CONTAINER WITH EASY-OPEN END

Alfred Edward Bolocca, Wheaton, and Richard Leo Joosten, Carteret, New Jersey, assignors to American Can Company, New York, N.Y., a corporation of New Jersey
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The present invention relates to a hermetically sealed container or can having an easy-open end which is manually openable without the use of tools, and more particularly it relates to an end closure especially adaptable for use on containers having pressurized products therein and which can be easily and quickly manually opened by a consumer, and still more particularly it relates to an easy-open end closure having a manually removable portion which can be safely removed by a consumer without any danger of cutting his fingers, either during or after the removal operation.

The present trend in packaging is directed toward "convenience packaging," and in the container field, such convenience packaging takes the form of containers wherein the end closure or a portion thereof can be manually removed by a consumer without resorting to the use of can openers, knives, or other tools. Particular emphasis has been directed toward a solution to the problem of providing an "easy-open" end for metal cans, which serve as the most usual form of comestible containers. In this area, the prior art is replete with attempted solutions.

One approach to the problem of providing an easy-open end closure for a metal can has been to provide a scored portion or score lines in the end closure to set off a portion which can be manually removed. This approach was followed in the early U.S. Patent No. 496,209 issued to Reiset et al., in other patents such as U.S. Patent No. 1,955,431 issued to Lymburner and U.S. Patent No. 2,011,778 issued to Sebell, and even such recent patents as U.S. Patent No. 2,978,140 issued to Walsh and U.S. Patent No. 3,067,910 issued to Amadsen.

The main objection to this approach is that it has not proven satisfactory in practice for "tin plate" ends. The term "tin plate" will be well understood by those skilled in the art as referring to sheet steel provided with a coating of tin in the range of 15×10⁻⁶ to 6×10⁻⁶ inches.

When, as described above, tin plate ends were provided with a removable portion, set off by score lines or other lines of weakening, the depth of such score lines became a critical factor. If the score lines were too shallow, the tin plate beneath them would remain too strong to be manually severed. If, on the other hand, the score lines were too deep, the end closure would be unable to withstand the pressure generated by the product within the container, and the result would be that the removable portion would "blow out" or be explosively released, thus creating an unsatisfactory and an often dangerous condition. Even if the manufacturer were able to provide score lines which extended to precisely the proper depth whereby the removable closure portion could be manually torn away, there still existed the problem presented by the sharp edges of the tin plate. Due to the fact that sheet steel, when torn along a scored line, presents a sharp edge, there was the ever-present danger that a consumer would cut his fingers on the edges of the removed portion.

Faced with the seemingly unsurmountable difficulties associated with providing an easy-open tin plate end, designers and manufacturers turned toward the use of aluminum ends. Because aluminum is a substantially softer metal than steel, the depth of the score lines became less critical and the severable portion of the end closure could be torn away with the exertion of less force by the consumer. Certain of these easy-open aluminum ends have enjoyed widespread consumer acceptance, such as the type illustrated in U.S. Design Patent No. 196,604 issued to Frazee. However, even though the use of aluminum has accomplished a minor breakthrough in the field of easy-open ends, there are still serious shortcomings associated with the aluminum easy-open end. First of all, aluminum is more expensive than tin plate. Furthermore, most can-making equipment is designed to handle tin plate, and the use of a material such as aluminum which has different ductility and other physical properties necessitates at least minor redesign or readjustment of such equipment. Still further, a raw edge of aluminum is still sharp enough to cut the user and thus the removed portion of an easy-open aluminum end still presents a safety hazard to the consumer.

All of the foregoing prior art was concerned with one type of solution to the problem of providing an easy-open metallic end closure—namely, to score or weaken the end so that an integral portion of the end may be manually torn away. A somewhat diverse solution to the problem has been to provide an aperture in the end closure and to then seal the aperture by means of an auxiliary patch or disc. The approach of this latter solution has the advantage of eliminating the safety hazard presented by the raw metal edges present on a torn-away integral portion of the container end closure.

An early patent following this latter approach was U.S. Patent No. 2,034,007 issued to Smith wherein an aperture was provided in the end closure and a metal patch was superimposed and adhesively secured to the end closure by means of a soft solder. It was intended that the metal patch be manually removable, but such a construction was not entirely satisfactory because the great amount of force the consumer had to exert to break the solder bond could hardly classify the construction as an "easy-open" end.

A somewhat related approach was illustrated in U.S. Patent No. 2,147,004 wherein an aperture was provided in the end closure and inner and outer metal patches were adhesively secured together to seal the aperture. To open the container, the outer patch was peeled away and removed and the inner patch depressed downward into the container. While such a construction was satisfactory from the point of view of easy opening, it was quite deficient in terms of sanitation and hygienics since the adhesively coated inner patch dropped into contact with the food or beverage housed within the container.

In U.S. Patent No. 2,870,935 issued to Honthgelling, a container end closure was provided with an aperture and inner and outer thermoplastic patches were adhesively secured to the end in overlying relationship to the aperture. The thermoplastic patches were then heated to cause them to fuse or cohere to one another in the region of the aperture, and it was intended that when the outer patch was manually removed by the consumer, the cohered portion of the inner patch would be torn away with it. While the Honthgelling end did provide an appreciable advance in the art, it was not altogether satisfactory, particularly for use on beer cans. It was found that if the resin film were made sufficiently strong to resist rupture due to the pressure of the product, it was too strong to be readily manually removed; and conversely if it were weak enough to be torn out by hand, it was too weak to withstand the pressure. Numerous other difficulties beset the Honthgelling end because of its thermoplastic patches. Such patches were permeable and transmitted light, both of which could have a serious effect on certain container products, particularly if they were comestibles such as beer. Also, the thermoplastic patches were elastic or stretchable to such a degree that high
internal container pressure caused them to balloon outwardly at the aperture.

Recently, U.S. Patent No. 3,101,879 was issued to Meyer-Jagenberg for an easy-open closure for a fibre container. The end aperture is provided in a fibre container and an inner foil patch is adhesively secured to the inner container wall surrounding the aperture and the patch is perforated or weakened in the shape of the aperture. An outer foil patch is adhesively coated and secured to the container wall over the aperture. Within the boundaries of the aperture, the adhesive on the outer foil patch serves to adhere the inner and outer patches together. Thus, when the consumer manually removes the outer patch, the adhered portion of the inner patch tears away within the lines of weakening, and the container is opened. However, while it is possible that such a construction works well for use on fibre container walls as envisioned by Meyer-Jagenberg, the construction would be unsatisfactory for use on metal end closures since the entire outer patch would be adhesively secured to the metal end. Thus, to open the end, a consumer would have to physically break the entire adhesive bond between the outer patch and the end, and even if this were possible in view of the bonding power of new high strength adhesives, such an end construction could hardly be considered "easy-opening."

It is believed that all of the herebefore related matter will serve to establish for those skilled in the art, that prior art approaches to the problem of providing an easy-open metal end closure for a container have been dichotomous in that two or more or less distinct approaches to the problem have been formulated. One approach has been to provide a weakened portion in the end closure so that the consumer may manually remove the weakened portion to open the container. The other approach has been to provide an opening or aperture in the end closure and to then seal this opening with suitable patch means so that the consumer may manually remove the patch means to open the container. As previously stated, prior art attempts at each of these approaches have not been altogether satisfactory and the need for a safe, satisfactory easy-open metal end for containers is still present.

It is therefore an object of the present invention to fulfill the aforementioned need and to provide a safe and easy-opening metal end construction on a container.

Another object of the present invention is to overcome the shortcomings and deficiencies associated with the prior art.

Another object of this invention is to provide a manually openable metal end closure for a container which needs no tools for opening and which presents no safety hazard to the consumer.

Another object of this invention is to provide an easy-open construction particularly adapted to tin plate ends.

Another object of this invention is to provide a container with an easy-open metal end construction which is strong enough to withstand the forces generated by pressurized products during and after their processing, yet can be easily opened by a consumer with a minimum exertion of force.

Another object of this invention is to provide a container having an end construction which can be manually opened by a consumer but which, when so opened, will not present any sharp raw metal edges to cut the fingers of the consumer.

Numerous other objects and advantages of the invention are apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

The foregoing objects are attained by providing a container with a metal end closure double sealed to the upper end thereof. The end or end closure is provided with at least one suitably shaped aperture extending through the metallic material from which the end is fabricated. An inner foil patch is adhesively coated, the adhesive is activated, and the patch is applied to the inside of the end closure overlying the aperture. An outer foil patch with no adhesive coating is then applied to the outside of the end closure overlying the aperture. Within the boundaries of the aperture, the activated adhesive on the inner patch causes the inner and outer patches to become adhered to one another. A suitable tab is appended to the outer patch, and when a consumer grasps the tab and pulls it, the outer patch lifts easily away from the end since it is not adhesively adhered to the end itself. As the outer patch lifts away, the adhered portion of the inner patch remains affixed and thus tears away along with the outer patch thereby opening the aperture in the end to facilitate removal of the container contents. Since the torn-away portion is only foil, it offers no danger of cutting the consumer's fingers and it can be safely handled and thrown away.

Referring to the drawings:

FIGURE 1 is a perspective view of a hermetically sealed container having an easy-open end embodying the features of the present invention.

FIG. 2 is an enlarged fragmentary transverse sectional view taken substantially along line 2—2 of FIG. 1; and

FIG. 3 is a fragmentary perspective view of the container and end closure and illustrating how the end closure can be easily manually opened by a consumer.

As a preferred and exemplary form of the present invention, FIG. 1 illustrates a container having a tubular body generally designated 10 and an easy-open end closure generally designated 12 hermetically sealed to the body 10 and forming therewith the completed or sealed container. The container body is of the type which can vary in size and shape and can be variety and particularly adaptable for holding beer, carbonated beverages and other similar fluid products.

The construction of the container closure 12 is shown in greater detail in FIG. 2 wherein it can be seen that the closure is fabricated of a sheet of metallic material having a central panel generally designated 14 with parallel planar inner and outer surfaces respectively identified as 16 and 18. The central panel is generally flat and at its periphery it merges downward into a slightly annular peripheral countersink channel 20. The outer limits of the channel 20 are formed by an upward generally vertical wall 22 which interlocks with the wall of the container body 10 to form a conventional double seam generally designated 24 which hermetically secures the end closure 12 to the body 10.

The end closure 12 may be fabricated of any desired metallic material since the opening and closing mechanics, and for these reasons tin plate is the preferred material for the end closure 12 and the thickness of such tin plate is in the order of ten mils (0.010 inches).

A main aperture or pour hole 26 is formed within the end near an edge of the central panel 14. The aperture can be of any suitable shape such as round, elongated, or the like, but for ease of manufacture, a round hole, as illustrated, is preferred. While the size of the hole is not critical, it should nevertheless be kept as small as possible, consonant with the function it must serve, so as not to materially weaken the structure of the end 12. When a round pour hole such as 26 is utilized, a smaller vent hole 28 is spaced away from the main hole 26 in the central panel 14. The vent hole 28 is located in a position where it will be opened prior to opening of the main hole. Thus, when the container 10 is opened, the pressure differential between the interior of the container and the ambient atmosphere sur-
rounding the container will be equalized. This will prevent an "explosive release" from occurring when the main hole 26 is punctured. An "explosive release" is the phenomenon which occurs when a covering is removed from a large hole which has differential pressures on its opposite sides. As the covering just slightly opens an edge of the hole, the higher pressure immediately releases toward the lower pressure, thus blowing the covering toward the low pressure side with a terrific force not unlike an explosion. Naturally, this may create a safety hazard and consequently it is important to utilize an opening design wherein "explosive release" is eliminated. The vent hole 28 thus serves to eliminate the possibility of "explosive release" and also serves to vent the container while pouring through the main hole to thus allow a smooth stream to flow out of the container.

An imperforate inner patch 30 is secured to the inner surface 16 of the end closure central panel covering the holes 26 and 28. The patch 30 can be fabricated of thin tearable material, such as metal foil, with aluminum foil being the preferred material. The patch 30 is coated with an adhesive layer 32 and when suitably activated, as by the application of heat, this adhesive layer 32 serves to bond the patch 30 to the inner surface 16 of the end closure 12. The adhesive material which forms the layer 32 can be a synthetic resin or a polymeric material that is adhesively compatible with the material of the end closure 12 and with the material of the patch 30. Some exemplary adhesives which are suitable are superpolyamides of the nylon type, polyurethanes, polyvinyl plastisols, vinyl solutions and copolymers of ethylene and acrylic acid. The preferred thickness of the adhesive layer 32 is in the order of two mils (0.002 inch).

An imperforate outer patch 34 is superimposed on the outer surface 18 of the end closure central panel 14 in such a location as to overlie the holes 26 and 28. The outer patch 34 has no adhesive coating on its underside and it lies in juxtaposed and superimposed direct contact with the material of the central panel 14. In the region within the holes 26 and 28, the outer patch 34 is embossed into contact with adhesive layer 32 carried by the inner patch 30. The adhesive layer serves to firmly bond or adhere the inner and outer patches together within the boundaries of the holes 26 and 28. The outer patch 34 remains fixed in its location by the adhesion from the layer 32. Although, as illustrated, both patches 30 and 34 are embossed inwardly within the boundaries of the holes 26 and 28, the construction of the present invention is not limited to such an arrangement. Instead, the inner patch 30 can remain planar and the outer patch 34 can be embossed inward further to meet with and adhere to the adhesive layer 32. Likewise, if desired, the outer patch 34 can remain planar and the inner patch 30 can be embossed outward further to adhere the adhesive layer 32 to the outer patch.

A tab 36 is adhered to and preferably integral with the outer patch 34 at its end adjacent the vent hole 28. The tab can be provided with transversely extending ridges or wrinkles which serve as indicia to indicate to the consumer which end of the patch 34 is to be pulled and which also serve to provide ease of gripping in case the tab "is wet.

The manner of opening the container is illustrated in FIG. 3. The tab 36 is grasped between the thumb and forefinger and manually pulled in the direction of the main hole 26. As the outer patch 34 is pulled past the vent hole 28, the adhered portion of the inner patch 30 leaves the upper part of the container in the form of a small round segment 30b which remains attached to the underside of the outer patch 34. When the segment 30b is completely severed from the main patch, the container is opened and the outer patch 34, with the segments 30a and 30b adhered thereto, can be blown away.

It should be noted that this torn-away portion has no sharp edges and thus prevents no safety hazard, either during or after the severing operation. It should also be noted that since the patch 34 is embossed outward in any way to the outer surface 18 of the central panel, the consumer does not need to break any adhesive bond in removing the patch and thus the container can be very easily opened. The only force which the consumer need exert is one sufficient to tear through those areas of the imperforate and inner patch located within the boundaries of the holes 26 and 28, and this force is particularly minimal because the sharp edges of circumscirbing the holes on the inner surface 16 tend to cut through the adhesive and the inner patch as the outer patch 34 is removed.

In order to assure that it is the inner patch 30 rather than the outer patch 34 that tears or severs, it is preferable to utilize a construction wherein the outer patch 34 is stronger or less tearable than the inner patch 30. This can be accomplished in various ways while still keeping both patches imperforate. For example, the outer patch 34 may be made of thicker stock than the inner patch 30. Also, for any given thickness of the patches, the outer patch 34 may have a higher tensile strength than the inner patch 36, as for example, a higher temper aluminum foil outer patch and a dead soft or fully annealed aluminum foil inner patch.

Although FIG. 2 is not drawn to scale, it will nevertheless be apparent that the adhesive layer 32 is thinner between the patches 30 and 34 than between the inner patch 30 and the end closure inner surface 16. This thinning is due to the pressure exerted when the patches 30 and 34 are embossed together, thus causing the adhesive material trapped between the patches to flow radially outward toward the walls of the apertures. If this embossing pressure is great enough, the adhesive material may actually contact the walls or boundaries of the apertures, but in most instances the pressure will not be that great and the result will be that a narrow annular space will exist between the outer limits of the adhesive material and the walls of the apertures. Since the outer patch 34 is not adhered to the outer surface 18 of the central panel, the annular space at the periphery of each aperture is thus exposed to the ambient conditions outside the container and it is possible for such an annular space to become filled with air, liquid or other fluids. However, since the adhesive layer 32 is firmly affixed to the inner surface 16, it prevents any fluid within the annular space from intermixing with the container contents, and it thus renders the container hermetic.

The adhesive layer 32 also prevents the inner patch 30 from seriously deforming or blowing off under the influence of pressure. Often, there will be a sharp pressure differential on opposite sides of the end closure 12. For example, if the product within the container is beer, during pasteurization of such beer the internal container pressure will build up to about 90 p.s.i. (pounds per sq. inch) and that internal pressure pushes the inner patch 30 outward. If the product within the container is coffee, which is generally packed in a vacuumized condition, there initially exists within the container a negative internal pressure which causes the inner patch 30 to tend to deform inwardly. In either instance, the adhesive layer 32 must be strong enough to prevent the inner patch from being pushed inward, as shown by the body 10 or blown out through the apertures 26 and 28.

While the material from which the patches 30 and 34 are fabricated must be tearable and should be slightly deformable to permit embossing, they should not be too stretchable or elastic or else those portions of the patches...
within the boundaries of the aperture will tend to “balloon” either inwardly or outwardly toward the lower pressure. This tendency toward “ballooning” is resisted in great measure by the fact that the patches are fabricated of metallic foil rather than plastic. Since metal inherently has a greater tensile strength and a reduced modulus of elongation, it is not nearly as “stretchable” as plastic, and hence the metal naturally counteracts ballooning which could occur freely if plastic patches were used. Moreover, within the boundaries of the apertures, the thickness and thus the rigidity is increased since both patches 30 and 34 and the adhesive layer 32 join together to form a laminate which is strong enough and thick enough to resist “ballooning.”

Although the present invention has been described with particular emphasis toward an easy-opening means for a container metal end, it should be understood that the invention has equal applicability to any wall of the container and not merely to the end wall exclusively. If for some reason it was preferably to install the opening means on the body walls 10 of the container, it would operate with equal efficacy thereat.

It is thought that the invention and many of its attendant features 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 parts 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.

We claim:
1. An easy open end closure for a container comprising:
a sheet metal end including a planar central panel and a peripheral portion adapted to be secured to a container body;
said central panel having an inner surface adapted to be disposed within said container body and an outer surface adapted to be disposed without said container body;
said central panel having at least one shaped aperture extending therethrough from said inner to said outer surfaces;
an imperforate metallic foil inner patch of substantially uniform tearability having an adhesive layer on one surface thereof;
said inner patch overlying said aperture and being disposed with a portion of said adhesive layer contacting and adhering to said inner surface surrounding said aperture and the remaining portion of said adhesive layer being exposed within the boundaries of said aperture;
an imperforate metallic outer patch juxtaposed to said outer surface and overlying said aperture;
at least one of said patches being embossed towards said other patch to bring said outer patch and the exposed portion of said adhesive layer into adhering contact, said inner patch being more readily tearable than said outer patch;
the adhesive layer within said aperture that adheres said inner and outer patches together being thinner than the adhesive layer that adheres said inner patch to said panel and a portion of said adhesive within said aperture extending laterally of the adhering surfaces of said inner and outer patches to substantially fill any voids within said aperture; and
a tab means on said outer patch which, when manually gripped and pulled, causes said outer patch to lift away from said end and simultaneously causes that adhered portion of said inner patch within the boundaries of said aperture to tear away from the remainder of said inner patch and remain adhered to said outer patch, thus opening the aperture in said end.

2. The end closure set forth in claim 1 wherein said sheet metal is tinplate.
3. The end closure set forth in claim 1 wherein said metallic foil for each of said patches is aluminum foil.
4. The end closure set forth in claim 3 wherein said inner aluminum foil patch is thinner than said outer aluminum foil patch whereby said inner patch is more readily tearable.
5. The end closure set forth in claim 1 wherein said adhesive layer comprises a synthetic resin.
6. An easy-open end closure as defined in claim 1 wherein said end is provided with a pouring aperture and a smaller vent aperture spaced away from said pouring aperture, with said patches overlying both of said apertures.
7. An easy-open end closure as defined in claim 6 wherein said tab means is on the end of said outer patch nearest said vent aperture to thus assure that manual removal of said outer patch will open said vent aperture before said pouring aperture.
8. An easy-open end closure as defined in claim 1 wherein said tab means is integral with said outer patch and is provided with means to improve its gripability.

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THERON E. CONDON, Primary Examiner.
G. T. HALL, Assistant Examiner.