

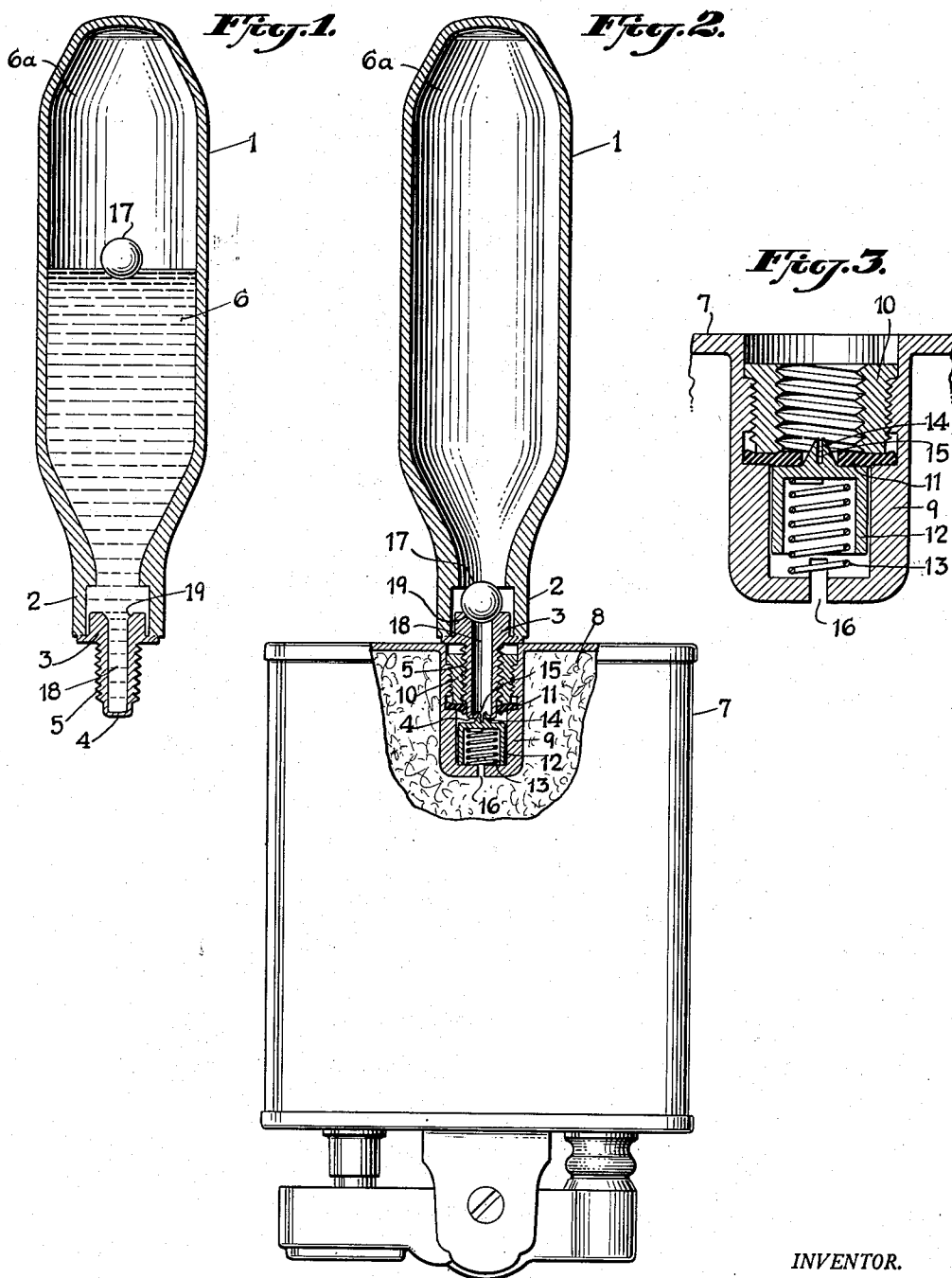
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FUEL STORING AND CHARGING CARTRIDGE

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## FUEL STORING AND CHARGING CARTRIDGE

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The invention relates to fuel storing and charging cartridges containing fuels such as butane, isobutane or propane which convert into gaseous form at room temperature and pressure, but which are confined in the cartridge so as to provide a supply of fuel therein which normally is partly in liquid form and partly in the form of gas under pressure. Cartridges of the above type are useful in fueling cigar lighters utilizing fuels of the above mentioned type, the cartridge being temporarily attached to the lighter proper during the fuel charging operation, and then disconnected and thrown away.

In accordance with the present invention, I provide a hermetically sealed fuel charging cartridge of the puncturable diaphragm type, which is partially filled with fuel of the butane type in liquid form, the cartridge also containing a body of permanent gas under pressure substantially higher than the vapor pressure of the fuel, and also containing a float member which floats upon the body of liquid fuel in the cartridge. When the diaphragm of the cartridge is punctured, the high pressure of the above mentioned body of permanent gas ejects the liquid body of fuel rapidly from the cartridge, and as the liquid level in the cartridge falls, the float member moves into engagement with an annular seat associated with the fuel delivery passageway of the cartridge, to seal or substantially seal the cartridge against the immediate escape of the pressurizing gas along with the charge of liquid fuel. Thus no appreciable amount of pressurizing gas will pass into the fuel chamber of the lighter which is being charged or recharged from the cartridge, and the fuel charging operation will not produce in the fuel chamber of the lighter, an internal gaseous pressure higher than the vapor pressure of the fuel.

The permanent or pressurizing gas used for the above purpose may be, for example, nitrogen, carbon dioxide, air, or other preferably non-inflammable gas which does not react with the fuel, and in referring to a permanent gas I have reference to a medium which will remain in gaseous form throughout the range in temperature and pressure which a cigar lighter and its charging cartridge may be expected to encounter in normal use. For example, a cartridge of the above character may be partially filled with a desired quantity of liquid fuel of the butane type which has at normal room temperature a vapor pressure of between 20 and 27 p. s. i. gauge pressure, nitrogen gas then being injected into the cartridge until the gaseous pressure therein

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reaches between 45 and 200 p. s. i. gauge, according to the desired charge of liquid fuel, the cartridge then being sealed. The greater the volume of liquid fuel introduced into the cartridge, the higher the gaseous pressure required in the cartridge for rapid and complete transfer of the liquid fuel from the cartridge into the fuel chamber of the lighter. Thus the gaseous pressure in the cartridge will be substantially higher than the vapor pressure of the fuel and only a small fraction of the fuel in the cartridge will be in gaseous form so long as the cartridge is sealed. When the cartridge is attached to the lighter and punctured to carry out the fuel charging operation, the expansion of the pressurizing gas under high pressure will cause the liquid fuel to be injected very rapidly into the fuel chamber of the lighter and then the cartridge will be pressure sealed by the float member as above mentioned, to prevent the passage of the pressurizing gas into the fuel chamber of the lighter. At the time the seal is thus effected, the gaseous pressure in the cartridge will still be above the vapor pressure of the fuel.

Further features and advantages of the invention will be in part obvious and in part specifically referred to in the description hereinafter contained which, taken in conjunction with the accompanying drawings, shows a fuel storing and charging cartridge constructed to operate in accordance with the invention; the disclosure however should be considered as merely illustrative of the invention in its broader aspects. In the drawings—

Fig. 1 is a central longitudinal section taken through a preferred form of cartridge, the latter being shown in the inverted position which it should assume during the fuel charging operation.

Fig. 2 is a similar view showing the cartridge in charging relation to a cigar lighter, and at the completion of the fuel charging operation.

Fig. 3 is an enlarged sectional view of an injection valve mechanism constituting part of the lighter shown in Fig. 2.

The cartridge is shown as having a hollow cylindrical metallic casing or shell 1, from which extends a neck 2 into which is received a nozzle 3, having a puncturable diaphragm 4 which hermetically seals the interior of the cartridge. The nozzle 3 may be provided with screw threads 5 for engagement with the injection mechanism of a lighter as hereinafter described, and as above stated the cartridge should be understood as partially filled with a body 6 of fuel of butane type

in liquid form, and with a body 6a of pressurizing gas thereabove at a pressure higher than the vapor pressure of the fuel.

The lighter casing 7 has therein a fuel chamber 8 into which the butane type fuel is to be charged, and stored partly in liquid and partly in gaseous form. For fuel charging purposes the lighter is shown as provided with a valve housing 9 having a hollow threaded stud 10 therein, into which the threaded portion 5 of the cartridge is screwed. An elastic washer 11 is held in position by the stud 10, and except during the fuel charging operation a cup-like valve member 12 is urged by a spring 13, and also by the internal pressure in chamber 8, into sealing engagement with the inner surface of the washer 11, thereby to seal the chamber 8. This relationship of the parts is shown in Fig. 3.

When the cartridge 1 is screwed into the valve mechanism as shown in Fig. 2, a puncturing head 14 on the valve member 12 pierces the diaphragm 4 after member 12 has been pushed down into seating engagement with the housing 9 as shown in Fig. 2, and thereupon the body of liquid fuel 6 in the cartridge 1 will be forced by the pressure of the pressurizing gas 6a, through the slot 15 in the puncturing head 14 down through the space surrounding the valve member 12, and through the slot 16 in valve housing 9 into the fuel chamber 8.

During the fuel charging operation, the fuel cartridge and the lighter should be held in inverted position as shown in Fig. 2, to insure that the body 6 of liquid fuel will be initially forced in liquid form into chamber 8, before the pressurizing gas and the relatively smaller amount of fuel in gaseous form which will be admixed therewith, reaches chamber 8.

During the charging operation, as the liquid level in the cartridge falls, the float member 17 which is carried by the body of liquid fuel, approaches the fuel passageway 18 in nozzle 3, and when the ejection of liquid fuel from the cartridge has been substantially completed, this float member 17 will be pressed by the relatively high gaseous pressure in the cartridge (which pressure will still be substantially above the vapor pressure of the fuel) into engagement with the annular seat 19 in nozzle 3, thus sealing or substantially sealing the cartridge against the egress of the pressurizing gas and the relatively small amount of fuel in gaseous form which will be admixed therewith.

The float member 17, being of larger diameter than the passageway 18, may be inserted into the casing 1 before the nozzle 3 is assembled therewith, after which the cartridge will be charged with fuel and pressurizing gas as above described, and the nozzle 3 is welded in place. The float member 17 may be constructed for example of synthetic rubber of the buna-n type having non-communicating cells or pores therein, the porosity of such compounds being controllable to alter the specific gravity thereof, to provide a float member having a specific gravity of about .5 at 160 p. s. i. gauge pressure. Preferably the float member 17 is molded into the form of a sphere having a non porous surface, and it may be somewhat deformable under pressure, so as to effect a substantially fluid-tight seal when pressed into engagement with the annular seat

19; however a very slow leak past the float will not be seriously objectionable, so long as a "blow out" is avoided, since the charging operation is completed in a short interval, and the cartridge normally will soon be disconnected from the lighter and discarded.

The above disclosed form of injection valve mechanism should be considered as merely illustrative, and while the invention has been disclosed as carried out by a cartridge of the above described specific construction, it should be understood that changes may be made therein without departing from the invention in its broader aspects, within the scope of the appended claims.

#### I claim:

1. A portable fuel storing and charging cartridge of the character described having a hermetically sealed hollow casing, said casing containing in liquid form, a body of fuel of the butane type and also containing permanent gas at a pressure substantially higher than the vapor pressure of the fuel, said permanent gas at pressure higher than the vapor pressure of the fuel being in admixture with fuel in gaseous form, said casing having a fuel conducting passageway therein, a puncturable diaphragm sealing said passageway, said cartridge having an annular seat interposed between said diaphragm and the interior of said casing, and a float member carried by the aforesaid body of liquid fuel, said float member being engageable with said annular seat to prevent the pressurizing gas from escaping from the cartridge along with the liquid fuel, when the said diaphragm is punctured to cause ejection of the liquid fuel from said casing by the pressure of the gas within said casing.

2. A portable fuel storing and charging cartridge of the character described having a hermetically sealed hollow casing, said casing containing in liquid form, a body of fuel of the butane type and also containing permanent gas at a pressure substantially higher than the vapor pressure of the fuel, said permanent gas at pressure higher than the vapor pressure of the fuel being in admixture with fuel in gaseous form, said casing having an ejection nozzle extending therefrom, said nozzle having a fuel conducting passageway therein, a puncturable diaphragm sealing said passageway, said cartridge having an annular seat interposed between said diaphragm and the interior of said casing, and a float member carried by the aforesaid body of liquid fuel, said float member comprising a substantially spherical body of synthetic rubber of the buna-n type having non-communicating pores therein, and being engageable with said annular seat to prevent the pressurizing gas from escaping from the cartridge along with the liquid fuel, when the said diaphragm is punctured to cause ejection of the liquid fuel from said casing by the pressure of the gas within said casing.

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