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⑤④ **Metal container and method of manufacturing the same.**

⑤⑦ This invention relates to a metal container and a method of manufacturing the same, wherein a separate bottom plate (2) is fitted to a cylinder body (1) by adhesive joint means (3), the adhesive being distributed in a constant manner over the effective joint surfaces in a convex style in contrast to the prior concave style, so that the joint section enjoys a satisfactory sealing and enough strong endurance against the extra internal pressure and the impact load. The convex form of the adhesive can be produced by inverting the assembled body (1) and inserted bottom plate (2) while effecting a curling step, or by addition of pressure to the interior of the body (1), or by heating the joint area, or by providing recesses (27) in the plate (2) to allow adhesive to flow into a curled end part of the body (1).

FIG. 5

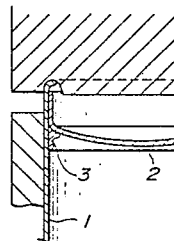
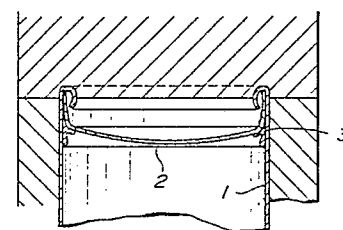


FIG. 6



Description

METAL CONTAINER AND METHOD OF MANUFACTURING THE SAME

This invention relates to a metal container for pressurised material and to a method of manufacturing the same.

5 Metal containers, in other words, pressure holding containers have been largely used for aerosol containers and others, and there is still a large demand therefor in the various industrial fields.

A container of this type, in the prior art, was mainly formed by the step of drawing raw material into a cylindrical body with an integral bottom and processing also the top part to be smaller in diameter for the mouth by so-called necking procedures, whereon the top is closed by another member equipped with valve apparatus in the final stage of the completion.

10 The metal container completed through the above procedures in the prior art, however, is restricted in selecting the raw material, like aluminum, since it needs ductility and to be able to be easily cast. Further, the completed container is not strong enough for the pressure endurance because of the nature of the material itself.

15 In order to obtain better endurance of the pressure, U.S. Patent No. 4,241,844 disclosed the following manufacturing method. Firstly draw the cylindrical body having at its one end the smaller diameter and having its other end open, i.e. with no integral bottom at all, and with the same diameter as the cylindrical body, and then fit a disc-like bottom plate produced by another step in the open end by adhesive joint means and caulking means.

20 This method accordingly allows the use of harder metallic material than aluminum, such as steel plate, and thus the cylindrical body is able to be made of steel plate as the said body is produced by means of the step with an open end.

After the bottom plate is inserted and furnished with adhesive in the bottom portion of the cylinder, the end part of the said bottom portion interfolds the said bottom plate, and the caulking is made, whereon satisfactory pressure endurance is sustained.

25 With the above mentioned method, however, there is a problem in obtaining a good seal in a satisfactory condition. As the bottom plate is inserted forcibly into a bottom portion of the cylindrical body furnished with adhesive, a skirt portion of the bottom plate frictionally engages with the inner wall of the cylindrical body, and this engagement sweeps the adhesive upwardly and finally the adhesive retains like a semilunar-like group just over the place between the inner wall and the shoulder of the bottom plate. After the insertion is finished, the semilunar-like group of the adhesive exists all around in the inside. As above explained, because of the friction effect, the adhesive does not almost exist correctly between the whole outer circumference of the bottom plate and the inner wall of the cylinder, and thus the sealing is only kept by the said semilunar-like collective group of the adhesive. Thus, the effective surface of the adhesive which is to secure the whole outer circumference of the bottom plate with the inner wall becomes quite small, so that the desirable and satisfactory seal is not obtained.

35 The disclosure indicates the use of strong adhesive of the hardening type, and therefore when the adhesive comes to a collective group as mentioned aforesaid, the flexibility of the adhesive cannot be attained, and the said group is easily detached or broken against the pressure change caused by the inner forces or against the transformation of the bottom plate or that of the cylinder lower portion caused by the impact load, whereon the sealing is sometimes broken.

Therefore, it is the main object of this invention to resolve the problems as mentioned above.

The present invention has as an object the provision of a metal container and a method of manufacturing the same with a satisfactory seal between the cylinder and the bottom plate.

45 It has as a further object the provision of a method of manufacturing a metal container which maintains a good seal by increasing the adhesive effective areas between the inner wall of the cylinder and the outer circumference of the bottom plate.

It is another object to provide a method of manufacturing a metal container with an improved seal by preventing the adhesive from becoming a semilunar-like collective group even if a hardening type of adhesive is used.

50 It is a still further object to provide a method of manufacturing a metal container with an improved seal by retaining the adhesive in the required place in the case of high-viscose adhesive usage.

It is yet another object to provide a method of manufacturing a metal container with a resistant seal on a joint point, against a pressure change or against an impact load.

55 It is yet a still further object to provide a method of manufacturing a metal container which can be produced on present existing equipment without any excessive capital investment.

It is a further object to provide a method of manufacturing a metal container with an improved seal by adopting a method of forming a piece or plural pieces of ditch on the skirt portion of the bottom plate, along the said ditch the adhesive runs up to the curling portion, whereafter the adhesive is hardened to overlap on the whole gaps therewith.

60 This invention relates to a metal container and a method of manufacturing the same, wherein a separate bottom plate is fitted in the cylindrical body by adhesive joint means, and it is characterised in increasing the effective areas for adhesive between the inner wall of the cylindrical body and the outer wall of the bottom

plate, improving the seal of the adhesive joint means by preventing the hardening adhesive from coming into a semilunar-like collective group, and precluding damage to the sealing part and deterioration of the sealing power caused by the pressure change or the impact load.

If a high-viscose adhesive is utilized, it is adapted to make the relative adhesive coming into the whole gaps correctly so as to increase the sealing ability, whereas both damage and deterioration of the sealing joint part is prevented against the pressure change and the impact load. 5

Furthermore, it is characterised in forming a piece or plural pieces of ditch on the skirt portion of the bottom plate, along the said ditch the adhesive runs through up to the curling portions whereafter the adhesive is hardened to overlap on the whole gaps properly, which promotes the increase of the effective areas for the adhesive and also the sealing ability and also promotes the shock resistant powers caused by falling. 10

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figures 1 and 2 show a prior art metal container, Figure 1 being a cross-sectional view showing the container just before a bottom plate is fitted to a cylindrical body, whilst Figure 2 is a fragmentary cross-sectional view showing the arrangement when the said plate is fitted to the body, 15

Figure 3 is a fragmentary cross-sectional view of a metal container of the invention showing the position just before a bottom plate is fitted to a lower portion of the cylindrical body of the container,

Figure 4 is a fragmentary cross-sectional view showing the arrangement when the bottom plate is adhesively secured in the body,

Figures 5 and 6 are cross-sectional views showing respective curling steps, 20

Figure 7 is a perspective view showing the supply of adhesive,

Figure 8 is a cross-sectional view showing an alternative style of bottom plate,

Figure 9 is a plan view showing the step to provide a specimen for a stripping test,

Figure 10 is a perspective view of the said specimen,

Figures 11 and 12 are schematic views for the relative testing method, 25

Figures 13 and 14 show a further embodiment of the invention, with Figure 13 being a cross-sectional view showing the working arrangement, while Figure 14 is a fragmentary sectional view showing the adhesive joint part between the cylindrical body and the bottom plate,

Figures 15 to 17 show a still further embodiment of the invention, with Figure 15 being a fragmentary sectional view showing the working arrangement, while Figure 16 is a fragmentary sectional view showing the step of curling and Figure 17 is a fragmentary sectional view showing the arrangement when the bottom part is jointed with the cylindrical body, and 30

Figures 18 and 19 show a yet still further embodiment of the invention with Figure 18 being a perspective view of the bottom plate, while Figure 19 is a fragmentary sectional view showing the joint between the cylindrical body and the bottom plate. 35

Figures 1 and 2 show the construction and manufacture of a prior art metal container. The present invention is substantially based on the said construction, but it increases the adhesive effect between a cylinder 1 and a bottom plate 2 as well as improving the sealing ability thereof.

Referring to Figures 1 and 2, the cylinder 1 has its lower end open and its other end drawn into a smaller diameter top, where a dispensing means 24 such as a cap with an emitting valve is provided, the body between the ends being cylindrical. The bottom plate 2 is inserted into the said open end of the cylinder 1 to form the lower closure of the cylinder 1, and it is in the form of a disc with a dome-like top portion 22 and a depending skirt portion 21. 40

Adhesive 3 is applied between the fringe of the bottom plate and the inner wall of the cylinder 1 and the sealing joint part is formed between the two components. The lowest part of the cylinder 1 is subject to a curling operation and this folds over the skirt portion 21 of the bottom plate 2, whereon the skirt portion is pinched by the lowermost portion of the cylinder, to produce resistance against movement of bottom plate 2 out of the cylinder 1 as a result of inner pressure. 45

In the prior art metal container, the adhesive applied between the cylinder 1 and the bottom plate 2 tends to come a semilunar-like collective group between the shoulder of the bottom plate 2 and the inner wall of the cylinder 1 as a result of the frictional engagement of the bottom plate 2 with the inner cylindrical wall during the insertion procedure. 50

As above, when the adhesive comes together in a semilunar-like group, the flexibility or the elasticity of the adhesive is lost, and as a result the internal pressure or the impact load breaks the adhesive effect and the sealing ability is lost, because both the cylinder and the bottom plate cannot withstand such internal pressure nor the impact load. 55

This invention aims to resolve these problems as mentioned above.

With reference to Figures 3 to 8, the cylinder 1 and the bottom plate 2 are the same as those of the prior art, and in the adhesive application step the adhesive is supplied circumferentially along the inner wall of the open end 11 of the cylinder 1. In this step, as shown in Figure 7, a nozzle N of an adhesive container is placed at a defined portion of the inner wall of the cylinder 1 and runs at 150 rpm, for example, and the adhesive agent is, for example, dispersed at 18 c.c. per minute, the adhesive 3 being applied circumferentially along the inner wall of the open end 11 as shown in Figure 3. The adhesive applied area must be the contacting area between the skirt portion 21 and the inner wall of the cylinder 1 when the bottom plate is fitted in the cylinder 1. 60

The bottom plate 2 is inserted into the cylinder body furnished with adhesive from the open end 11, and as 65

shown in Figure 4, the bottom end of the skirt portion 21 and the open end 11 of the cylinder 1 become axially aligned, i.e. flush. In this situation, the adhesive 3 as shown in Figure 4 comes a semilunar-like group around the periphery of the dome-like portion 22 of the bottom plate 2.

The assembled body of the said cylinder 1 and the said bottom plate 2 is then placed upside down, and subject to a curling procedure as shown in Figures 5 and 6. The curling method is similar to the prior art method, and during the curling step, the bottom plate 2 is forcibly pushed inwardly into the cylinder 1 as the open end portion 11 is bent to interfold the bottom plate 2. After the said curling is finished the curling portion is formed circumferentially all around the bottom end of the skirt portion 21 as shown in Figure 6, and finally the said skirt portion 21 is pinched by the curling portions. After this curling procedure, until the adhesive 3 runs dry to be hardened, the condition of standing upside down must be maintained, during which the adhesive 3 runs along the surface of the cylinder inner wall and along the dome-like portion 22 by the liquidation of the adhesive 3. In order to obtain this natural flow of the adhesive 3, it may be necessary only to keep this container standing upside down for stocking. By this procedure, the flow of the adhesive 3 is along the inner wall of the cylinder 1, and it is also along the slope towards the domed middle of the bottom plate, whereas the semilunar-like collective group of the adhesive 3 which is the fatal defect of the prior art is completely cleared, and in this case, the semilunar-like group comes in convex style instead of the previous concave style.

In the said embodiment, the following materials are available for forming the cylinder 1: steel plate, steel plate furnished with aluminium plating, aluminium sheet, cladding steel plate and compound steel plate furnished with plastics coating in its inside.

The following adhesive agents are available for the said embodiment: epoxy solvent agent such as epoxy-amine type, or epoxy-urethane adhesive with high-viscose quality.

In this embodiment, the upper end of the skirt portion 21 can be provided with some taper, but this end can alternatively be without any taper, as shown in Figure 8, having the hemispherical part 23, which is also easy and smooth to allow the said bottom plate 2 to be fitted into the cylinder 1.

The gap tolerance between the bottom end 11 of the cylinder and the skirt portion 21 is preferably between 0.1 and 0.3mm. In the case where the skirt portion is equipped with taper, as shown in Figure 4, some small circumferential gaps are formed, into which the adhesive 3 flows. In other words, at least, on the upper part of the skirt portion, adhesive is accordingly provided.

The application of the adhesive 3 and the fitting of the bottom plate 2 are made in compliance with the prior art.

With the invention, the cylinder 1 is kept standing upside down, and the caulking is performed on the skirt portion 21. During the time when the caulking is performed and/or the maintenance time of keeping the above standing, the adhesive 3 runs down along the inner wall of the cylinder 1 from its semilunar-like group, and accordingly the said group of the adhesive 3 is gradually running lower and finally it changes its form into a convex style from its original concave style. Keeping this arrangement, the adhesive joint part is dried and the resultant cylinder 1 is surely jointed around the hemisphere of the bottom plate 2.

The adhesive is now applied over the circumferential edge part of the dome portion 22 and over the inner wall of the cylinder 1 in even thickness, as seen in the convex style between the bottom plate 2 and the cylinder 1. Therefore, the adhesive applied areas can transform themselves in correspondence with the transformation of the dome portion 22 and the inner wall of the cylinder 1.

Even if the applied adhesive is fixed in quantity, the effective surface for the adhesive is larger in comparison with the prior method in which the semilunar-like collective group is unavoidable.

As above explained, the adhesive applied areas can transform themselves accordingly by which the damage by pressure change or impact load is avoided and the satisfactory sealing is kept correct. At the same time, the increase of the effective areas for the adhesive also promotes the sealing ability when compared with the same produced by the prior art.

With regard to the present invention, a stripping test was performed and the relative data are now indicated and explained as follows:

The test container was of the following construction:

Diameter :	50mm
Height :	124mm
Thickness of the cylindrical body at the joint part:	0.27mm
Thickness of the bottom part at the joint part:	0.36mm
Material :	aluminum alloy
Adhesive :	Epoxy polyamide plastics adhesive 0.6 gram used.

The test specimen was adapted, as shown in Figure 9, cutting the piece down at 5mm wide at 120 degree

intervals, and the specimen was completed in the manner of Figure 10.

The testing was performed, as shown in Figures 11 and 12, with the application of a pull gauge. Bottom side 25a was stabilized firmly and cylinder side 25b was connected with the pull gauge, whereon the operation of pulling was employed with readings of the pull gauge being taken.

The test result for 10 pieces is shown in the following table:

<u>Number of specimen</u>	<u>1a</u>	<u>1b</u>	<u>1c</u>	<u>2a</u>	<u>2b</u>	<u>2c</u>			
Stripping Power (Kg)	12.9	13.5	13.4	13.4	13.0	13.5			
Spe- cimen	<u>3a</u>	<u>3b</u>	<u>3c</u>	<u>4a</u>	<u>4b</u>	<u>4c</u>	<u>5a</u>	<u>5b</u>	<u>5c</u>
Power	13.2	13.3	13.6	13.4	13.4	13.3	13.4	13.7	13.2
Spe- cimen	<u>6a</u>	<u>6b</u>	<u>6c</u>	<u>7a</u>	<u>7b</u>	<u>7c</u>	<u>8a</u>	<u>8b</u>	<u>8c</u>
Power	12.7	13.6	13.4	13.1	13.4	12.7	13.5	13.3	14.0
Spe- cimen	<u>9a</u>	<u>9b</u>	<u>9c</u>	<u>10a</u>	<u>10b</u>	<u>10c</u>			
Power	13.5	13.3	13.4	13.0	13.5	13.6			

At the same time, the same test was performed for a container which was manufactured by the prior art in the semilunar collective group of adhesive, and the relative result is as below:

<u>Spe- cimen Number</u>	<u>11a</u>	<u>11b</u>	<u>11c</u>	<u>12a</u>	<u>12b</u>	<u>12c</u>			
Stripping Power (Kg)	3.5	3.1	3.9	4.2	4.4	3.8			
Spe- cimen	<u>13a</u>	<u>13b</u>	<u>13c</u>	<u>14a</u>	<u>14b</u>	<u>14c</u>	<u>15a</u>	<u>15b</u>	<u>15c</u>
Power	4.1	2.9	4.1	4.5	3.4	3.6	3.3	4.5	4.1
Spe- cimen	<u>16a</u>	<u>16b</u>	<u>16c</u>	<u>17a</u>	<u>17b</u>	<u>17c</u>	<u>18a</u>	<u>18b</u>	<u>18c</u>
Power	3.4	3.5	3.2	3.0	3.5	3.4	3.7	2.8	3.3
Spe- cimen	<u>19a</u>	<u>19b</u>	<u>19c</u>	<u>20a</u>	<u>20b</u>	<u>20c</u>			
Power	3.6	3.4	4.0	4.3	3.6	3.8			

On checking the above data, the stripping power for the present invention shows 14.0 kgs at maximum and 12.7 kgs at minimum, and 13.34 kgs at average, while the same power against the prior art shows 4.5 kgs at maximum and 2.8 kgs at minimum, and 3.66 kgs at average, all of which show that the strength of a container joint of this invention is approximately 3.5 times that of the prior art.

The recommendable adhesive is epoxy type, non-solvent, two-part adhesive, and hardening type such as epoxy-amine adhesive, epoxy-polyurethane adhesive and epoxy-polyamide adhesive.

The adhesive used in the above field test is epoxy-polyamide type in the following constitutions:

	<u>MAIN AGENT</u>	<u>HARDENING AGENT</u>
5	EPOXY QUANTITY	165 ~ 185
	AMINE VALUE	-
	VISCOSITY	5000 ~ 7000
		CPS
10	PERCENTAGE	75%
		400 ~ 440
		4000 ~ 5000
		CPS
		25%

Now, with reference to Figures 13 and 14, a modified embodiment of the invention is explained. In this modification, all elements between cylinder 1 and the bottom plate 2 including their constitutions of the joint working and adhesive furnishing are substantially same as explained in Figures 3 to 8. The embodiment has its characteristic in providing extra pressure into the inner side of the container from the outside.

By the extra power of pressure, the semilunar-like collective group of adhesive is now prevailing over the inner wall of the cylinder 1 and also over the dome portion 22 of the bottom plate 2, and finally the semilunar-like group is formed into a convex shape by distribution of its adhesive.

After assembling the bottom plate 2 into the cylinder 1, a pressure difference is established between the inside and the outside, in other words, a high pressure is created in the inside. The applied adhesive is urethane type belonging to the epoxy-amine system. If the pressure increasing step is effected independently, the pressure condition applied can be a few atmospheric pressures for a few seconds. The above condition depends upon the size of the gap between the cylinder 1 and the skirt portion 21 of the bottom plate 2 and also upon the viscosity of the applied adhesive. In a case where the gap is larger and the viscosity is weaker, the pressurising time must be shortened accordingly, while in a case where the gap is smaller and the viscosity is stronger, the time must be increased.

As above mentioned, when the pressure is received in the interior, the semilunar-like collective group of the adhesive is forced to flow forcibly into the gap between the open end 11 and the skirt portion 21, and the gap is filled with the adhesive as the result. When the pressure is removed, the adhesive stays as it is in the gap.

The pressure step is an independent step as above mentioned, but this relative step proceeds simultaneously in correspondence with the curling step.

The flow of the adhesive is now explained with the curling step as follows:

As shown in Figure 13 and Figure 14, during the curling step, the open end 11 of the cylinder 1 is bent to the inside for curling. The method of this curling is exactly the same as in the prior art, and during the curling step the adhesive has still not yet hardened as the bottom plate 2 is pushed into the inside of the cylinder 1. When the curling step is completed, the curling portions are formed around the bottom end of the skirt portion 21 as shown in Figure 14, and thus the said skirt portion 21 is pinched by the curling portions.

During the above steps, as shown in Figure 13, the inside of the cylinder 1 is receiving the fixed pressure, and the adhesive 3 is thus forced to flow into the gap between the cylinder 1 and the skirt portion 21. Under these conditions, the bottom plate 2 is pushed into the inside of the cylinder by the curling step. In compliance with the two factors that the bottom plate 2 is forcibly moved into the inside and that the continuous pressure is maintained, the adhesive 3 is compelled to flow into the said gap even if the pressure time is quite short.

As shown also in Figure 13, there is a pressure supply line from a pressure supply (P.S.), and it is properly controlled in correspondence with the curling step. By this arrangement the fixed pressure in the inside of the cylinder is correctly kept and simultaneously the curling step is progressed, and thus the adhesive 3 forcibly flows into the gap between the cylinder 1 and the bottom plate 2.

In this embodiment, at the same time as the bottom plate 2 is pushed into the cylinder 1, the adhesive 3 is also pushed into the gap between the cylinder 1 and the skirt portion 21, whereas the semilunar-like collective group of the adhesive on the upper part of the skirt portion 21 is gradually broken down to move into the gap.

In this embodiment, the following material is available for the cylinder: steel plate, steel plate furnished with aluminum plating, aluminum sheet, thin cladding steel plate and compound steel plate furnished with plastics coating in its inside. The applicable adhesive: epoxy type, two-part adhesive such as epoxy-amine agent, epoxy-urethane agent and so on, with a quality of strong viscosity.

After the step of putting adhesive on the inner wall of the cylinder 1, the bottom plate 2 is inserted from the open end 11 of the cylinder 1, and at this instant the adhesive 3 forms the semilunar-like group at the upper part of the skirt portion 21. Then the fixed pressure is put into the inside of the cylinder 1, and the semilunar-like group of the adhesive 3 is forced to flow into the said joint section. In other words, the gap is filled with the adhesive. According to the flow of the adhesive 3 as above, the semilunar-like group is gradually broken down into a formation of convex type, contrary to the semilunar-like form. Namely, the adhesive flows over along the inner wall of the cylinder 1 and also over along the inclined surface of the skirt portion 22 into the average thickness, whereas the adhesive supplied areas are easy to transform in accordance with the transformation of the wall or that of the skirt portion 21. The adhesive 3 in those areas stays as it is.

In succession to the aforesaid pressure step, the open end 11 is bent inwardly for curling the skirt portion 21 and finally the said portion is caulked, whereas the bottom plate 2 is fixed in the lower portion of the cylinder 1.

Thereafter, the adhesive 3 is dried and hardened to connect tightly the joint section between the cylinder 1

and the bottom plate 2.

Thus, the adhesive 3 flows forcibly into the gap between the cylinder 1 and the skirt portion 21, and the said gap is filled with the adhesive 3. Accordingly, the adhesive prevailed areas may transform by themselves in correspondence with the transformation of the inner surface of the skirt portion 21 and also with that of the cylinder inner wall, whereas the sealing joint section is neither damaged by an interior pressure change or by an impact load nor the sealing ability is deteriorated.

Moreover, the contacting surface between the inner wall of the cylinder 1 and the skirt portion 21 is larger in comparison with that of the prior art, and therefore the sealing ability is much greater.

During the simple step of adding pressure to cause flow of adhesive, the adhesive itself does not change in quality.

With reference to Figures 15 to 17, another modification of the invention is explained. The previous modification depended upon a pressure adding method, but the present modification is concerned with extra heating.

According to Figure 15, the assembled body of the cylinder 1 and the bottom plate 2 is upright, whereon heating is temporarily employed upon the adhesive joint section. The applied adhesive is urethane type belonging to the epoxy-amine system, and the heating condition is defined at 150°C for a few seconds. When so heated, the semilunar-like group of the adhesive 3 at the upper part of the skirt portion 21 gradually runs down into the gap between the open end 11 and the skirt portion 21 because the viscosity is weakened by the heating procedure, and finally the gap is filled with the adhesive 3. Immediately after the heating procedure is stopped, the adhesive regains its original viscosity.

As a heating procedure, as shown in Figure 15, an infrared heater H is recommended, or else a high-frequency heater is also applicable.

As shown in Figure 16, the open end 11 is bent inwardly in the curling step. The curling step is the same as for the prior art. In the curling step, the bottom plate 2 is pushed inwardly into the inside of the cylinder 1, and at the final stage of the relative curling step the curling portion is formed to surround the bottom end of the skirt portion 21, wherefore the skirt portion 21 is pinched by the relative curling portions.

The applicable adhesive is recommended: two-part adhesive of epoxy type such as epoxy-amine adhesive, epoxy-urethane adhesive with the quality of the strong viscosity.

In this modified embodiment, the heating procedure is expressed as an independent step, but this procedure may be included together with the insertion step of the bottom plate 2. In a case where the above co-procedure is adopted, the semilunar-like collecting group of the adhesive becomes very small.

After the adhesive 3 is furnished, where the bottom plate 2 is inserted from the open end 11 of the cylinder 1 the semilunar-like collective group of the adhesive 3 is formed at the upper part of the skirt portion 21. As the applied adhesive is of strong viscosity, enough volume of the adhesive does not exist in the joint section between the cylinder 1 and the skirt portion 21.

Once the heating is applied to the said joint section to weaken its viscosity, the semilunar-like collective group of the adhesive 3 flows into the gap of the said joint section and the adhesive 3 fills the said gap. The semilunar-like group of the adhesive 3 gradually decreases its group unity to change into the convex style, and the average prevailing areas of the adhesive 3 adjust themselves to transform in correspondence with the transformation of the cylinder inside wall and with that of the skirt portion 21. The adhesive 3 recovers its original viscosity after the heating is stopped, and thus the adhesive 3 remains filling the said joint section.

Then, the bottom plate 2 is tightly fixed at the lower part of the cylinder 1 through the steps of the said curling and caulking.

When the adhesive is dried and hardened, the required condition is obtained.

As explained above, the adhesive 3 stays filling the said gap, whereas the group unity of the semilunar-like collective group of the adhesive 3 gradually decreases to change into the convex style and the average prevailing areas of the adhesive 3 adjust themselves to transform in accordance with the transformation of the cylinder inside wall and with that of the skirt portion 21. It is also understood that the sealing joint section is neither damaged by an internal pressure change or by the impact load nor the sealing ability is deteriorated.

Moreover, the adhesive effecting areas between the inner wall of the cylinder 1 and the skirt portion 21 are larger in comparison with that of the prior art, and therefore the sealing ability is far greater.

This embodiment only requires the simple heater apparatus, which does not affect at all the mass production system both costly and systematically.

Figures 18 and 19 refer to a still further modification of the invention, which can be applied to any of the embodiments already described.

At the skirt portion 21 of the bottom plate 2, a recess or ditch 27 or a plurality of recesses or ditches 27 at fixed intervals therearound is established, so that the adhesive can flow into the curling portion 28 and it is dried and hardened.

It is recommendable to establish three or four ditches in the size of 0.1 ~ 0.2mm deep and 0.1mm wide. The applicable adhesive 3 is two-part and non-solvent epoxy type with 2,500 ~ 4,000cp viscosity.

In order to allow flow of the adhesive 3 into the curling portion 28 through the ditch, a 3-minutes heating operation at 150°C is employed or alternatively pressure at 0.5kg/cm² for half a second is employed.

The adhesive 3 flows into the curling portion 28 through the ditch 27 and also it fills at the same time the gap between the inner wall of the cylinder 1 and the skirt portion 21. Accordingly, it is not necessary to prepare the slope at the upper part of the skirt portion 21 as shown in Figure 4. The gap tolerance between the cylinder 1

and the skirt portion 21 may be fixed at zero, namely no tolerance is necessary.

According to this embodiment, the adhesive effective areas are increased and the airtightness therewith is also strengthened, wherefore the durability against a shock caused by falling and so on is well maintained.

As the curling portion 28 filled with the adhesive becomes a rigid body completely with the integrity like pure metal, a metal container with quite a good seal is obtained.

For this embodiment, where the steel plate is adopted for the cylinder 1, the cut edge is completely covered with the adhesive 3, which prevents the relative edge from becoming rusty, and, further, as the curling portion 28 is filled with adhesive 3 it rejects any incoming of water, and this waterproof situation benefits the step of shrink packaging. The shrink film is likely to deform itself by absorbing the aqueous vapour caused by remaining water therewith. In general, the aerosol container receives the hot water test for leakage after refilling, and during this test it is quite often that the air existing in the gap of the said curling portion 28 comes out to be mistaken as a leakage. This embodiment definitely avoids such a mistake in the relative testing procedure.

Claims

1. A metal container comprising:

a cylinder means (1) adapted to be the main body of a container;

a bottom plate means (2) having a dome-like top disc (22) and a cylindrical skirt portion (21) with its outer wall parallel or nearly in parallel corresponding with the said cylinder means;

a joint means to connect the said bottom plate means with the said cylinder means; characterised by a curling portion formed in the bottom of the said cylinder means so as to adhere the said skirt portion of the bottom plate means inwardly to the container tightly, and the said joint means consisting of adhesive (3) of rather hardening type which is prevailing along both the inner wall of the said cylinder means and the surface of the skirt portion, and the said adhesive looks like a convex style therewith.

2. A metal container according to claim 1 wherein at least one ditch or recess (27) is formed at the skirt portion (21), and the said joint means is effective up to the curling portion through the said ditch or recess.

3. A metal container according to claim 1 or claim 2, wherein the said joint means employs adhesive (3) with the nature of non-solvent, two-part epoxy type.

4. A metal container according to claim 3, wherein the said joint means employs adhesive (3) with the nature of epoxy-amine type.

5. A metal container according to claim 3, wherein the said joint means employs adhesive (3) with the nature of epoxy-polyamide type.

6. A metal container according to claim 3, wherein the said joint means employs adhesive (3) with the nature of epoxy-urethane type.

7. A metal container according to claim 1, wherein a skirt portion (21) of the bottom plate means (2) has a tapering surface, whereby a gap is formed so that the joint means is effective between the inner wall of the said cylinder means (1) and the skirt portion (21).

8. A metal container comprising:

a cylinder means (1) adapted to be a main body of a container;

a bottom plate means (2) having a dome-like top disc (22) and a skirt portion (21) corresponding with the said cylinder means;

a tapering surface formed on the upper part of the said skirt portion and making a gap between the inner wall of the said cylinder means and the skirt portion wherein the said joint means is effected;

a curling portion formed in the bottom of the said cylinder means so as to adhere the said skirt portion of the bottom plate means inwardly to the container tightly, and the said joint means consisting of adhesive (3) of rather hardening type which is prevailing along both the inner wall of the said cylinder means and the surface of the skirt portion, and the said adhesive looks like a convex style therewith.

9. A metal container according to claim 8, wherein at least one ditch or recess (27) is formed at the skirt portion (21), and the said joint means is effective up to the curling portion through the said ditch or recess.

10. A metal container according to claim 8 or claim 9, wherein the said joint means employs adhesive (3) with the nature of non-solvent, two-part epoxy type.

11. A metal container according to claim 10, wherein the said joint means employs adhesive (3) with the nature of epoxy-amine type.

12. A metal container according to claim 10, wherein the said joint means employs adhesive (3) with the nature of epoxy-polyamide type.

13. A metal container according to claim 10, wherein the said joint means employs adhesive (3) with the nature of epoxy-urethane type.

14. A method of manufacturing a metal container comprising:
a step to apply joint means (3) circumferentially of an inner wall in the vicinity of an open end (11) of cylinder means (1) forming a main body of the container;
a step to fit or insert a bottom plate means (2) having a dome-like top disc (22) and a skirt portion (21) with its outer wall parallel or nearly in parallel corresponding with the inner wall of the cylinder means (1) into the cylinder means from the said open end; characterised by, 5
a step to caulk the skirt portion (21) of the bottom plate means (2) by curling the said open end towards the inside after the bottom plate means is inserted into the cylinder means, and
a step to transfer the joint means along on the inner wall of the cylinder means and on the surface of the bottom plate means and to make the said joint means look like a convex style during the said caulking step and/or the other succeeding step. 10
15. A method according to claim 14, comprising a step to set the assembled body of the cylinder means (1) and the bottom plate means (2) upside down and to maintain this situation for some interval, by which the joint means flows along the inner wall of the cylinder means and on the surface of the bottom means and assume a convex shape. 15
16. A method according to claim 14, comprising a step to employ extra pressure on the joint means before its hardening procedure, by which the joint means flows along on the inner wall of the cylinder means (1) and on the surface of the bottom plate means (2) and assumes a convex style.
17. A method according to claim 14, comprising a step to employ heat on the joint means for flexible status, by which the joint means flows along on the inner wall of the cylinder means (1) and on the surface of the bottom plate means (2) and assumes a convex style. 20
18. A method according to any one of claims 14 to 17, comprising a step to form at least one ditch or recess (27) on the skirt portion (21) of the bottom plate means (2), whereby the joint means fills the curling portion through the said ditch or recess.
19. A method according to any one of claims 14 to 18, comprising a step to form tapering on the upper part of the skirt portion (21) of the bottom plate means (2), whereby the joint means is adapted to run into a gap produced by the said tapering between the inner wall of the cylinder means (1) and the skirt portion (21). 25
20. A method according to any one of claims 14 to 19, comprising employing as the joint means adhesive (3) with the nature of non-solvent, two-part, epoxy type. 30
21. A method according to any one of claims 14 to 19 comprising employing as the joint means adhesive (3) with the nature of epoxy-amine type.
22. A method according to any one of claims 14 and 19 comprising employing as the joint means adhesive (3) with the nature of epoxy-polyamide type.
23. A method according to any one of claims 14 to 19 comprising employing as the joint means adhesive (3) with the nature of epoxy-urethane type. 35

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FIG. 1

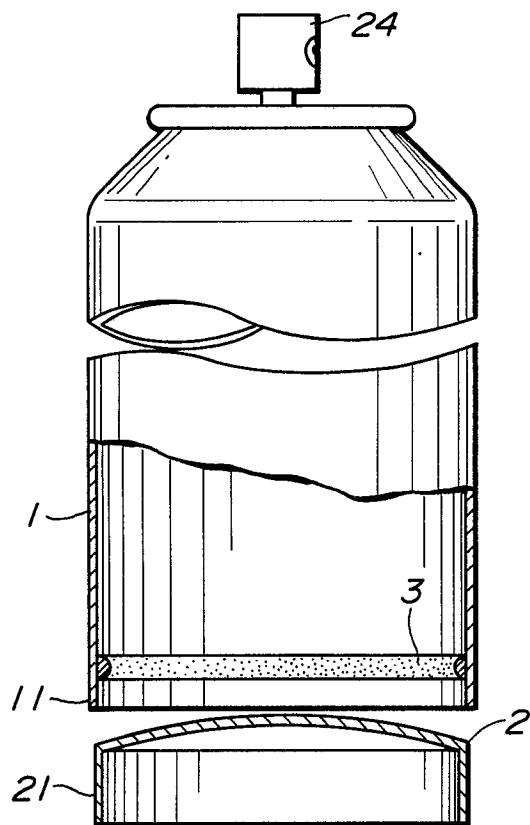


FIG. 2

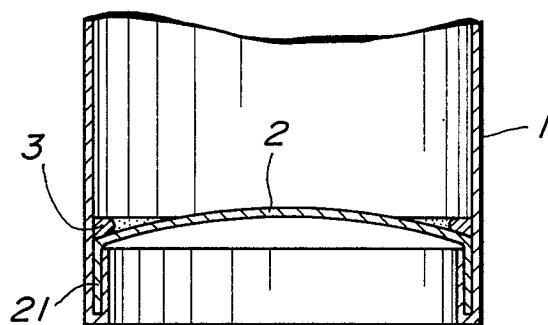


FIG. 3

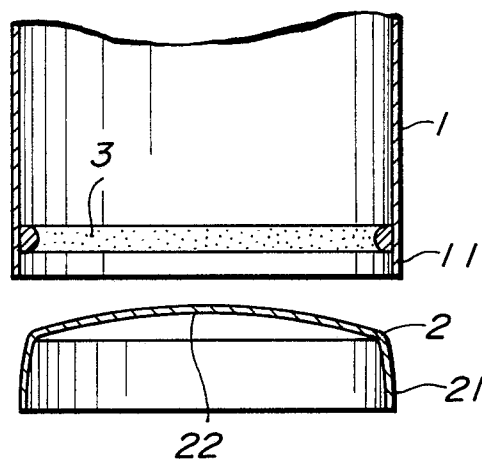


FIG. 4

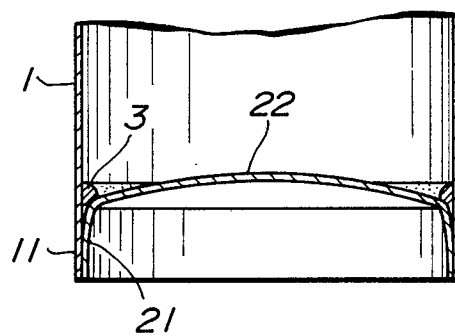


FIG.5

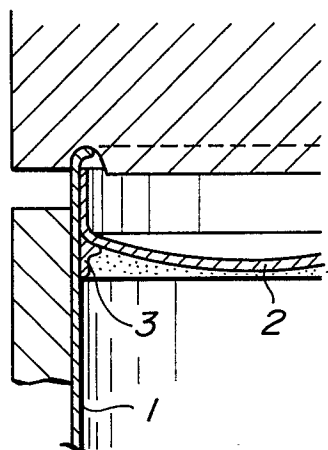


FIG.6

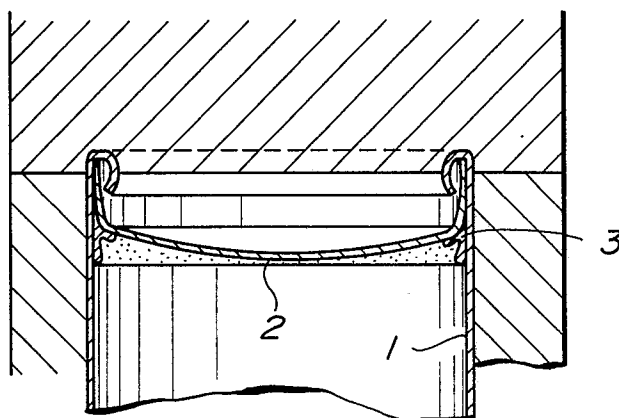


FIG.7

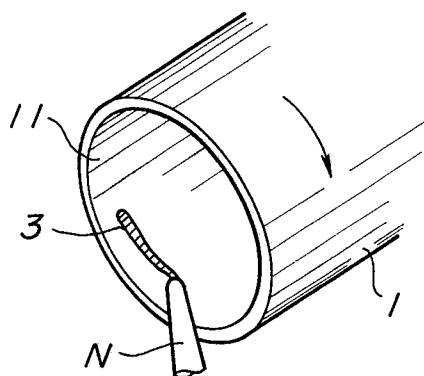


FIG.8

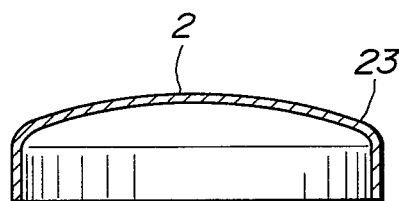


FIG.9

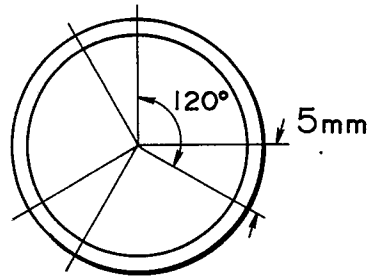


FIG.10

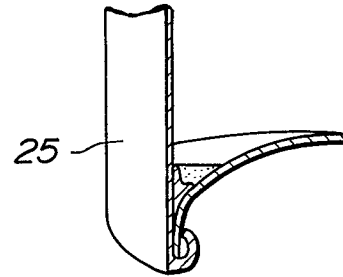


FIG.11

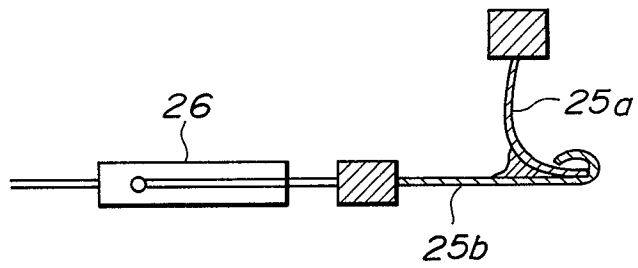


FIG.12

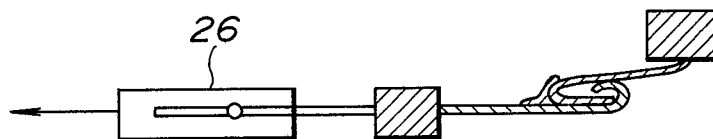


FIG. 13

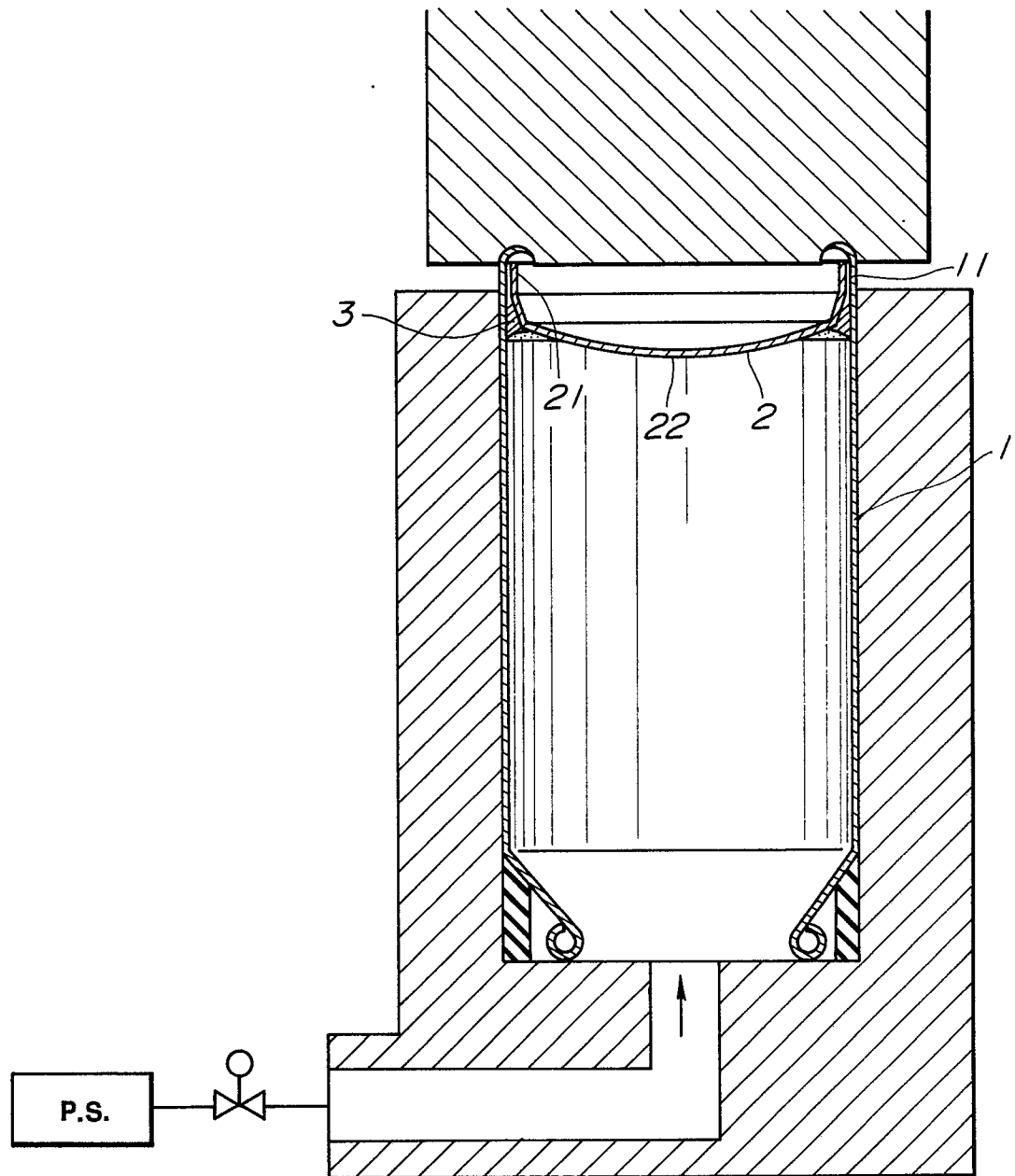


FIG.14

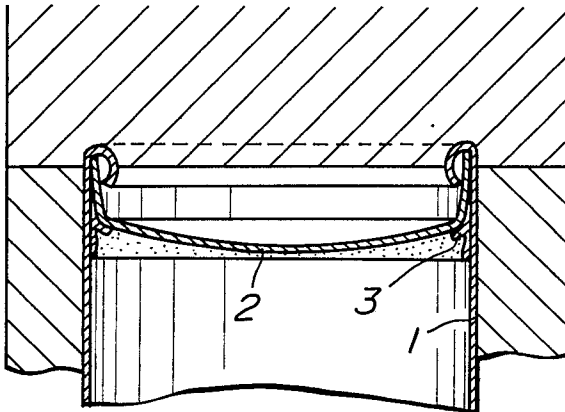


FIG.15

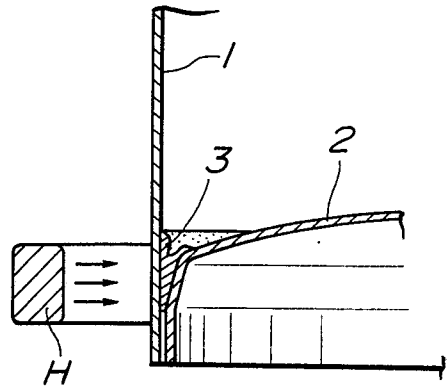


FIG.16

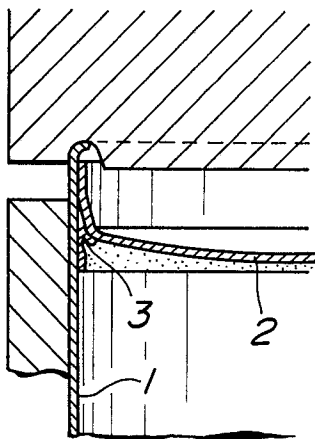


FIG.17

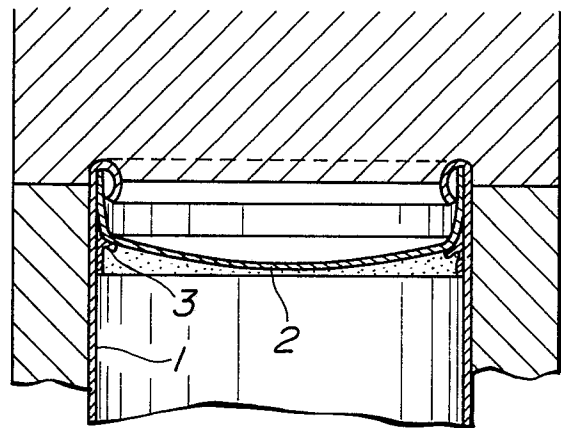


FIG.18

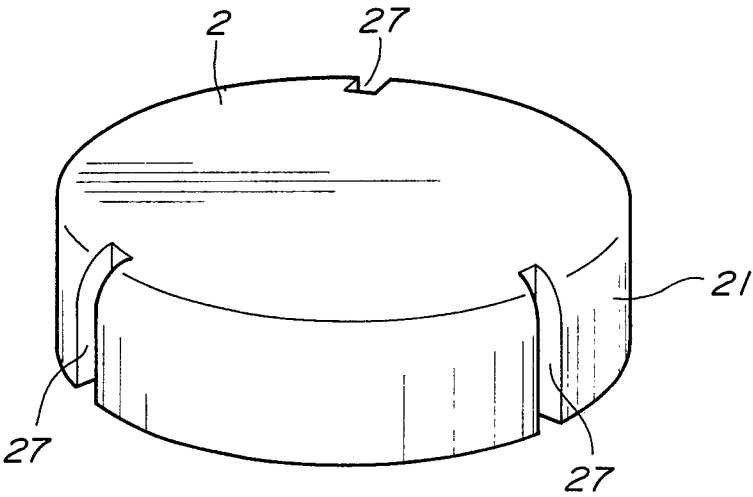


FIG.19

