May 25, 1948. S. BERGSTEIN 2,442,161

METHOD OF MAKING GAS FILLED FLEXIBLE CONTAINERS

Filed Oct. 10, 1944 2 Sheets-Sheet 1

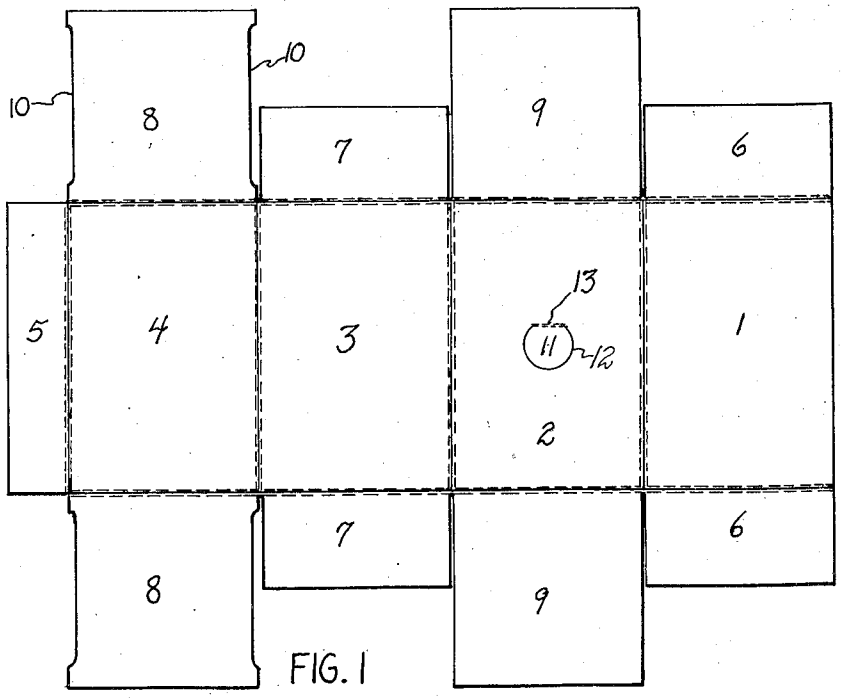


FIG. 1

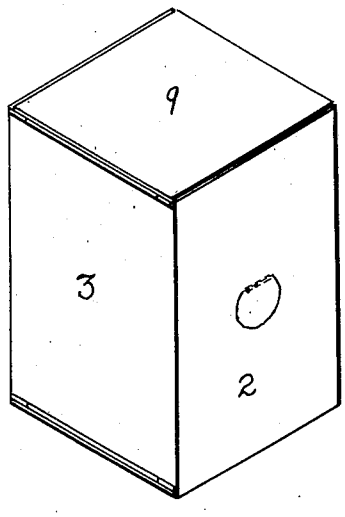


FIG. 2

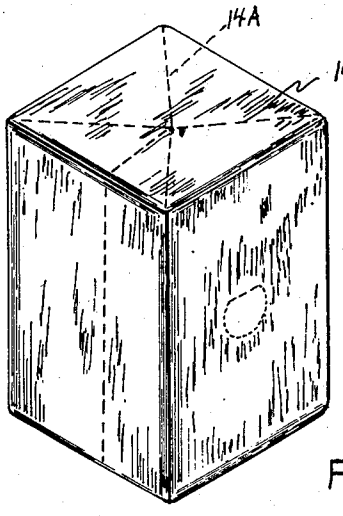


FIG. 3

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METHOD OF MAKING GAS FILLED FLEXIBLE CONTAINERS

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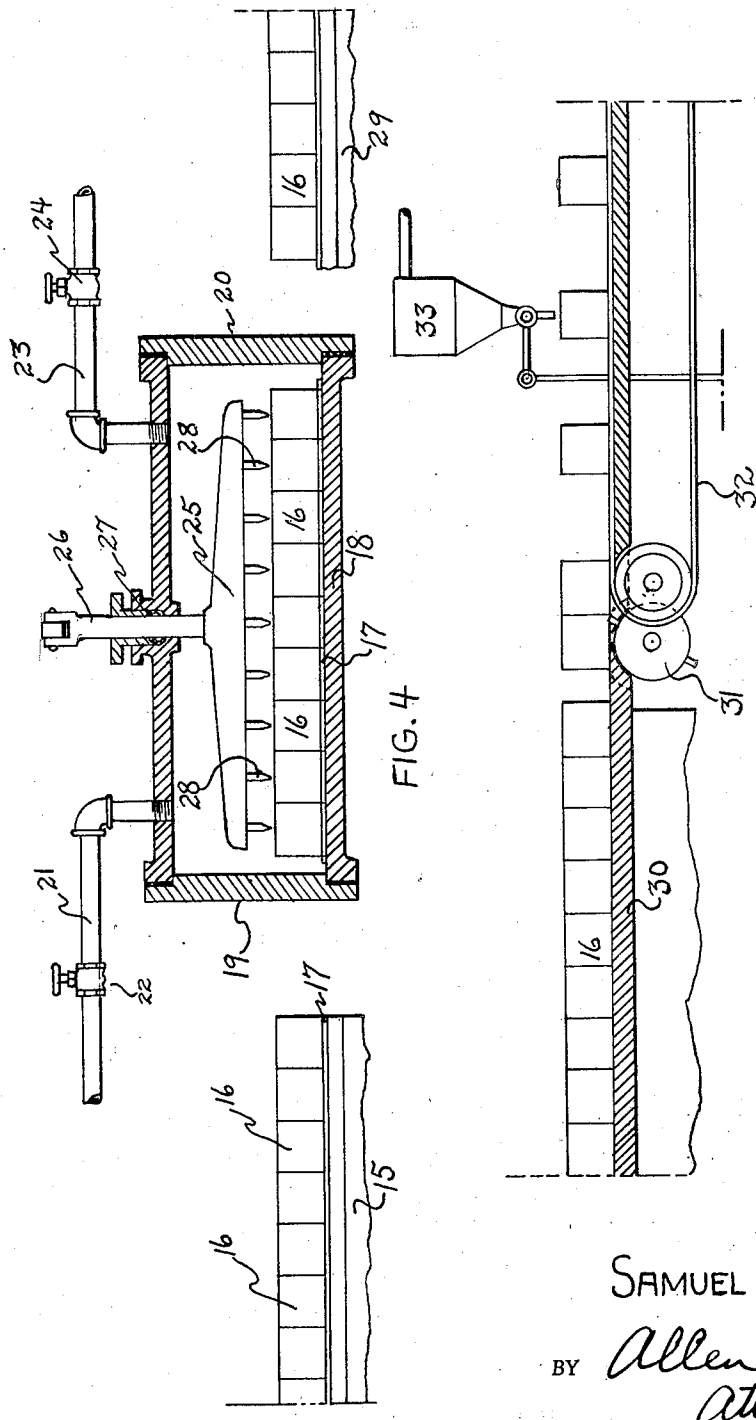


FIG. 4

FIG. 5

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METHOD OF MAKING GAS FILLED FLEXIBLE CONTAINERS

Samuel Bergstein, Cincinnati, Ohio

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5 Claims. (Cl. 93—2)

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My invention has for its principal object the provision of flexible walled packages in which the contents are immersed in a special atmosphere to be retained about the contents for as long as the package lasts.

Most food products require protection against the loss or gain of moisture, and this problem has been pretty well solved in various ways, as by the provision of moistureproof wrappings, sealed bags, and the like. But many food products additionally require protection from oxidation and other chemical changes producing rancidity, deteriorating taste, or introducing foreign tastes and odors. Such protection is best attained by immersing the goods in a non-reactive atmosphere within the package.

Attempts have been made to provide flexible walled packages containing controlled atmospheres, but these attempts have not been commercially satisfactory. They have followed the procedure of introducing the desired atmosphere along with the contents or of effecting atmospheric exchange prior to the sealing of the package. This was necessary because the ultimate seal at the closures involved cementing together layers of the flexible material of the packages in lapping or face-to-face relationship. The seal was, therefore, essentially an interior seal.

Introducing the desired gas along with the contents or introducing it into the filled but unsealed package can be accomplished; but great difficulty has been encountered in providing dependable gas-tightness in packages where reliance must be placed on an interior seal.

Hence, in commercial practice, products requiring immersion in a non-reactive gas, have had to be packaged in glass or in metal.

I have found that flexible gas containing packages may be provided by a procedure involving a new concept. Briefly, in the practice of my invention, I first enclose the goods in a flexible walled package which, in itself, does not require to be gas-tight. It may be made of gas-tight materials and may be provided with interior seals such as have been mentioned above; but this is not necessary.

The property of gas-tightness is imparted to the closed package by the next step of my process which involves the formation over the whole package of an externally located, tough film of gas-tight substance. There are various ways in which the substance may be applied, but the most convenient way is to immerse the filled and closed package in a bath of sealing substance of thermoplastic character which, when the package is

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withdrawn from the bath, will form about it an integral, continuous, imperforate and gas-tight skin. Since this skin is relied upon for gas-tightness, it is essential that it be sufficiently tough to withstand the strains of handling and shipment to which the package will be subjected.

The next step of my procedure involves forming one or more openings through the skin and the flexible wall or walls of the container to provide a gas passageway or passageways from the outer air to the interior and contents of the package. This may be done by puncturing the skin and the underlying wall or walls with a suitable instrument, or it may be done by exerting pressure on a preformed weakened portion of the flexible wall of the package so as to form an opening through the wall, and so as to tear or puncture the gas-tight skin at the same time. The introduction of the desired special atmosphere and the expulsion of the contained air may then be accomplished through the opening or openings in a variety of ways. When atmospheric exchange has been effected, the package is then resealed by forming over the opening a closure of sealing substance. The sealing substance must be one capable of forming a gas-tight skin, of bonding to or fusing with the material of the first mentioned gas-tight skin, and having sufficient strength to withstand the strains of handling and equipment.

Where the opening in the sealed package is of relatively large extent, it is within the scope of my invention to provide a support for the skin closure in bridging over the opening. This support may be in the nature of a piece of flexible material disposed over the opening; but the essential seal is formed by the skin itself extending continuously across the opening and bonded to or fused with the first applied skin.

Reference is made to the accompanying drawings wherein I have shown an exemplary container and an exemplary mode of treatment for it.

Figure 1 shows a carton blank suitable for forming a sealable package, similar to the carton described and claimed in my co-pending application entitled "Cartons for sealing by immersion," Serial No. 538,764, filed June 5, 1944 (now Patent No. 2,412,031), but having an additional feature as hereinafter described.

Figure 2 shows the carton of Figure 1 after it has been erected, filled with contents, and both ends thereof closed.

Figure 3 shows the package in Figure 2 after it has been dipped in a sealing and skin-forming

substance to effect a continuous, enveloping, gas-tight skin.

Figures 4 and 5 taken together show diagrammatically various steps involved in one mode of treating the containers to effect gas exchange therein and in resealing the containers, as will be described hereinafter.

In Figure 1 is shown a carton in flat knocked down form constructed according to my said co-pending application. This carton has enclosing body walls 1, 2, 3, 4 and a glue flap 5, demarked by the usual score lines. The carton, as shown, is provided with "seal end" flaps, two short flaps 6 and 7 being articulated to the ends, respectively, of walls 1 and 3, an intermediate flap 8 being articulated to each end of the wall 4, and an outer flap 9 being articulated to each end of wall 2. The carton blank is formed of boxboard (either proofed or otherwise) and is tubed in the usual fashion by bending it upon two of its score lines and adhering the glue flap 5 to the wall 1, either on the inside or outside of the tubed structure.

In the carton as shown there may be incorporated in one or more of the walls, a small cut-out or provision for the formation of a gas opening. I have shown a tab 11 in the wall 2, defined by a line 12 of perforation or cutting, and which may be folded on a crease line 13.

Figure 2 is the package shown in Fig. 1 after it is filled with contents and the flaps at both ends adhesively secured. The short flaps 6 and 7 are folded first, then flap 8, and finally flap 9, adhesive being applied between the meeting surfaces. It is usual to erect the carton, close one end of it as described, fill it, and then close the other end. The filled carton may then be immersed, if desired.

The object of the immersion is to apply a uniform, continuous, outer skin or coating of gas-tight type, and continuous over the whole outer surface of the package, whatever that surface may be. The nature of the sealing medium is of the utmost importance because gas tightness will depend in important degree upon the continuity and the characteristics of the film so formed by the dipping or immersion operation.

Furthermore, it is to the skin so formed that fusion is accomplished during the resealing operation. A strong film-forming characteristic is essential in the coating substance, so that in simple application operations the formation of a continuous skin is assured. The substance must be one capable of forming a gas-tight skin. Hence the substance must itself be impervious to atmospheric air and the desired inert gas or gases, but the skin formed must be free of blow-holes and other imperfections which would permit breathing. The substance is preferably one which has good adhesion to the container walls to which it is applied; and it must be one which, in skin or membrane form, at temperatures to which the package will be subjected, is strong, tough and non-brittle, so that it will withstand the strains of handling, storage and shipment. Other qualities are frequently desirable such as resistance to water or moisture, lack of odor or toxicity, lack of noticeable color, and transparency, as where the skin is applied over printed surfaces. It should also be low in cost.

The various qualities are most conveniently attained in thermoplastic mixtures. Paraffin, for example, is deficient in many of the required qualities; but paraffin, or mixtures of paraffin and micro-crystalline waxes, or other waxy substances can be toughened and improved as to their skin-forming characteristics and rendered permanently non-brittle by the addition of various natural or artificial resinous substances.

I give as one example of a formula which has been found satisfactory in the production of gas-tight packages according to this invention, the following:

	Per cent
Paraffin wax (132° M. P.)	50
Micro-crystalline wax (Petrosene B—Socony Vacuum)	50
Ester Gum (melting point, 154°)	12

This composition is brought to molten form at a temperature preferably 20 to 30° F. above the melting point of the composition itself, and the sealed package as previously described is immersed for a matter of seconds only in the molten composition, and is thereupon withdrawn. Because the dipping is carried out in the molten composition and the package promptly withdrawn, it can be subjected to further handling and use almost instantly because the composition sets by cooling and cooling is rapid. Because of the advantage of rapid setting by cooling, I prefer to use a thermoplastic composition such as the one given above in carrying out my invention. However, if desired, other types of sealing mediums may be used such, for example, as a resin in solution or in emulsion, provided that, after the film so applied has been allowed to set or harden by cooling or evaporation or otherwise, the package itself is found to be covered with an integrated gas-tight skin or outer coating.

Total or repeated partial immersions are convenient and effective ways of forming the gas-tight skin, though the application may be made otherwise if desired. The operations may be carried out by machine or by hand. Where thermoplastic substances are used, their melting points should not be so high as to impair the package or its contents; and where the package walls are porous, care should be taken to form an adequate external skin by avoiding too great penetration of the skin-forming substance into the walls. The avoidance of excess fluidity and excess temperatures in the coating medium is helpful. It is not without the scope of my invention to dip the package a plurality of times either in the same or in baths of different substances so as to thicken the skin or form a skin of different layers.

It will be noted in Figure 1 that the side edges of the intermediate flaps 8 are cut back slightly (intermediate the ends of the side edges) as at 10. When the carton is closed as has been described, shallow recesses are thus left at opposite end edges of the carton between the outer and inner flaps. These recesses may be filled with the sealing compound when the package is dipped, sealing the outer to the inner flaps, and forming a very strong bond. The plug-like configuration of the sealing compound in these recesses is very strong and forms a protection against disruption upon handling.

In Figure 3 the outer gas-tight skin on the package is indicated at 14.

The precise nature of the flexible walled package does not form a limitation on my invention, otherwise than as set forth specifically in the appended claims. The desired contents may be enclosed in a single- or multi-walled bag, and the gas-tight skin formed thereover as hereinabove

taught. Or the contents may be placed or sealed in one or more bags which in turn are placed in an outer carton, like that hereinabove described, or otherwise. As hereinafter explained, a carton may be wrapped prior to dipping. The essential is the provision of a container of flexible, single- or multi-walled character, about which the flexible, integral, gas-tight skin may be formed, which skin will constitute the outer surface of the package, at least at the time of gas-exchange and resealing as hereinafter taught.

In the formation of the gas-tight skin on cartons, certain factors must be kept in mind. A perfect and complete seal must be obtained so that the package cannot breathe either through the faces or edges of the boxboard. Boxboard is normally absorptive to the coating; and to the extent that the coating substance strikes into the board it is less effective in producing gas-tightness, since an external, integral film or skin is most effective in this regard. Precautions must be taken to form and maintain the integrity of an outer skin, either by insuring the application of a sufficient quantity of the coating composition, or by minimizing or preventing absorption.

As to the latter, the viscosity of the coating composition will have an effect. But it is possible to size a filled and closed carton so as to destroy or minimize its absorptivity. Thus a carton may be dipped in or otherwise coated with a cellulosic or resinous composition so as to seal its pores, and afterwards it may be dipped in the coating composition. By way of a single example, a filled and closed carton may be dipped in a solution of polyvinyl alcohol or other vinylite resin, dried, and thereafter coated so as to form a gas-tight skin.

Excellent results are obtained with a carton which is first wrapped in some material that is in itself quite gas-tight—such, for example, as Cellophane—and is then dipped as described. A wrapping of this kind not only adds an extra barrier against gas penetration, but provides better mechanical protection in that, if some point of the skin is disrupted the wrapper remains to prevent leakage. Other advantages are also realized. Less difficulty is encountered with blow-holes in the skin produced by the escape of bubbles of internal gas expanded by heat during the coating step.

The overall cost, in the employment of a wrapper, is frequently less because the decreased amount of coating substance required (due to the lessened absorptivity) offsets, or more than offsets, the cost of the wrapper. As a wrapping material, I may use any flexible, gas-tight film or membrane, for example, Cellophane, cellulose acetate, ethyl cellulose and other non-fibrous films, as well as fibrous ones such as glassine. Composite, plied sheet materials including such films, or paper, or metal foils, may also be employed.

The wrapping operation does not require description. It may be performed by hand or by any of the known wrapping machines. The wrap itself does not have to be adhesively secured in such manner as to be gas-tight in itself; but the folds should be well made and held down sufficiently so that a satisfactory skin may be formed when the package is dipped closing any crevices in the wrapper but not permitting penetration of the dipping compound to the interior of the wrap. These requirements are easily met by modern wrapping machines. In Figure 3, I have indicated a wrapping in dotted lines at 14*a*.

The characteristics of the dipping compound can be advantageously varied in accordance with the nature of the surface to which it is to be applied. For a Cellophane-wrapped package, an excellent formula is:

	Parts
Paraffin, M. P. 135°	100
A mixture of 25 parts of a high molecular weight hydrocarbon resin such as Vistanex and 75 parts paraffin	15
Vistanex #6 (a low molecular weight resin)	3

Other exemplary formulae are:

	Parts
Paraffin	100
Ester gum	20
Vistanex #6	5

or

	Parts
Paraffin (M. P. 133–135°)	100
The 25–15 Vistanex paraffin mixture mentioned above	20
Ester gum, or of a resin known as Penros and manufactured by Newport Industrial Chemical Company	20

Other dipping compounds, thermoplastic or not, may be employed to form the gas-tight skin providing they meet the general requirements given above.

I have now produced, in any of the ways taught, a completely sealed and gas-tight, filled package; but the atmosphere in it is air. In a continuation of my process I now effect an exchange of the air for some controlled atmosphere, for example, an inert gas.

An ensuing step in my process is the disrupting or puncturing of the outer skin or coating and the container wall or walls, at one or more relatively small predetermined areas. This may be done mechanically. In Figure 4, as one exemplary showing, the puncturing or rupturing of the outer film is carried out on a group of packages side by side through the use of an overhead frame bearing fingers or puncturing means which, when the frame is lowered with respect to the packages, actually perforate or puncture the skin and container walls, or register with the tabs 11 on the cartons, depressing them, and in either case effecting a gas passageway into the interior of the packages.

In this punctured condition the containers are subjected to conditions producing atmospheric exchange. One way of accomplishing this object is to subject the packages first to vacuum to withdraw the atmosphere within them, and afterward to the desired gas under atmospheric pressure. The vacuumizing and introduction of the gas may be done in a chamber in which the cartons are placed for the purpose. The effecting of a gas opening in the containers and the resealing of them after gassing may also be accomplished in the same chamber; but may be accomplished elsewhere.

In Figures 4 and 5 I have shown one form of apparatus which may be used. An assembly of the filled and sealed cartons 16 is shown resting on a tray or pan 17 on a work table 15. In line with this work table is a chamber 18 having removable end closures 19 and 20. When the closure 19 is removed, the assembly of cartons on its tray may be slid into the chamber and accurately positioned therein, whereupon the closure 19 may be replaced.

The chamber 17 is provided with a connection 21, valved as at 22, to a vacuum pump or vacuum

cylinder, not shown. It has also a connection 23, valved as at 24, to a source, not shown, of the desired gas to be substituted in the carton.

An overhead bar 25 is mounted in the chamber on operating shaft 26 passing through a packing gland 27. Pins or fingers 28 are so mounted on the bar 25 that when the bar is lowered they will contact tabs 11 and, slightly depressing them, will break the skin of sealing substance along the cut line 12, thus effecting a gas opening in the cartons. The tabs 11 should preferably be depressed only slightly, not sufficiently to give them a marked permanent set, so that when the fingers 28 are subsequently raised, the tabs will spring back substantially in the plane of the carton walls in which they are formed. Or the pins 28 may be puncturing points arranged to form one or more small holes through the skin and walls of each container.

With the cartons in the airtight chamber 18, the vacuum pump connected to conduit 21 is first utilized, the valve 22 being turned to open position, to pull a substantial vacuum whereby to exhaust the cartons. Then the valve 22 is closed, the valve 24 opened, and a supply of CO_2 or other desired gas is released into the chamber until the pressure in the chamber has been raised to atmospheric pressure. By this process, through the openings above described, the air is withdrawn from the packages in the chamber, and is subsequently replaced with the desired other gas.

The group of gassed packages is now withdrawn from the chamber on its tray 17 onto a work table 29, the closure 20 of the chamber being first opened. As shown in Figure 5 the cartons may be passed along a table 30, then separated by a device 31 and delivered to a conveyor 32 in spaced relation. The gas openings will now be sealed as hereinafter described.

The means for effecting gas exchange need not be those specifically above described. For example, as set forth in my copending application entitled Method of gassing filled packages, Serial No. 553,374, filed September 9, 1944. I may dispense entirely with a vacuum-pressure chamber, and instead puncture the skin and the carton walls with hollow needles, blowing in the desired gas through one and permitting the escape of air through the other. Or I may employ a single needle with means for slightly enlarging the hole it makes, blow in the gas through the hollow needle, and permit escape of the air about the outside of the needle. Proper placement of the needle orifice or orifices will insure rapid and efficient gas exchange.

I have shown diagrammatically at 33 a reservoir including means to apply a thermoplastic sealing substance to the gas openings.

With heavier-than-air gases the resealing is conveniently done outside the chamber 18 as shown, but it may be accomplished within the chamber if desired. As to the resealing, the essentials are that the gas opening about the tab 11 be closed by a sufficiently strong skin of gas-tight substance, sufficiently adherent to the carton walls or to the sealing substance thereon. The resealing may be accomplished in several ways, the essential attribute being what might be termed skin repair. Where the opening or openings formed in the preformed skin and the carton wall are small, a simple application of skin forming substance as might be done by redipping, by wiping on a layer of thermoplastic substance in adhesive form, or by depositing a mass of sealing substance over the opening, may be all that is required. The ability of a film forming substance to bridge a gap in the preformed skin and the container wall, depends upon a number of factors such as the size of the opening, the thickness of the material deposited and the viscosity of the material as determined by its temperature or otherwise, together with its tenacity under those conditions. As I have already explained, in order to bridge a larger opening, it is within the scope of my invention to apply first a covering or reinforcement of Cellophane, paper, paperboard, or other flexible web, and then apply the skin forming substance over that in such a way as to regenerate the integrity of the enveloping skin upon the package.

While I have described my invention in certain exemplary embodiments, it is applicable to flexible walled packages having, when filled with contents, sufficient ability to retain their shapes to permit the treatments set forth herein. It will be clear how my invention may be applied to sealed bags of single and plural walled types. Such bags, treated substantially as hereinabove described, may in themselves constitute completed packages. A bag may be filled with contents, closed, provided with the exterior integral gas-tight skin, as I have taught, and then included within a carton; and the presence of the outer carton will not interfere with the practice of my invention providing by means of a suitable large aperture, it exposes sufficient of the surface of the bag and the skin thereon to permit the formation of gas openings and the subsequent sealing thereof by skin repair.

Products to be packaged may merely be enclosed in a wrapping and the method of my invention carried out thereon as will be clear. Any of the packages of my invention may be subsequently enclosed in outer cartons, wrappings or the like, as may be desired. Reliance for gas-tightness is upon the integral continuous gas-tight skin which I have described, and which is imposed over a package containing the desired contents. The number of package walls underlying this skin is unimportant so long as the gas opening or openings may be effected therethrough, and the presence of external walls does not vary the effect of my invention so long as these walls did not interfere with the puncturing and repair of the gas-tight skin, or were applied after such puncture and repair.

I have achieved a very simple and inexpensive process and package which provides the desired retention of inert atmospheres over a long period of time, to make a low cost package for foodstuffs and the like which offers a protection of inert atmospheres comparable to vacuum gassed metal cans.

Modifications may be made in my invention without departing from the spirit of it.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

I claim:

1. A method of packaging which includes enclosing a product to be packaged along with air in a flexible-walled enclosure to form a package, forming over all external surfaces of said package, a continuous, imperforate gas-tight covering so as to render said package gas-tight, puncturing said covering and a flexible wall of said package to effect an interchange opening, replacing the air in said package with a desired gas introduced through such an opening, and then reclosing such opening by means including an imperforate, gas-

tight covering for such opening joined in a gas-tight fashion with said first mentioned covering.

2. A method of packaging which includes providing a closed flexible package with contents therein, immersing in and withdrawing said package from a fluid which when set provides an integral gas-tight skin over the whole outer surface thereof, effecting an interchange opening through said skin and a wall of said container, removing from said package the internal atmosphere and replacing said atmosphere with another gas through said opening, and thereafter re-sealing said opening with a gas-tight covering, the said fluid being a thermoplastic sealing substance in molten condition, and the resealing being accomplished by positioning over said opening a flexible bridging member and forming over said bridging member a gas-tight skin integrally bonded with said first mentioned skin.

3. A method of packing products in controlled atmospheres, which comprises completely enclosing said products in a flexible-walled package, applying a sealing substance externally to the walls of said package to form a continuous, gas-tight skin thereabout, locating said package in a casing, puncturing said skin and a flexible wall of said package to form a gas opening, evacuating the casing, admitting a desired gas into the casing to restore atmospheric pressure and effect atmospheric exchange within the package, withdrawing the package from the casing, all without submitting the walls of the package to unequal internal and external pressures, and resealing said opening with a gas-tight skin covering said opening and integrally bonded to said first mentioned skin.

4. The process claimed in claim 1 wherein said enclosure comprises a paperboard carton and which includes the step of first wrapping said carton with a flexible substance, over which said continuous, imperforate gas-tight covering is formed.

5. The method claimed in claim 1 including the step of wrapping the said package in a non-fibrous web, resistant in itself to the passage of gas, over which the gas-tight covering is formed, and thereafter puncturing said wrapping along with said covering and flexible wall.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
248,146	Crocker	Oct. 11, 1881
1,538,277	Dula	May 19, 1925
1,632,412	McCrystal	June 14, 1927
1,692,822	Eckstein	Nov. 27, 1928
2,135,479	Berch	Nov. 8, 1938
2,281,187	Waters	Apr. 28, 1942
2,292,295	Royal	Aug. 4, 1942