A plastic liquid-gas bottle including an inner liner made of wetting fabric which closely hugs the bottle walls and dips continuously in the liquid as the same is consumed, whereby to maintain over the entire inner bottle surface in the gaseous zone a moist film that assists heat transfers and thereby enables the output of gas from the bottle to remain constant through time and independent of the level of liquid remaining in the bottle.

3 Claims, 16 Drawing Figures
LIQUID-GAS BOTTLE

The present invention relates to a liquid-gas bottle and more particularly to a plastic bottle with an internal wetting liner that allows the gas consumer to be supplied with a virtually constant output of gas throughout the period during which he uses his fuel.

When the discharge valve on a gas bottle is opened, the output first decreases rapidly, then tends to stabilize.

For as the gas is driven out of the bottle, it is necessary to supply the energy needed to vaporize the liquid phase. If the bottle is initially at room temperature, this energy cannot originate from a heat transfer from the exterior and must therefore necessarily originate from the enthalpy of the liquefied gas, so that the temperature of the latter drops rapidly together with the vapour tension and hence the output. This drop in the temperature of the bottle accordingly allows a certain heat input Q to take place from the exterior, whereby equilibrium is established to some extent.

However, there is customarily a slight reduction in the output throughout the period during which gas is drawn from the bottle, for the overall heat transmission coefficient in the liquid zone is two or three times greater than that existing in the gas zone, so that the heat transfers are much more effective in the liquid zone than in the gaseous zone. The output from the bottle consequently decreases gradually as the level of the liquid drops, which can be a disadvantage for a consumer who wishes to maintain constant the heat capacity of the fire fed with the bottled gas.

In the case of metal bottles, however, the high heat conducting capacity of the bottle walls greatly attenuates this drop in output as the bottle empties, for if the heat transfers are better in the liquid zone than in the gaseous zone the wall in contact with the liquid will be at a lower temperature than the wall in contact with the gas, so that in the case of a metal bottle a certain amount of extra heat is transmitted by conduction through the wall metal from the exterior to the interior of the bottle.

In the case of a plastic bottle, on the other hand, this heat input is virtually inessential since the heat conduction coefficient of the material is two hundred times less than that of metal and there is therefore nothing to attenuate the drop in output which inevitably takes place as the level of the liquid in the bottle drops.

The present invention accordingly provides for a wetting liner incorporated into the inner surface of the plastic material when the latter is injected or blown to give the bottle its final form, this lining being wetted completely by the liquefied gas throughout the useful life of the bottle whereby to ensure continuous liquid-phase transfers over the entire surface of the walls in contact with the gas.

Further particularities and advantages of the invention will emerge from the description which follows with reference to the accompanying non-limitative exemplary drawings, in which:

FIG. 1 shows two bottle elements made of plastic;
FIG. 2 shows the application of a liner according to the invention;
FIG. 3 depicts an alternative embodiment;
FIG. 4 shows a bottle assembled to its liner and filled with liquid gas;
FIGS. 5 through 11 portray different forms of embodiment of the wetting liner;
FIG. 12 shows a bottle obtained by blowing;
FIGS. 13 through 15 show an elastic liner utilizing either a concertina configuration or strips, devised for lining the bottle of FIG. 12, and
FIG. 16 is a graph on which output versus time curves have been plotted.

Reference is first had to FIG. 4 for a showing of a bottle generally designated by reference numeral 10, comprising an outer envelope 1 made of stratified material, a wall 2 made of plastic, and an inner wetting liner 3 made of fabric.

As is well-known, heat transfers are better in the zone containing liquefied gas (the convection coefficient of which may be 13 cal/m²h°C for example) than in the zone 5 (the convection coefficient of which may be 6 cal/m²h°C, say). Hence the temperature θ of the upper dome 6 of the bottle in contact with the gas will in principle be higher than the temperature T of the lower dome 7 in contact with the liquid unless the heat conducting capacity of the walls makes it possible by conduction to achieve a continuously uniform temperature θ = T by virtue of a continuous flow of heat from the dome 6 to the dome 7. It is precisely this heat regulating input which, in the prior art, takes place in steel bottles (curve I of FIG. 16) but not in plastic bottles (curve II), in which the downslope representing the decreasing output is very marked.

In accordance with this invention (curve III), the wetting liner 3 pumps liquid continuously and assists, over the entire inner surface of the bottle, a heat transfer in the liquid phase which, as will be apparent from the table below, makes it possible to obtain a uniform output of gas that is for all practical purposes independent of the degree of depletion of the bottle.

<table>
<thead>
<tr>
<th>Moment in time</th>
<th>Output in grams/hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel bottle</td>
<td>Plastic bottle</td>
</tr>
<tr>
<td>A: start of stabilized zone</td>
<td>56.4</td>
</tr>
<tr>
<td>B: end of stabilized zone</td>
<td>45.6</td>
</tr>
</tbody>
</table>

In order to achieve the figures in the above table it is preferable to ensure a close bond between the plastic 12 of each bottle element and the cotton fabric or felt liner 3 by bonding a thermo-adhering fabric, for example. Alternatively, the liner may be folded back upon itself as shown at 8 in FIG. 3 and be arranged around a die (not shown) that applies it against the injected material 9 while the same is still in the pasty state.

The liner fabric 3 may be prepared in various appropriate ways whereby to provide, by the cutting up of one or more strips, the exactly developable cylindrical surface 23 to 25 of the envelope which it is to line.

The strip of wetting fabric may be cut around an equatorial axis xy (FIGS. 5 and 6) or a pole P (FIGS. 7 and 8), or be prepared compositely (FIGS. 9 and 10).

Alternatively, it would be possible to weave a sort of one-piece sock, jacket or bag 11.

In cases where the bottle is obtained by injection followed by blowing (FIG. 12), it will be seen that the liner of wetting fabric first hugs the shape of the rough product of injection (depicted in dash lines at 13) in
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the form of an elastic girdle 14, a gusseted girdle 15, or an arrangement 16 of strips or sections sliding over one another. In all these alternative arrangements, the subsequent blowing of the plastic bottle in the pasty state permits of obtaining the bulging wall 17 made of plastic and bearing an inner liner of wetting fabric according to this invention that ensures the constant output reflected by curve III in FIG. 16.

It goes without saying that changes and substitutions may be made in the embodiments hereinafter described without departing from the spirit and scope of the invention, as set forth in the appended claims.

What is claimed is:
1. A plastic liquid-gas bottle, characterized in that it includes an inner liner made of wetting fabric which closely hugs the bottle walls and dips continuously in the liquid as the same is consumed, whereby to maintain over the entire inner bottle surface in the gaseous zone a moist film that assists heat transfers and thereby enables the output of gas from the bottle to remain constant through time and independent of the level of liquid remaining in the bottle.
2. A liquid-gas bottle according to claim 1, characterized in that the liner is made of thermo-adhering fabric.
3. A liquid-gas bottle according to claim 1, characterized in that the liner is made of cotton.

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