

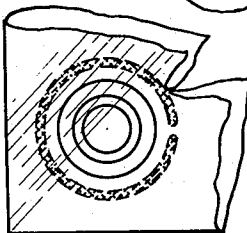
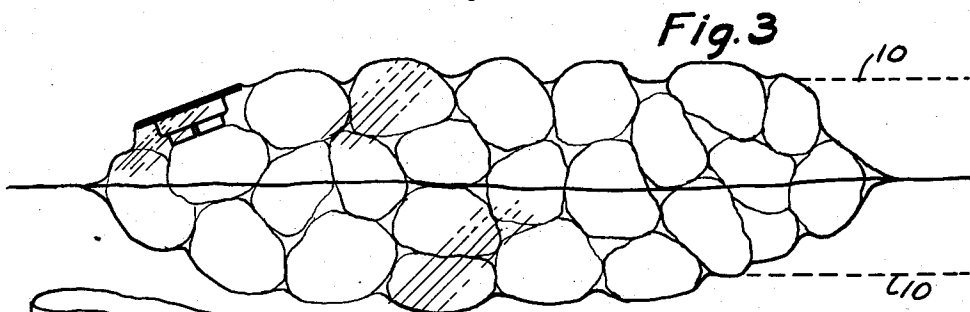
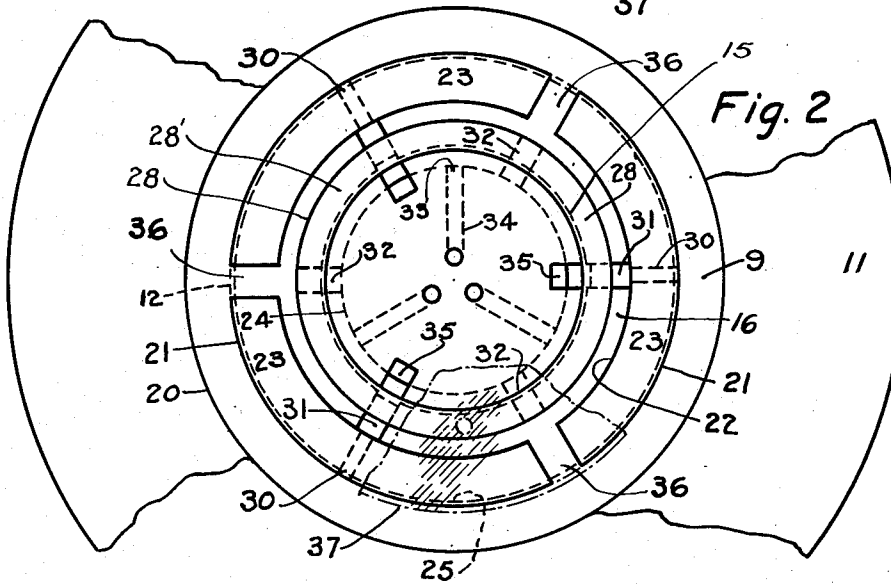
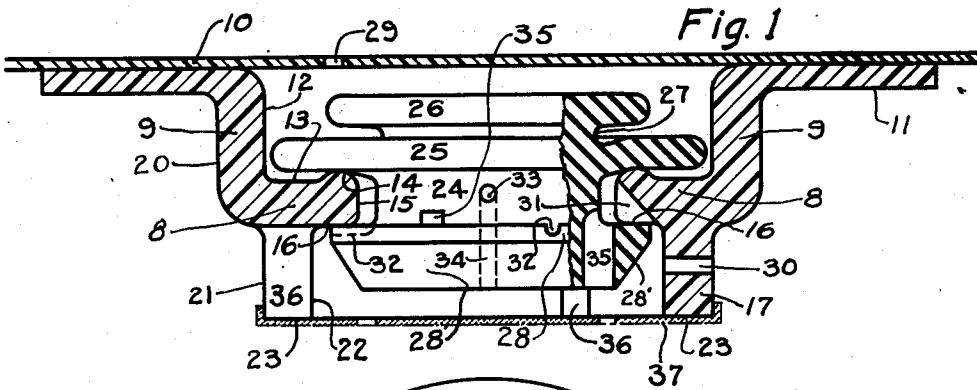
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FLEXIBLE BAG FOR VACUUM SEALING

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FLEXIBLE BAG FOR VACUUM SEALING

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This invention relates to vacuum packed flexible containers and to a method of packaging same.

With the development of the arts of packaging and preserving there has arisen what is by now a long-standing problem in the art of packages formed of flexible materials, in which articles, such as food stuffs, can be placed, but so made that the entire container can be evacuated so as to maintain the contents under a high degree of vacuum for long periods. The commercial efforts toward this end in the past have been both expensive and uncertain and therefore of limited application. This is for the reason that the method of packaging used first evacuates the bag containing the packaged materials, then, and second, while attempting to maintain the vacuum seals the previously open end of the bag or container. This has resulted in improper or inadequate degrees of evacuation, in waste of the material of the bags, through tearing off the excess necessary for the evacuation step, and, in frequent cases, in improper sealing. This is for the reason that with certain types of packaged materials of the powdered or like sort of materials to be packaged there are frequently present small powdered particles light enough to move on a current or stream of air. With the withdrawal of the entrapped air through the open end of the bag or container, these small particles moving with the withdrawing air, frequently partially ionized by friction, cling to the walls of the container, so that when the ultimate heat or like sealing occurs, the particles between the walls at the joint or connection preclude an actual tight or permanent seal, so that air seepage is permitted through the supposedly sealed bag end. Obviously this soon vents the vacuum and the packaging is improper, which is disastrous if the material is supposed to be maintained under vacuum.

Another disadvantage of the previous attempts at filling, evacuating and sealing filled flexible containers lies in the fact that with the procedures followed it is impossible to obtain more than a certain degree of evacuation, less than complete, so that there remains a certain volume of air, however thin, in effect. Or the products packaged may be such as to emit a gas during a certain period which partially or completely fills the container. With incidence to extremes of temperature, or, and more commonly, with high altitude attainment through air freight or the like, the relative increase of internal pressure by the expansion of the entrapped gas or

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air, or by the decrease of density of the external atmospheric air, in many cases increases the internal pressure to such degree as to cause bursting of the container, with consequent spoilage of the contents.

By applicant's method a bag or container is provided of suitable flexible or film material, such as one of the many available plastic sheet materials, open on one end. A performed valve unit is heat sealed or adhesively mounted on a desired area of one wall of the container. The open bag is then filled with the desired material to be packaged, and the range of such materials seems infinite, excluding only liquids, and the open end of the bag is then sealed, as by heat or adhesives or both. The materials are thus disposed in a sealed container containing entrapped air. Then the bag is exposed to an evacuated atmosphere, either enclosing the whole bag, as when a plurality thereof are to be evacuated simultaneously in a chamber, or selectively adjacent to the preformed valve unit of a given bag by a suitable manipulatable nozzle mounted thereover.

It is among the objects of this invention: to provide a cheap and economical flexible bag for the preservation under vacuum of any contents placed in the bag; to provide a sheet material with a vacuum sealing valve element; to provide a combination of a valve with a flexible container which can be simultaneously coupled together and placed under venting relations so as to facilitate vacuum sealing the container; to provide a plastic sheet with a valve seat of related material arranged for mutual heat sealing into a single unit; to improve methods of packaging material in flexible containers under vacuum; to provide a bag or flexible container with a sealed in valve unit assembly while providing an open mouth for the insertion of materials to be packaged and which is susceptible to sealing at the open mouth without regard to the internal pressures in the container, and which is thereafter subjected to exposure to differential internal and external pressures for sealing; to minimize the losses formerly due to improper sealing of flexible containers arising from particles drawn out through the mouth of the container being disposed between the contiguous portions of the bag at the sealing line; to provide a flexible container or bag for vacuum packaging contents thereof, with valve means having the property of venting internal relative pressures whenever the differential between internal and external pressures becomes appreciable, whereby

after sealing the entrapped air can be evacuated from the bag or flexible container which snaps shut and prevents the ingress of external atmosphere, and whereby any gases produced by or liberated from the contents of the bag can be safely vented without permitting external atmosphere to enter, and furthermore whereby any entrapped air or gas in the sealed bag or container, when expanding because of decrease of external pressures can vent the excess volume of gas from the bag to prevent rupture thereof under such internal pressure; to provide a method and means for packaging articles in flexible containers with an inserted entrapped gas content in the containers in contact with the contents of the container; to provide a flexible container with a preformed valve unit assembly in adherent relation to the walls of the bag so as to preclude adverse contact of the goods in the container from the valve unit; and other objects and advantages will become more apparent as the description proceeds.

In the accompanying drawings forming part of this description:

Fig. 1 represents a fragmentary section, on an enlarged scale, of a portion of the flexible sheet forming the container with a valve assembly heat-sealed thereto, and showing the opening formed in the sheet in communication with the valve for venting the air from within the bag when the latter has been filled and completed.

Fig. 2 represents a fragmentary bottom plan of the valve unit of Fig. 1.

Fig. 3 represents a bag formed according to the invention, containing articles to be preserved, after the bag has been evacuated to substantially eliminate internal air therefrom.

Fig. 4 represents a fragmentary plan of a bag or flexible container with the valve unit sealed partially away from the goods-receiving portion of the container so that venting through the valve can occur, while contact of the bag contents with the valve unit is substantially precluded.

By the invention herein, sheets or films of air-tight plastic material, such as the products known in the trade as "Pliofilm," "Saran" and the like, are provided, either as single thicknesses, or pluralities thereof in a laminated sheet, which are preferably transparent, tough, impervious to air penetration and, where required, non-toxic when used with food stuffs, all designated herein as sheets. There are many such plastic film materials which are now or will become available for use in this invention. For purposes of description, it will be assumed that the preferred material is the Dow Chemical Company's product "Saran." A sheet 10 of such film is provided, of any desired size, arranged either as a tube for sealing of the ends to form a bag or flexible container, or for folding upon itself with heat-sealed or adhesively sealed edges to form an open-mouthed flexible bag or receptacle, or for association with a similar or related sheet for heat or related adhesive sealing on three sides to form such open-mouthed flexible container. A valve unit assembly is provided, formed of a valve seat element, and a resilient, illustratively rubber, valve button or insert, operatively associated therewith. The valve seat is formed of material capable of heat sealing or adhesive attachment to the sheet 10. With polymerized materials it will be evident that solvents can be used in forming bodily mergence between the plastic components. Usually the valve seat will be of the same plastic material as the sheet. Illustrative-

ly then, the valve seat unit is also formed of "Saran" having a chemical composition identical with the sheet 10, and the valve seat unit or element is molded into the shape to be recited. The molded valve seat element molded from "Saran" is not rigid but is capable of restrained flexure, and is normally of sufficient thickness as to be generally self-sustaining. The molded valve seat unit, except possibly in the smaller inner valve seat portion where rigidity may be important, may be capable of partial flexing or yielding under certain minor stresses. The plastic valve unit as molded comprises an upper annular flange 11, of sufficient area as to insure firm sealing under heat or solvent with the surface of the sheet 10 to which it is juxtaposed in assembly. The flange is restrainedly flexible so as to conform without unsealing to the shape assumed by the contiguous areas of the sheet, as the latter conforms to packaged contents in "vacuumizing." The flange 11 merges at substantially a right angle into a generally cylindrical well 12 of such axial length as to establish adequate clearance between the top of the valve button to be described, and the inner surface of the juxtaposed portion of sheet 10, and is of such diametric width as to receive and permit flexing of the resilient flange of the valve "button" to be described. The well is formed of a wall 9 having inner wall surface 12 and outer surface 20, and internally terminates in the generally horizontal valve seat 13, which usually and preferably includes an annular crest 14, to facilitate sealing between the flexible member of the "button" to be described and the valve seat. The crest 14, if provided, or the valve seat area 13, merges more or less arcuately into the generally concentric axial valve guide surface 15, of relatively short axial extent, preferably, although obviously not essentially, parallel to, and staggered inwardly of, the wall 12. Valve seat 13, crest 14, and valve guide 15 are surfaces of a transverse or horizontal wall 8, terminating in a lower horizontal anchoring surface 16. The valve seat unit is completed by a short cylindrical guard 17, generally parallel with the wall 9 of the well 12, extending downwardly from transverse wall 8 externally radially inwardly staggered from the external surface 20 of the well, in the external guard surface 21. The guard extension 17 has an internal surface 22 of greater diameter than guide 15 so that it is radially outwardly spaced from the surface 15 of the guide, to form a clearance for the hooking portion of the valve "button." Apertures are formed in the guard extending radially completely therethrough below the surface 16 of the valve seat as shown at 30 in order to admit air to the lower surface of the valve seat, even if the end surface 23 of the guard 17 should happen to be sealed off by the contents of the ultimate bag. Any desired means can be used to prevent entry of packaged material into the guard extension 17 to a degree permitting abutment against the end of the button. Such means includes making the guard 17 longer, or attaching a guarding cap 37 or insuring that the end thereof is only abutted by a complementary sheet portion of the bag, as by enclosing the flange in a heat sealed incomplete ring joining opposite contiguous surfaces or sheets of the bag together to enclose the valve unit thereby, as shown in Fig. 4. While these apertures 30 may be drilled or otherwise formed so that they do not interrupt the end surface 23 as indicated

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at 30, for ease of formation in molding the apertures such venting apertures preferably comprises one or more axial through slots 36, extending part or the full length of the guard 17. Preferably, there are three such slots 36, in angular substantially equal spacing as shown. If desired, in the molding of the valve seat unit, small slits or slots 31 can be formed through the valve seat extending from the surface 16 to the surface 15 to permit or facilitate venting, to be described.

For operative association with the molded "Saran" valve seat as described, a single unitary resilient valve "button" is provided of soft rubber or the like, comprising a stem 24, which may be solid or hollow, and of such diameter as to enter and contract within the guide 15. Stem 24 leads at the top into a flexible flange 25 of such diameter as to overlie the valve seat 13, by extending radially outwardly beyond the crest 14 substantially out of frictional engagement with well 12. The flexible flange 25 is preferably reinforced toward the center by the smaller flexible flange 26, connected thereto by a short thick shank 27 and so designed and located as to reinforce the center of the valve unit, to preclude it from being drawn inwardly into the container under high differential internal and external pressures. The valve stem 24 at the lower end terminates in the laterally extending flanged or hooked element 28, arranged to underlie the surface 16 of the valve seat to prevent the valve button from being forced out of the valve guide by internal pressures when the outer members of the valve are subjected to vacuum conditions. The resilient unitary valve button at the lower end is tapered as at 28' to facilitate axial insertion into the valve seat unit. Preferably the stem 24, between the flanges 25 and 28 is predeterminedly a little shorter than the axial length of the valve guide 15, so that when anchored, the sealing flange 25 is biased toward and against the valve seat 13 by slight axial extension of stem 24. The relation of the axial length of the stem 24 to the valve guide 15 is predetermined to establish the differential between internal and external pressures at which the valve will unseat for venting purposes. To assist in venting, the upper surface of hook portion 28 can be provided with one or more shallow grooves or channels 32 of such length as to conduct venting air from the outer surface of hook flange 28 to delivery externally of stem 24. Alternatively or additionally, an axially extending eccentrically disposed slot 35 is formed extending through anchoring portion 28 and leading at least part way up stem 24. Slot 35 may simply axially pierce flange 28 or continue radially to the outer periphery thereof.

In assembling the flexible container, the valve button is first inserted axially to anchored relation in the valve seat, preferably, as noted, under slight axial tension on stem 24. The assembly is then placed under the sheet of material 10 in operative parallel contacting relation between elements of a heat or other sealing device. This is not shown, but preferably is of the well known electronic type. Simultaneously, preferably, but not essentially, one or more heated or cold needles or other piercing devices (not shown) are brought into contact with the sheet 10 in general registration with the well 12, to form minute apertures 29, as the only surface interruption in the sheet 10 adjacent to the valve. Al-

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ternatively according to the selected materials suitable adhesives such as partial solvents may be applied to the flange 11 which is held under pressure against sheet 10 until sealing bonding is secured.

The sheet 10 then carries, as a substantially integral part, the valve assembly, and from this sheet, in accordance with the well-known methods of procedure with such materials a bag is formed, open at one edge thereof. Let it be assumed, in Fig. 3, that the open end is at the right hand end of the bag, as shown in dotted lines. The thus prepared bag is ultimately filled through the open mouth and the open mouth is then heat sealed or adhesively bonded as shown in full lines at the right of Fig. 3. The bag then contains entrapped air. Illustratively, the contents of the bag can be any sort of food stuffs, such as dried fruits, cereals, meats, such as beefsteaks, whole carcasses of fowl, or the like. As soon as desired after the filled bag has been completed by the final edge heat or other sealing, it is exposed to "vacuumizing." This can be done in small establishments by small pumps having a sucking intake large enough to rest over and upon the sheet 10 superposed over the valve assembly, so as to pull a vacuum on the individual bags. In larger assembly plants pluralities of the filled containers are placed in large chambers at random and all are simultaneously evacuated by evacuating the chamber and holding the vacuum conditions long enough to evacuate the air from all of the sealed containers.

When the evacuation of the filled sealed containers begins, there is substantially atmospheric pressure within the bag, while at the aperture 29, and therefore on the entire surface of flange 25, there is less than atmospheric pressure. The higher internal pressure passes through one or more of the venting passages to the space beside the stem 24 under the flange 25, raising the latter slightly from the valve seat against the resilient bias of the short stem, to vent the internal air pressure in the bags. This venting continues as long as the differential pressures on the opposite sides of the flange 25 are positive on the interior of the container. As soon as the internal and external pressures become substantially identical, the flange 25 snaps down upon and against the valve seat 13, including the crest 14, if, as is preferred, such is used. The outer surface of sheet 10 adjacent to aperture 30 is then exposed to atmospheric pressure, replacing the low pressure formerly incident on the outer surface of the flange 25, and the flange 25 is forced by atmospheric pressure into tight sealing engagement against the valve seat. The vacuum thus created in the container maintains as long as the air is excluded from passage any way through the sheet 10 into the interior of the bag formed thereof. If the material is airtight, such maintenance of vacuum is a function of the completeness of the adhesive or heat sealing at the edges and between the flange 11 and sheet 10.

The advantages of the invention in cheapness, availability, maintenance of high vacuum, with visibility of the contents, will be apparent, from the preceding description, but a further advantage attaches to the invention depending somewhat upon the puncturability of the rubber valve unit. For this purpose, the valve is made hollow and the package is one in which an inert gas is to be brought into contact with the packaged goods

within the flexible bag. Such gases are those having preservative functions or being free from an oxygen content, or otherwise conducing to the preservation of the contents. With such package, after filling the bags or containers and sealing off the mouths thereof, the packages are exhausted of air in the manner described, utilizing the venting characteristics of the valve unit as before. After as high a degree of vacuum as possible is attained and held until further processing is desired, a needle communicating with a source of the replacement or inert gas or vapor is inserted through the rubber valve unit into the interior of the flexible bag, and a charge of such gas is permitted to be drawn or is forced into the bag without unsealing the valve from the plastic valve seat. The gas replacement may be a mere partial satisfying of the vacuum so that a small residual gas supply exists in a still evacuated sealed container, or the gas insert may be of a complete atmosphere, so that no actual vacuum exists in the container, but the gas content is proper to safeguard the contents thereof. With a residual vacuum, the external pressure and the rubber itself both conduce toward automatic sealing of the minute aperture formed by the inserted and then withdrawn gas needle.

Having thus described my invention, I claim:

1. A flexible bag, comprising a sheet of air-tight flexible material formed into a portion at least of a bag, a pre-formed valve unit sealed to an area of said sheet and forming with said area a box-like enclosure having appreciable depth relative to said sheet, said valve unit being of appreciably greater stiffness than the sheet to which it is attached and comprising a wall surface defining a well partially closed at the inner end by a radially inwardly extending transverse valve seat having a generally annular bore, the axis of which is substantially normal to said area, the outer end of said wall merging into a mounting flange generally parallel to the transverse valve seat and extending radially outwardly of said wall and sealingly engaged with said area, with the portion of the area extending transversely across the well forming an upper substantial closure of said enclosure, a resilient valve element having a stem disposed in said bore, a flexible flange mounted on the stem and overlying the valve seat within the well and forming with the stem and valve seat the inner substantial closure of the enclosure spaced from and protected by said portion of the area, means for effectively anchoring the stem in

the bore in spaced relation to said flexible flange, first means forming a conduit for gases from the interior of the bag to the flexible flange radially inwardly of the valve seat, second means forming a conduit for gases from the interior of said enclosure to the exterior of the bag, said stem in position being under an initial tension to hold the flexible flange against the valve seat predetermined to retain the sealing engagement of the flexible flange against said valve seat until a predetermined differential of gas pressures externally and internally of the bag exist in such sense as to permit the lifting of the flexible flange from the valve seat within the enclosure by flow through the first means to vent a given excess internal pressure from the bag, while sealing said valve against said valve seat by pressure through said second conduit means when the differential pressures externally and internally of the bag are in the opposite sense.

2. A flexible bag as claimed in claim 1, further characterized by guarding means preventing solid bag contents from blocking said first conduit means.

3. A flexible bag as claimed in claim 1, further characterized by guarding means mounted on said wall means preventing the bag contents from blocking said first conduit means.

4. A flexible bag as claimed in claim 1, further characterized by guarding means preventing the bag contents from blocking said first conduit means and comprising a compartmented portion of the bag containing said pre-formed valve unit and separated from the main portion of the bag by a peripheral area of sealing interconnection between opposite sheet areas of the bag, having a connecting opening between the compartmented and main portions of the bag forming part of the first conduit means.

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