible temperature difference, the charged fuel will be subject to about 10% of its volumetric increase. In addition, a small additional percentage must be allotted to possible erroneous manipulation on the part of the user during charging, so that 12-15% of free or gaseous space should be reserved within the lighter container I at the conclusion of the charging operation.

It is a common constructional feature to all the foregoing embodiments of the present invention, that the movable assembly III having a charging conduit formed therein is reciprocable sealingly along the inside wall surface of the cooperating skirt member II by means of a plurality of sealing means and that these sealing means are arranged to be moved, so as to bring the axial portion of the discharge opening serving as means for defining the maximum allowable or safety charging quantity of liquefied fuel into communication with the ambient atmosphere, or into disconnection therefrom.

This application is a division of my application Serial Number 59,377, filed September 29, 1960,

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:

- In a gas-fueled cigarette lighter,
  - a container,
  - a cylindrical skirt member secured to said container and having a discharge opening in the side wall thereof,
  - a stem member axially movable in said skirt member and having a first flange at its outer portion,
  - a first packing ring received in said first flange and engaging the inner face of said skirt member,
  - said discharge opening being disposed inside relative to said first packing ring in the inoperative position of said stem member,
  - said skirt member including a second flange intermediate its ends and said flange having an opening to permit axial movement of said stem member, said discharge opening also being located outwardly relative to said second flange,
  - a spring disposed between said flange of said stem member and said flange of said skirt member and urging said stem member into its outermost inoperative position,
  - said stem member having an axial injection passage leading into a radial injection passage to terminate at the periphery of said stem member, said injection passage being closed at its inner end except to said radial passage,
  - said stem member having a first outer portion of smaller diameter extending through said skirt member flange and a second inner portion of larger diameter, located below said skirt member flange,
  - two second packing rings disposed in said second portion of said stem member axially spaced apart from each other and on opposite sides of said radial feeding passage of said stem member and said two second packing rings engaging the inner face of said skirt member,
  - so that in the outermost inoperative position of said stem member said discharge opening and said radial passage are closed from the atmosphere, and upon performing an inward stroke of said stem member to a point wherein said first packing ring moves beyond said discharge opening and the innermost of said two second packing rings passing the inner end of said skirt member, the injection passages communicate with said container and said discharge opening communicates with the ambient atmosphere.

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