METHOD AND APPARATUS FOR IMPROVING THE VACUUM INSIDE LINERS FOR VACUUM BOTTLES

A method is disclosed for improving the vacuum inside glass liners for vacuum bottles, according to which, in a space (1), between the double walls (2 and 2') of the glass liner (3), and after its silvering and drying, one or more "getters" (4) are introduced into it through a tubette (5). When the pumping out of the air is done from below and the tubette (5) is positioned on the lower central portion of the liner, a part (6) is introduced into the tubette which lodges itself in the lower opening (7) of the outer wall (2). This forms a barrier or filter which prevents the "getters" (4) from escaping from the space (1). The part (6) is equipped with openings (6A), as well as lower (6B) and upper (6C) grips, working as springs. Part (6) is not necessary if the pumping operation is done from below and the tubette (5) is positioned on the lower side portion or on the upper portion of the liner, or if the pumping operation is done from above or from the side, or in addition, if the "getter" itself has physical, chemical or mechanical elements which cause it to expand to larger dimensions than the internal diameter of the tubette (5). Furthermore, the part (6) is not necessary if, after having introduced the "getter" through the tubette, the latter's diameter is narrowed by means of the softening of the glass and its stretching.
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METHOD AND APPARATUS FOR IMPROVING THE VACUUM INSIDE LINERS FOR VACUUM BOTTLES

Field of the Invention

The present invention relates generally to vacuum bottles and, more particularly, concerns a liner for said bottles which exhibits an improved vacuum.

Background of the Invention

The great majority of vacuum bottles are manufactured with vacuum-insulated glass liners, such liners having double walls with a slight distance between them. This results in an internal space in which a vacuum is created when the air existing in the internal space is pumped out through a tubette, normally located at the lower extreme of the liner's external wall, and sometimes, on the upper part or the side of the same. The tubette is sealed off once the desired vacuum pressure has been reached.

Prior to pumping the air out of the internal space, the double walls of the liner are internally mirrored or silvered through a chemical process in which water is one of the elements present. After mirroring, in order to pump the air from the space between the walls which have been mirrored, efficient drying is necessary so as to allow for a vacuum at an adequate pressure to permit the vacuum liner to function properly.

This drying is seldom efficient, for in addition to water, which produces steam vapors, gases are present which continue to be generated by other chemical components used in the mirroring process, and the glass walls themselves also emit gases when subjected to a vacuum. This freeing of gases requires nearly perfect drying, which is difficult to achieve at levels permitting a sufficient vacuum for effective thermal insulation.

The use of "getters" which absorb gases would reduce
this problem, for the same would work in the vacuum space as small vacuum pumps, absorbing the residual gases remaining in the pumped-out space due to lack of drying, before and during the pumping process. Using "getters" before mirroring is inconvenient, because they are contaminated by the mirroring solution, and upon such contamination, high temperatures and prolonged drying times are required for the "getters" to be able to work as "getters" once again.

In accordance with the present invention, one or more "getters" are introduced after the bottle has been mirrored and dried, the same remaining totally efficient in absorbing the residual gases due to their being easily activated.

These dry "getters" are introduced into the space which exists between the double liner walls through the tubette in the external wall of the same and through which the air from the internal space is pumped out. Therefore, these dry "getters" must have dimensions which are smaller than the internal diameter of the tubette. If the liner is pumped out from the bottom and the tubette is positioned in the lower central portion of the liner, a small part, such as a barrier or filter is provided inside of the tubette which keeps the "getters" from escaping from the internal space, either by being dragged out by the air contained inside it when the liner is pumped out to produce the vacuum or due to the force of gravity.

This part will not be necessary if the liner is pumped out from its lower portion and the tubette is positioned on the lower side portion of the upper portion of the liner, or if the liner is pumped out from the top or from the side, whatever the position of the tubette on the liner may be (at the top, the bottom or the side), since, under these circumstances, there will be no risk of the "getters" being sucked out
or falling out due to the force of gravity.
The barrier or filter part also will be unnecessary if, in the makeup of the dry "getters", one or more chemical, physical or mechanical elements are added that dilate or expand their dimensions after they have been introduced into the space between the double walls, such that they cannot be sucked out or fall due to the force of gravity, because their expanded dimensions are larger than the internal diameter of the tubette through which they were originally introduced.

Another way of keeping the "getter" from being sucked out or falling out due to the force of gravity is narrowing the tubette after the "getters" have been introduced through the same, this narrowing being obtained through the softening of the glass or its stretching, by which the internal diameter of the tubette will become smaller than the diameter of the "getters".
The barrier portion can have innumerable configurations, yet it must have basic construction characteristics which, in addition to allowing for the passage of the air for perfect pumping, in order to produce the vacuum, will allow the barrier's firm coupling at the inside extreme of the tubette so as not only to avoid the dragging out of the dry "getters", but also their dragging out when the air is being pumped out.

As such, with the dry "getters" remaining permanently in the inside space which exists between the double walls of the liners, the thermal vacuum insulation of the space will reach extremely high quality levels, resulting in the increase of the vacuum bottle's thermal efficiency. The amount of time during which cold or heat can be retained inside the liner will be substantially increased.

Brief Description of the Drawings
To illustrate the preceding objects and features, drawings of preferred embodiments of the present invention are attached, through which the same can be better visualized:

Figure 1 is a schematic longitudinal sectional view of a glass liner in which the present improvement is embodied;

Figure 2 is an enlarged detail of the lower extremity of the glass liner of Fig. 1, illustrating the correct positioning of the filter for the "getter";

Figures 3 to 5 are some examples from among the innumerable possible configurations for the filter;

Figure 6 illustrates an example of a liner which need not use the filter-part, an embodiment in which the tubette is positioned on the lower side portion of the liner and the pumping out of the air down from below;

Figure 7 is another enlarged detail of the tubette illustrating an embodiment utilizing the narrowing of its diameter, which embodiment does not need to use the filter-part either;

Figure 8 is a perspective view of a getter assembly which, when utilized, eliminates the need for the filter-part;

Figure 9 is a fragmentary sectional view similar to Fig. 2 illustrating the use of the getter of Fig. 8; and

Figure 10 is a sectional view, similar to Figure 1, illustrating a method for pumping out the liner, without the risk of having the getters sucked out or drop out by force of gravity.

Detailed Description of the Preferred Embodiments

The objective of the present invention is improving the vacuum inside glass liners for vacuum bottles. In the existing space 1 between the double walls 2 and 2', which make up the glass liner 3, after the mirroring and the drying of the liner 3, one or more "getters" 4
are introduced into the space through the tubette 5, through which the air from the space 1 is pumped out, these "getters" 4 having a smaller diameter than the internal diameter of the tubette 5.

After the placement of the "getters" 4, when the pumping out of the air from the liner is carried out from below and the tubette 5 is positioned on the lower central portion of the liner, a part 6 is introduced in the tubette 5 until the same lodges itself in the lower opening 7 of the outside wall 2 of the liner 3. This forms a barrier or filter which keeps the "getters" 4 from coming out as a result of the pumping out of the air contained inside space 1 in order to create the vacuum or as a result of the force of gravity.

Part 6 can have innumerable configurations, but all of them should have openings 6A dimensioned to be smaller than the "getters" 4, keeping such "getters" from escaping due to the drag from the pumping out of the air or the force of gravity. These dimensions must be smaller, but not so small that they restrict pumping air out of the space 1 or make it difficult. The smaller grips 6B of the part 6 work as springs in order to keep the part 6 in engagement with the inside wall of the tubette 5, keeping it from dislodging itself from the opening 7 and entering into the space 1 in the liner 3. In addition, the part 6 has upper grips 6C which also work as springs, and which open after having passed through the opening 7 of the liner 3, and whose diameter is larger than that of the tubette 5, thus keeping the part 6 from being dragged out during the pumping out of the air from the said space 1 or from falling due to the force of gravity.

When the air is pumped out from below, through with the tubette 5 located on the lower side portion (Fig. 6) or the upper portion of the liner, the "getters" 4 are used without the need for the part 6, since in such
cases there is no risk of the same being sucked out during the pumping out of the air or of falling out due to the force of gravity.

In addition, the referred to part 6 is not necessary if the air is pumped out of the liner from above or from the side, whatever the position of the tubette 5 on the liner may be (on the upper, lower or side portion, since in these cases, as well, there is no risk of the "getters" being sucked out during the pumping out of the air or of their falling out due to the force of gravity.

"Getters" may also be used without the part 6 as long as the same have included one or more physical, chemical or mechanical elements in their composition or mounting which makes them dilate or expand to larger dimensions than the internal diameter of the tubette 5. For example, Fig. 8 illustrates a getter assembly 20 which provides a mechanical construction that obviates the need for the filter-part 6.

Getter assembly 20 broadly comprises the getter 4 (shown as formed into a rectangular shape) and a mounting bed 22, preferably made of steel. Bed 22 is provided with end tabs 24, 24 and center tabs 26, 26 which are bent over getter 4 to retain it in position on the bed. Bed 22 also includes four resilient legs 28, 28, 28, 28, which protrude outwardly and diagonally. However, the legs 28, 28 at the same end of the getter assembly 20 may be deformed so as to be brought together, as discussed further below. Owing to their resilience, the legs will return to the position illustrated in Fig. 8, if they are not retained in their compressed-together position.

In Fig. 9, two different getters of the type illustrated in Fig. 8 are shown. The upper one is disposed in the space 1 inside the glass liner 3 and has the same appearance as the getter illustrated in
Fig. 8. The lower getter, is being inserted into the tubette 5 and, for this purpose, the legs 28, 28 at the same end of the getter assembly 20 have been forced or compressed together so as to narrow the width of the getter assembly. This permits it to fit within the tubette 5 for insertion into the liner 3. However, once the lower getter enters the space 1 and free of tubette 5, the legs of the getter assembly will spring out, owing to their resilience and will assume the same configuration as in the upper getter. This makes the getter assembly 20 larger than the inside diameter of tubette 5, whereby it may not re-enter tubette 5 and is trapped within the space 1.

Those skilled in the art will appreciate that getter assembly 20 could have other constructions which would achieve a similar mode of operation. For example, instead of the legs 28, the end of the getter could be provided with a bead of material which expands when heated. The getter could then be inserted into tubette 5 as explained above, whereupon heat would be applied and the bead permitted to expand. If the bead is constructed so that, in its expanded condition, it is too large to pass through tubette 5, getter assembly 20 will once again be trapped within the space 1. Many materials are available which expand sufficiently upon heating to achieve this result. Sodium silicate is a preferred material, as it will expand sufficiently for the intended application and will have no deleterious effect on the interior surfaces of the vacuum liner.

The "getters" 4 may also be used without the part 6 as long as the tubette 5 is narrowed by means of the softening of the glass and its stretching after they have been introduced into the liner, thus reducing the internal diameter of the tubette and, consequently, keeping the "getters" from being sucked out during the pumping out of the air or from falling out due to the
force of gravity (Fig. 7).
As illustrated in Fig. 10, it is possible to avoid the need for filters or special getter assemblies if, during pumping out of air from the space 1, the liner is retained in a position such that tubette 5 is above the getters 4. In Fig. 10, the liner 3 has been inverted so that tubette 5 is at the top and the getters each drop down to the bottom of the space 1. With the liner so positioned, the weight of the getters will prevent them from being sucked out of space 1, and they cannot drop out of the space through tubette 5.
CLAIM

1. A method for improving the vacuum inside glass liners for vacuum bottles, the liner being of the type having a space (1) between spaced walls (2 and 2'), which make up the glass liner (3) and a tubette providing communication between the space (1) and the exterior of the liner, the liner (3) being mirrored and dried during manufacture, said process comprising the following steps:

- providing said tubette (5) with an inside diameter less than the spacing between the walls (2 and 2');
- introducing at least one getter (4) through the tubette (5), the getters (4) being sufficiently small to fit within the tubette (5); and
- introducing a part (6) into the tubette (5) after the getters (4) have been inserted, such part (6) being dimensioned and shaped to lodge within the space (1) at the entrance of the tubette (5) thereinto, thus forming a barrier or filter which keeps the getters (4) from coming out of the inside of the space (1) as a result the pumping out of the air contained inside such space or as a result of the force of gravity.

2- The method, of claim 1 characterized in that the part (6) has:

- openings (6A) which are dimensioned to be smaller than the getters (4), yet to allow for the pumping out of the air from the space (1);
- lower resilient grips (6B) positioned to remain within the tubette (5) and to act as springs which keep the part (6) tightly lodged against the inside wall of the tubette (5); and
- upper resilient grips (6C) positioned in space (1), also having the same spring effect which causes them to when open to a diameter larger than that of the tubette (5), thus keeping the part (6) from being drawn out of the space (1) and into the tubette (5).
3- A method for improving the vacuum inside glass liners for vacuum bottles, the liner being of the type having a space (1) between spaced walls (2 and 2'), which make up the glass liner (3) and a tubette providing communication between the space (1) and the exterior of the liner, the liner (3) being mirrored and dried during manufacture, said process comprising the following steps:
- providing said tubette (5) at a lower side portion or an upper portion of the liner (3);
- introducing at least one getter (4) through the tubette (5), the getters (4) being sufficiently small to fit within the tubette (5).
- whereby the getters (4) are not dragged out by the pumping out of air through the tubette (5), nor will they fall out as a result of the force of gravity.

4- A method for improving the vacuum inside glass liners for vacuum bottles, the liner being of the type having a space (1) between spaced walls (2 and 2'), which make up the glass liner (3) and a tubette providing communication between the space (1) and the exterior of the liner, the liner (3) being mirrored and dried during manufacture, said process comprising the following steps:
- providing said tubette (5) with an inside diameter less than the spacing between the walls (2 and 2');
- introducing at least one getter assembly (20) into the space (1) through the tubette (5), the getters assemblies (20) being of sized to fit within the tubette (5) and having a physical, chemical or mechanical element which makes them expand to larger dimensions than the internal diameter or the tubette (5) after their having been introduced into the space (1).

5- A method for improving the vacuum inside glass liners for vacuum bottles, the liner being of the type
having a space (1) between spaced walls (2 and 2'), which make up the glass liner (3) and a tubette providing communication between the space (1) and the exterior of the liner, the liner (3) being mirrored and dried during manufacture, said process comprising the following steps:

- providing said tubette (5) with an inside diameter less than the spacing between the walls (2 and 2');
- introducing at least one getter (4) through the tubette (5), the getters (4) being sufficiently small to fit within the tubette (5); and
- after the introducing step, narrowing the tubette (5) to an internal diameter which is too small to permit getters (4) to enter into the tubette (5).

6- A method for improving the vacuum inside glass liners for vacuum bottles, the liner being of the type having a space (1) between spaced walls (2 and 2'), which make up the glass liner (3) and a tubette (5) providing communication between the space (1) and the exterior of the liner, the liner (3) being mirrored and dried during manufacture, said method comprising the following steps:

- introducing at least one getter (4) through the tubette (5), the getters (4) being sufficiently small to fit within the tubette (5); and
- pumping air out of the space (1) to create a vacuum therein, while retaining the liner (3) in such a position that the tubette is above the getters, whereby the getters (4) are prevented from coming out of the inside of the space (1) as a result the pumping out of the air contained inside such space or as a result of the force of gravity.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 5 \ A47J41/02 F17C3/08

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 5 F17C A47J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Patent family members are listed in annex.

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  - "&" document member of the same patent family.

Date of the actual completion of the international search: 30 June 1994

Date of mailing of the international search report: 06.07.94

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Fax: (+31-70) 340-3016

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