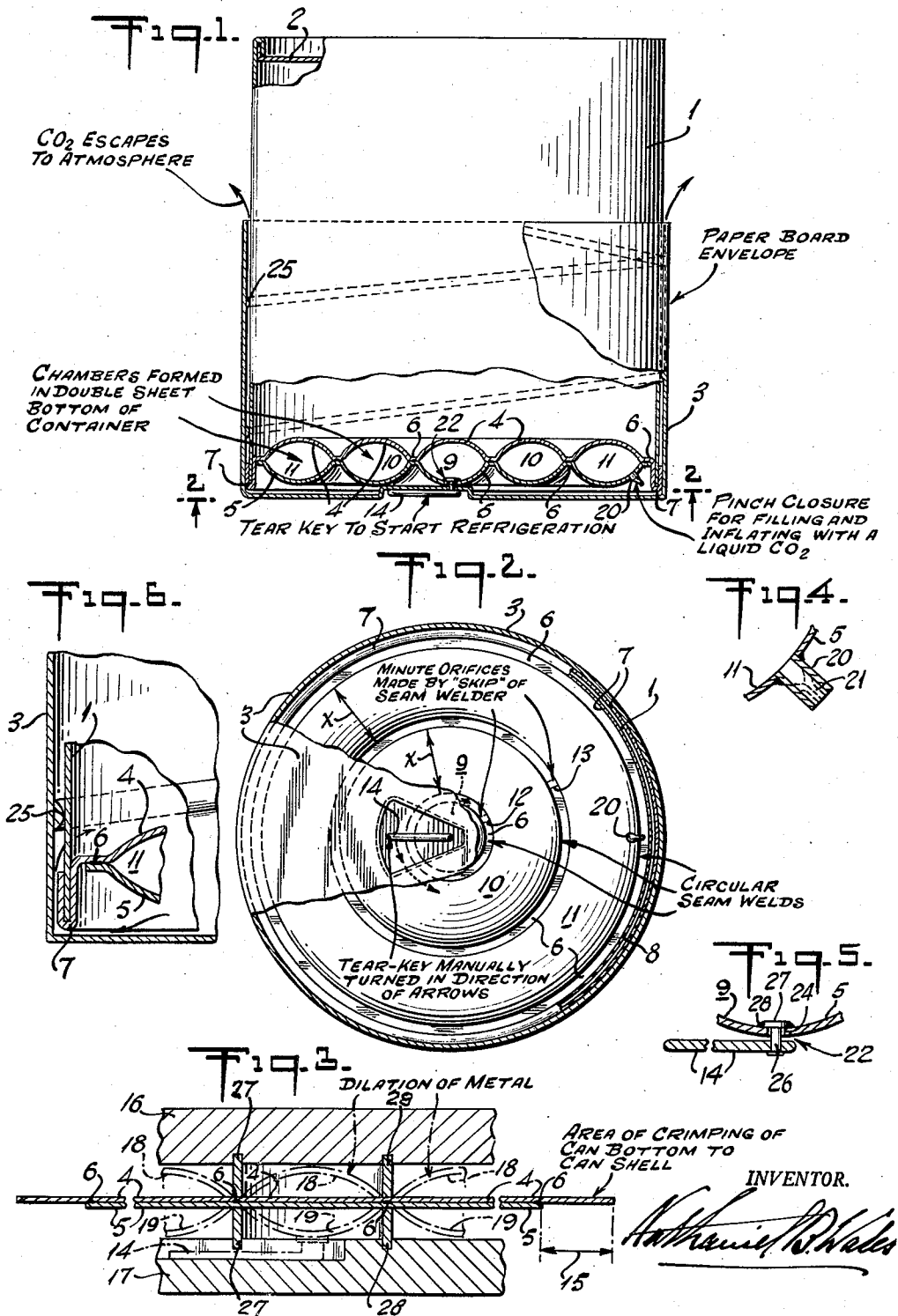


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Filed Jan. 7, 1958



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SELF-REFRIGERATING CONTAINER

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Application January 7, 1958, Serial No. 707,558

4 Claims. (Cl. 62—294)

This invention relates to a self-refrigerating container or can of the conventional disposable type, which has a storage or shelf-life of conventional canned goods extent and which chills its contents as and when desired by a tear-opened closure. More particularly the invention teaches the concept of such a can which is of a strictly conventional structure except the base or bottom end thereof which is composed of two flat circular steel sheets superimposed one on the other and then bonded together by concentric seam welds, all of which circular welds except the outermost one are interrupted at at least one point in their circular continuity to form an unwelded gap or space therein. This bottom element so welded when fitted with an entrant orifice through the lower steel sheet and an exhaust tear-type-opened closure also emplaced through the same sheet, becomes a hermetical multi-chambered can bottom when a refrigerant, such as liquid carbonic gas (CO_2) is permitted to enter the above mentioned entrant orifice while the sheets are held in a suitable jig or fixture and not only inflated by deforming the steel sheets between their respective concentric welds by the pressure of the CO_2 in its liquid state of substantially 1000 p.s.i., but also to test the element for leakage and fill the interconnecting chambers as connected by the interruption of the specified circular welds all in one operation. This multi-chambered element now charged with liquid CO_2 and then lacquered on its upper surface, which is to form the bottom surface of the can, has its entrant closure, which is formed by a tubular section of soft steel closed by squeezing its tubular section and is then conventionally crimped into the already formed can body.

The rigid requirements of low production cost of such a disposable container necessitates a rapid production sequence of operation, viz., chamber forming, filling and testing of the pressure containing structure and must be made of a light-weight steel of conventional can sheet specifications.

The objects of the invention are:

(a) A disposable container capable of chilling its contents at any time when desired, of low cost production and having the simplest and positive means to initiate its chilling action.

(b) A disposable container having an intercommunicating multi-chambered base filled with a liquid refrigerant and means to manually release the refrigerant to substantially atmospheric pressure in order to chill the contents of the container by the change of state of the liquid refrigerant in a minimum of time.

(c) A multi-chambered base, fitted to a conventional container body, filled with a refrigerant in its liquid state, such as CO_2 wherein due to predetermined orifice sizes communicating between the plurality of chambers a pressure drop occurs from one chamber to another on opening a manually operated closure to atmosphere such that "Dry Ice" is formed to a considerable extent in one or more of the interconnected chambers.

2

(d) Other objects are implicit in the accompanying specifications and drawings.

Referring to the drawings:

Figure 1 is an elevation partially in cut away section of the invention, to clearly show the multi-chambered base of the container.

Figure 2 is a section taken along lines 2—2 in Figure 1.

Figure 3 is a fragment in sectional elevation of the two sheets, one above the other after having been seam welded together in concentric circular welds and placed in a suitable fixture to be formed into a chambered member by inflation under the pressure of liquid CO_2 and coincidentally filled therewith and tested for leakage in one operation.

Figure 4 is a fragmentary, enlarged sectional view showing the filling orifice in open connection with chamber 11, with the side walls of the orifice, shown in dotted lines, deformed in a closed position by a hydraulic pressure forming tool.

Figure 5 is a fragmentary sectional view through the wall of the chamber 9 showing the tear-type opening key to release the liquid carbon dioxide from chamber 9.

Figure 6 is an enlarged sectional fragment of the completed container.

Numeral 1 represents the conventional body of a can with a conventional crimped-in cover member 2. Referring to Figure 3, a special fixture composed of an upper retractable frame 16 and a lower frame 17 to which are respectively secured circular ring supports 27 and 28 which when the fixture is closed, as is seen in Figure 3, engage and press against the circular concentric seam weldings 6 as is indicated in Figure 2. This fixture is desirable in production of the chambered base to prevent its warping and unwanted distortion when inflated and the chambers 9, 10 and 11 are pneumatically formed. In this manner after upper sheet 4 and lower sheet 5 having been welded together by seam weldings 6 and having filling orifice 20, see Figures 1 and 2, welded into lower sheet 5 and outlet tear-type closure 22 fitted and secured into the lower sheet 5 at the axis point of the concentric weldings 6 communicating with chamber 9, a source of liquid, CO_2 , carbon dioxide or other gas of similar physical characteristics is connected to filling orifice 20.

The pressure of liquid CO_2 at normal ambient temperatures is substantially 950 lbs. per square inch. Under this pressure and the distance x , seen in Fig. 2, having been taken into consideration, as well as the thickness of steel sheets 4 and 5 and their tensile strengths, this pressure of the liquid carbon dioxide deforms the area of sheets 4 and 5 as defined by the spaces between the respective circular welds 6 into a contour as is indicated in broken lines in Fig. 3 by numerals 18 and 19. It should be stated that connecting orifices 12 and 13 had been formed in the two inner concentric weldings 6 by an electronically controlled welding machine, as is now available to the trade. This welding machine can form a very precise interruption in the continuity in its welding operation so as to produce an accurate predetermined size of orifice as is graphically illustrated at 12 and 13 in Fig. 2.

This point is important, in that in the multi-chambered base unit, consisting of chambers 9, 10 and 11, the volume of 11 is far greater than the volume of chamber 10, and in turn, the volume of chamber 10 is far greater than chamber 9. The area of orifice 12 is preferably made slightly larger than the area of orifice 13 in order to attain on the manual opening of closure 22 a pressure differential between the respective chambers 9, 10 and 11, which will tend to produce "Dry-Ice" therein. Therefore, if chamber 11, the largest, has a pressure during the chilling phase of substantially 900 p.s.i. and the orifice

3

13 leading to chamber 10 results in a pressure therein of 5 atmospheres, this pressure ratio will produce "Dry-Ice" in chamber 10. The formation of "Dry-Ice" in these chambers is desirable due to its low temperature of minus 110 deg. F. and the consequent chilling effects to the contents of container 1 during its sublimation, which sublimation will extend over a longer period of time than the mere release of the liquid CO₂ with its subsequent change of state into a gas on being released from the chambered base for the necessary effective heat exchange of the cold gas to chill the contents of the container 1.

Moreover to prolong this important heat interchange to the contents of container 1 of that percentage of the gas that is not converted into Dry-Ice I employ a paper board jacket 3 or one made of equivalent insulative material to force the escaping gas from the opened orifice 24 to follow the exterior surface of container 1 before escaping to atmosphere. The interior of jacket 3 has spiral partitions or projections 25 which contact container 1 and effect a long spiral flow path for the cold gas before its escape from the top edge of jacket 3.

It will be noted that the circular sheet steel element 4 is of larger diameter than its companion lower sheet 5 as is shown in Figure 3 by the numeral 15, this area of a single thickness is crimped into the shell of container 1 to conventionally secure it into the container. I have found that by correctly proportioning the distance x, see Fig. 2, between the concentric welds 6 that I can use close to the conventional thickness of sheet stock in standard cans now manufactured and yet have an ample factor of safety to hermetically sustain the pressure of CO₂ in liquid state in the plurality of chambers in the container bottom composed of elements 4 and 5.

The manually open tear-type valve as is seen in Fig. 5 is composed of a lever handle 14 secured to a spindle 26 which passes up through orifice 24 and which has a head 27 which prevents its downward displacement through orifice 24. A soldered fillet 28 is formed around the edges of head 27 and the inner surface of sheet 5 to give a hermetic seal.

In brief, the chilling sequence of operation of the invention is as follows:

Based on the hermetical condition of manufacture of the inflation formed chambers in the container's base and the sealing of filling entry 20 and the tear-type key actuated gas release valve 22 and sealing orifice 24, the self-refrigerated container is always ready for supplying its contents in a chilled state by manually turning key or lever 14 which opens orifice 24 in chamber 9, the smaller one of the chambers and the last to be filled in a sequence flow from filling valve 20. It has been found in this art to be advisable, however, to only fill a chamber containing liquid CO₂ to an extent of 75% of its volume. Hence due to the direction of flow during filling, viz., through orifice 20, mostly air will be trapped in the relatively small chamber 9, forced in from chambers 10 and 11.

Therefore, a proper pressure gradient between chambers 9, 10 and 11 is quickly attained especially so between chambers 10 and 11 to produce Dry-Ice to a considerable extent.

To illustrate the chilling action by only utilizing the latent heat of a change of state of the liquid carbon dioxide which has a latent heat by its change of state of 125 B.t.u.'s per lb. at 70 deg. F. It would require 2¼ ounces of CO₂ liquid to produce a chilling effect of 20 B.t.u.'s which is sufficient to adequately chill 12 ounces of beer or soft drinks. However, the possibility of forming to some degree Dry-Ice in one of the plurality of chambers is desirable to prolong the chilling

4

effect and give time for a better interchange of a chilling effect into the container's contents.

It is evident, that the design and use of a series of seam weldings to subdivide the pressure sustaining areas on steel sheets 4 and 5 is desirable in order to use with a factor of safety light weight and relatively thin sheets but the employment of a plurality of liquid CO₂ sustaining chambers with predetermined orifices between, also produces the further advantages as has been above stated.

Due to the paper board jacket 3, as the cold gas leaves the manually opened orifice 24 the gas flow passes between the interior of the jacket 3 and the contour of the container 1. The jacket also is an insulant to protect the hand while holding the container.

It is evident that instead of deforming the sheets 4 and 5 they can be conventionally stamped and then the two sheets seam welded together in the manner above described; however, there are certain production advantages of pneumatically forming, filling and testing in one fixture. This procedure has been reduced to practice.

What I desire to protect by United States Letters Patent is encompassed in the following claims:

1. A self-refrigerating container of substantially conventional structure except for its bottom portion comprising a container shell, a bottom portion associated therewith, said bottom portion having a plurality of intercommunicating hermetically sealed chambers formed therein, means affording intercommunication between said chambers, said chambers containing liquid carbon dioxide (CO₂) at a pressure of at least 900 p.s.i., a manually operable outlet means affording access from said chambers to the atmosphere when opened, said intercommunicating means between said chambers being formed with their effective areas such that a pressure drop will occur between respective chambers at some point in their series of a sufficient degree to produce solid carbon dioxide (Dry Ice) in at least one of said chambers when said manually operable outlet means is opened, thereby effecting a prolonged refrigerating effect on the contents of the container.

2. The subject matter of claim 1 wherein said chambers are concentrically arranged in said bottom and the manually operable outlet means is located exteriorly of the bottom and opens into the centermost chamber.

3. The subject matter of claim 1 wherein an insulating jacket houses the bottom and side walls of the container to protect the hands of the user thereof and to bring the escaping cold gas into close thermal contact with the side wall of the container.

4. The subject matter of claim 1 wherein three chambers are employed, one chamber being centrally located in the bottom and the other two chambers being concentrically arranged with respect thereto, with the communicating means between the outermost chamber and the intermediate chamber and between the intermediate chamber and the innermost chamber being so formed in their effective areas that solid carbon dioxide (Dry Ice) will form in at least the intermediate chamber on opening of the outlet means.

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