Jan. 25, 1966 W. H. McKIEVER 3,231,152

PRESSURE CONTAINER

Filed Oct. 8, 1963

Fig. 1

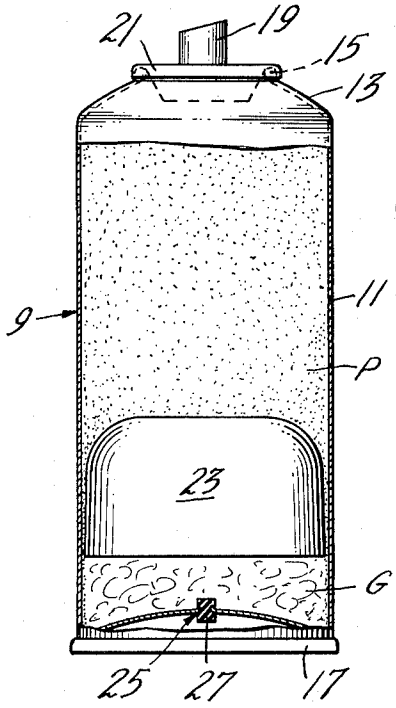


Fig. 3

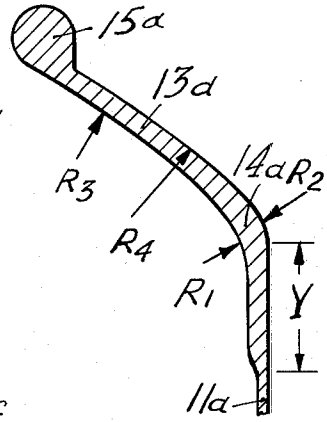


Fig. 2

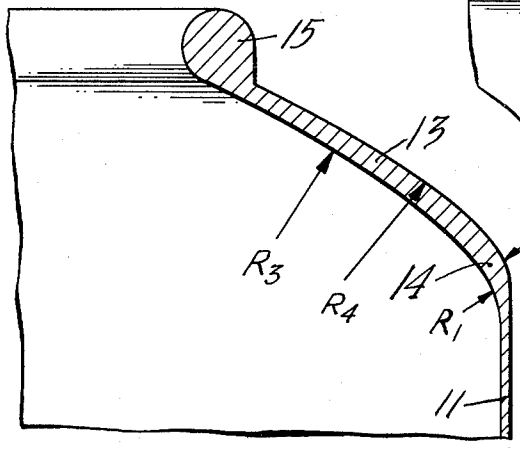
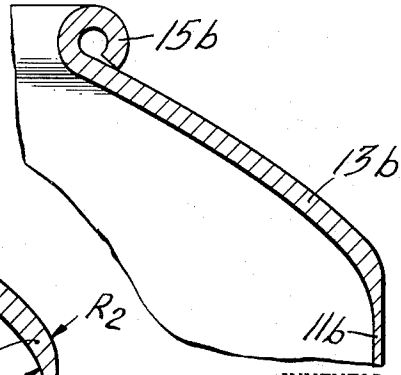


Fig. 4



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PRESSURE CONTAINER

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7 Claims. (Cl. 222—394)

This invention relates to pressure containers, and especially to substantially rigid containers designed to dispense a viscous fluent product or paste therefrom under the influence of gas pressure charged into the container at the time of filling. This is a continuation-in-part of my application Serial No. 85,690 filed January 30, 1961, now abandoned.

In preparing containers of this sort it was originally contemplated that a sheet metal can body would be used in the container; i.e. a can body roll formed from flat stock the opposite edges of which are interlocked in a side seam. Into this was charged a fluent or paste product and an inert gas as a propellant. In the form with which the present invention is concerned, the product and propellant gas are separated by a piston which is placed in the container between the product and the propellant gas, and the container is closed by seaming a sheet metal end thereto. Such an arrangement is disclosed in detail in United States Patent No. 3,022,923, issued February 27, 1962 to Henry T. Hoffman.

While the arrangement using a sheet metal can has proved effective for many applications, the presence of the customary side seam has been found to be a potential drawback in cases where the product is of moderate to low viscosity. In a few instances charged cans which have been stored on their sides have been found to permit leakage of the propellant gas past the piston via the side seam irregularity and into the product chamber where it would be dissipated at the first opening of the valve and thus render the structure useless for its intended purpose. Also in some cases the side seam has been known to give rise to a slight local longitudinal bow in the can wall. When present, this could now and then cause uncertainty in the operation of the piston as it moves gradually from one end of the can to the other under the urging of the propellant gas when product is expelled.

Suggestions have been made for overcoming these potential drawbacks by using can bodies which are made by a drawing operation from a metal blank so as to avoid the presence of a side seam. This, however, proved to have disadvantages perhaps more pronounced than those of the conventional side seam can, for the drawing process requires that the can body have a small draft angle. Consequently the can side wall actually has a slight but measurable taper from bottom to top. With an upwardly moving piston this is a serious drawback for the piston must either be excessively loose at the outset, or it will become progressively tighter and more resistant at the same time that the gas pressure is diminishing, with the result that likelihood of the piston's sticking midway of the container is increased.

An object of the present invention, therefore, is to provide an improved pressure can and piston combination giving freedom from the possibility of escape of gas pressure past the piston, and piston operation of improved reliability and decreased tendency for sticking.

Another object of the invention is the provision of a pressure container of improved strength, appearance, and mechanical operation without seriously affecting the overall cost.

Still another object of this invention is the provision of a seamless metal can body of improved construction capable of withstanding high internal pressure without

distortion or failure and also resistant to damage frequently encountered in handling during the fabrication operations.

To the accomplishment of these objects, I have discovered that a seamless can body formed of an impact extrudable material, such as lead or aluminum, with an accurately cylindrical side wall which is integrally joined with a thickened breast portion in a shoulder of special reinforced configuration, provides very beneficial effects and improved performance in pressure containers. By the expression "accurately cylindrical side wall" is meant a body wall having the characteristics of forming by impact extrusion, or substantially free of longitudinal taper.

Other objects, features and advantages will appear hereinafter as the description proceeds.

In the drawings:

FIG. 1 is an elevation, partly in longitudinal section, showing a completely assembled container according to the present invention;

FIG. 2 is a detail section to an enlarged scale showing the upper end and neck of a can body used in making the combination of the invention;

FIG. 3 is a view similar to FIG. 2 illustrating a modified embodiment of the invention;

FIG. 4 is a view similar to FIG. 2 but illustrating an alternate type of can body usable in carrying out the present invention.

Referring to the drawing, FIG. 1 shows a pressure dispensing container according to the present invention comprising a metal can **9** made up of a seamless body **11** having at one end an integrally formed breast **13** terminating in an annular neck bead **15**, and a sheet metal closure disk **17** seamed to the other end of the body **11** to close the same. The neck of the container is closed and sealed in any convenient manner. Customarily the neck holds a dispensing valve **19** which is carried by a mounting cup **21** suitably crimped in sealing relation to the bead **15**.

The assembly further includes a piston **23** which is slidable in the body **11** and is preferably of an impervious synthetic thermoplastic, e.g. polyethylene, molded in the shape of a downwardly opening cup. An example of such a piston is described in the above mentioned Hoffman patent. This piston provides a free moving barrier between a product P placed in the upper portion of the container and a propellant gas G placed below the piston.

The closure disk **17** has a small opening **25** for charging the container with pressurized propellant gas, and a resilient plug **27** is provided for closing the opening **25** when gas charging is complete.

The assembly and filling of the container is normally accomplished by first inserting the piston **23** into the can and then seaming the end member **17** into place on the open end of body **11**. Product P is then introduced through the neck of the can, whereupon mounting cup **21** together with its valve **19** is placed on the neck of the can and crimped about the bead **15**. Finally propellant gas under pressure is introduced beneath the piston **23** through opening **25**, and when the pressure reaches the proper value, a plug **27** is driven into opening **25** to seal the same. The container is then in condition for use. Opening the dispensing valve **19** allows the desired amount of product P to be expelled therethrough by the propellant gas G acting upwardly against the piston **23**.

According to the present invention I have succeeded in securing improved piston operation and improved pressure resisting construction by producing a can **9** having an accurately cylindrical seamless body **11**, with a smoothly domed breast **13** of thickened wall at one end thereof. The domed breast, in the preferred form as il-

lustrated, may be described as arcuate in cross section and is formed integrally with the side wall of the body at a shoulder 14 defined by inner and outer radii R_1 and R_2, respectively, providing a smoothly merging, unabrupt juncture.

These radii R_1 and R_2 have special significance in my present invention. It is pointed out that the inside radius R_1 is greater than the outside radius R_2. This permits the gradual integration from the heavier thickness of the breast 13 to the thiner wall of body 11; e.g. from a thickness of about .035" in the breast adjacent the shoulder down to a thickness of about .013" in the body wall below the shoulder. This provides for maximum thickness in the region of shoulder 14 and avoids the condition of a sharp or abrupt corner which has found to be extremely vulnerable to local failure. The result is improved strength in the shoulder region to withstand the combined affect of distortion and creep which often produces noticeable bulging and/or bursting under high pressure loading. Another advantage in having R_1 greater than R_2 is to permit better metal flow over the forming punch during impact extrusion. Otherwise, a restriction would result with consequent difficulty in obtaining proper metal flow and structural formation.

In addition to the improved configuration of shoulder 14, breast 13 is specially configurated for improved structural strength so that the breast, while thicker than the body wall, need not be excessively heavy to sustain the pressures contemplated within the container. As mentioned above, the breast is arcuate or concavo-convex in cross-section, giving it a dome shape for increased strength as well as camouflaging any minor outward distortion which is always possible in a pressure container. In addition, the breast wall is constructed thinner close to the neck bead 15 than at shoulder 14. I accomplish this by designing the forming tools to shape the breast with inner and outer surfaces which converge slightly from a maximum thickness at the shoulder to a minimum at the neck. The curvature of the inner and outer breast surfaces, respectively, is represented by the radii R_3 and R_4, illustrating how the breast is dimensionally constructed to achieve this effect. The result is that the thickness of breast 13 gradually progressively increases from the region of neck 15 out to the region of shoulder 14. The thinner region of the breast takes strength from the annular neck bead 15 whereas the major proportion of metal in the breast section is distributed outwardly from the neck toward the shoulder region where it is most needed.

The combined effect of the special breast and shoulder configuration as just described is greatly improved container strength without appreciable increase in material, thus providing a relatively inexpensive structure capable of containing pressures normally requiring containers of more costly construction and materials. At present the preferred construction involves forming the can body 11 by impact extrusion in a known manner from inexpensive metals which are readily handleable in this fashion. Examples of suitable materials are lead, aluminum and aluminum alloys. Of course tin and other materials are also suitable mechanically but would normally be barred from use by price considerations.

Subsequent to the impact extrusion operation, the body is trimmed in the customary manner to provide the requisite height and a smooth bottom edge for seaming.

FIG. 3 illustrates an alternate embodiment of my invention, identical in all respects to the configuration just described except for the addition of a heavy wall section which extends for a short distance Y below shoulder 14*a* along the wall of body 11*a*. This short section of body wall is, in effect, a continuation of shoulder 14*a* but not as great in thickness as the shoulder or breast 13*a*. For example, in one instance where the body wall was .013" thick, the short extension of shoulder 14*a* was formed to an .029" thickness, or slightly more than twice the body wall thickness and the dimenion Y was approximately .187". Besides the additional reinforcement to the shoulder, a principal advantage of this configuration is in the ability of the extended shoulder to withstand denting from the heavy shoulders of adjacent can bodies traveling through the runways of an assembly line. This feature, while adding somewhat to the fabrication of the can body, would have definite value where the speed and manner of handling during the manufacturing operation requires close order flow or bunching and/or inherently subjects the bodies to vibrations causing frequent contact.

It is contemplated that the disclosed can bodies having the configuration and features mentioned above can also be made of steel, in which case the operation would involve deep drawing a sheet of steel into a cup shape and then traveling the cup directly through a series of annular reducing dies which gradually thin and elongate the side wall while also reshaping it to a truly cylindrical form and ultimately eradicating the initial side wall taper resulting from the drawing step. A can body made according to this process is shown at 11*b* in FIG. 4. Such a can body is substantially identical in all respects with the bodies 11 or 11*a* previously described, except that bead 15*b* thereof is made by a subsequent forming or curling operation rather than being constructed in the primary can making operation as was the case with bead 15 or 15*a*. In assembly and use, the bodies 11, 11*a* and 11*b* perform identically in all respects.

For the purpose of defining the degree of cylindrical accuracy and freedom from unevenness and obstruction, the container of the present invention, regardless of the process used in its manufacture, may for convenience, be defined as having a body wall whose physical attributes are characteristic of those normally achieved by a process of impact extrusion.

From the foregoing it can be seen that I have provided an improved pressure dispensing container of the piston type capable of manufacture at prices compatible with commercial, large-volume merchandising programs and throw-away use, but which have a distinctly improved piston function in addition to a simplified, pressure-resistant design.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description and it will be apparent that various changes may be made in the form, construction, and arrangement of the parts and that changes may be made in the steps of the method described and their order of accomplishment without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In a pressure container comprising a substantially rigid tubular metal body including a side wall and a breast and said breast being adapted to receive a dispensing valve, the improvement which comprises:

said side wall and said breast being integrally joined in a smoothly merging shoulder;

said side wall being seamless;

said breast being thicker than said side wall and being concavo-convex in cross-section and extending upwardly and inwardly from said side wall in diminishing thickness from a maximum at said shoulder;

said shoulder being defined by inner and outer surfaces smoothly merging with the respective surfaces of said side wall and said breast;

and said inner shoulder surface having a radius greater than that of said outer shoulder surface.

2. The improvement of claim 1 wherein said side wall has an accurately cylindrical shape characteristic of impact extrusions.

3. The improvement of claim 1 wherein said breast terminates in an annular upstanding neck for mounting said valve.

4. The improvement of claim 1 wherein the inner and outer surfaces of said breast converge from a maximum thickness in the region of said shoulder to a minimum at said neck.

5. The improvement of claim 1 wherein said shoulder extends downwardly from said breast into a short cylindrical section the outer surface of which coincides with that of said side wall.

6. The improvement of claim 5 wherein said short shoulder section is of greater thickness than said side wall but less than said breast.

7. A seamless metal body for a pressure container, comprising an accurately cylindrical side wall and a thickened, inwardly and upwardly extending breast integrally joined to said side wall in a smoothly merging shoulder, said shoulder being defined by inner and outer curved surfaces smoothly merging with the inner and outer surfaces of

said breast and including a short cylindrical section merging with said side wall, said section being thicker than said side wall and having its outer surface coincide with that of said side wall.

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