Space saver container is a concept of shrinking containers so that its volume matches the volume of the contents. Thus as the contents are progressively consumed the container can progressively reduce in volume freeing up space outside the container for example in the closet or refrigerator where it may be stored. The reduction can be tailored to the situation in which the container is normally used. Thus in the case of say milk cartons the container reduces its foot print but in the case of ice-cream container the height is reduced thus increasing stacking space. The containers available today can create shelf space only when the contents of the containers are gone and when they are ready to be removed for disposal. The concept of space saver container volume reduction is enabled by a collapsible bellow structure that is biased to attain its maximum volume. The user forces the bellow shape to contract thus shrinking the container to match the volume of the content. To keep the shrunken volume stable a restraint means suitable to the type of container is used to balance the bias in the structure that keeps it at maximum volume. The versatility of the concept enables a wide application in situations where material is stored and space is at a premium. Additional functionality of the bellow structure can be designed into the structure to enable it to adopt a freestanding stance suitable to the application.
Space saving container example in use in a refrigerator
Day 1 of fresh filled containers vs Day 4 after contents are half.

Fig 23

Day 1

Day 1 of the week with Refrigerator Loaded with
- Half gal. reduced fat milk
- Half gal. non fat milk
- One gal. Orange juice

Ice Box
- Half gal. ice cream one flavor
- Half gal. ice cream second flavor

Refrigerator Shelf
Empty Space

Day 4

Day 4 of the week with Refrigerator Loaded with
- Half gal. reduced fat milk
- Half gal. non fat milk
- One gal. Orange juice

Ice Box
- Half gal. ice cream one flavor
- Half gal. ice cream second flavor

Refrigerator Shelf
Empty Space

Space available to restock after items shrink to a quarter of their original volume
PROGRESSIVE VOLUME ADJUSTABLE CONTAINER TO ELIMINATE UNUSED SPACE WITHIN THE CONTAINER

FIELD OF THE INVENTION

[0001] The invention, a space saver container, has wide application where efficient utilization of space is critical. The embodiments present herein are primarily directed towards containers used for storing consumables in refrigerators or closets with limited free space. The concept is simple: container volume must match the content volume throughout the process of content consumption to increase shelf space at the same rate as the rate of consumption of the contents. A measure of storage efficiency is the ratio of the volume of the material in a container to the volume of the container. When a container is full at the time of purchase, the storage efficiency is the highest, nearly 1. However, conventional containers maintain the container volume and shelf space utilization even though the contents are depleted through progressive consumption. In conventional containers, the volume of the material contained depletes the storage efficiency falls. When the container is half full, the storage efficiency becomes 0.5. Containers built to the concept of space saver container are volume adjustable to shrink in volume to the extent there is free space within the container. Thus, the storage efficiency of containers built to this concept are capable of maintaining their storage efficiency of nearly 1 through out the period they contain material, depleted or not. In effect the new containers release space to the shelf, space saver container based milk container would release space to the refrigerator as the milk is consumed. It is possible to stock up on items that are almost over as more and more space becomes available due to combined effect of other containers built to the new concept. The availability of space makes other items in the refrigerator more accessible particularly the ones stored along the back wall. To time a visit to the grocery store precisely when the contents are over is difficult and sometimes impossible. If the milk becomes a reality. The space saver container’s ability to release shelf space as soon as the contents are consumed enables restocking activity to begin well before the item is totally consumed. Thus space saver container improves accessibility, improves restocking window and reduces the risk of running out of essential items. The conventional containers in the instance of milk allow on an average a 12-hour window to re stock to have it available for breakfast the next day. This window can be considerably improved with a container built to the concept of space saver container. The disadvantage of fixed volume container storage is eliminated with adaptable volume design of the space saver container. By combining the space saver container concept with standard manufacturing practices a wide variety of storage solutions are possible. The embodiments presented herein address application of the concept to fluids and solid objects as in the case of milk, bottled water and ice cream but it is recognized that the concept can be extended to other material, objects and systems that require efficient space utilization. The ideal is a storage efficiency of 1 even when the volume of the stored entity changes.

DESCRIPTION OF PRIOR ART

[0002] There is prior art under the title of plurality of selectable volumes, which deals with cartons that by virtue of different folds create different volumes. Once assembled, the volume is fixed and the container behaves like a fixed volume container. There was no discovery of prior art on container design that retains adjustability of volume once assembled. The issues of stacking up and accessibility exist because of inability of the currently available containers to adapt their size to the volume of the content of the containers if so required by the consumer.

SUMMARY OF THE INVENTION

[0003] The concept of adjusting container volume to match the volume of the content is the basis of the invention referred to as space saver container.

[0004] The concept has been illustrated by applying it to four typical usages. Each application has differences in construction but substantially use the same principle. The differences have been highlighted through four embodiments:

[0005] Embodiment 1 is the application of the concept to half-gallon container for milk using elastic material to create a container composed of bellow biased for maximum extension. The bellow can be compressed and in the process behaves like a compressed coil spring that is stabilized through a restraint means, which enables the new shape to be stable. The reduction of volume is accompanied by reduction of footprint. In operation the restraint means is a ball chain. One end of the chain is a ball called anchor ball and the other end is a smaller ball called the latch ball. When a reduced volume is desired the user compresses the surfaces and pulls on the latch ball to take up the slack. The appropriate ball in sequence gets latched to hold the new shape of the container.

[0006] Embodiment 2 is the application of the concept to larger heavier containers that need a special handle. Balanced weight distribution becomes a requirement and has been addressed using an elastic material to create a pair of bellows symmetrically placed around the handle as a part of the container enclosure. The restraint means is identical to embodiment 1. Space saving is accompanied by reduction of footprint.

[0007] Embodiment 3 is the application of the concept using a non-elastic material to create container that can collapse by creating folds in the construction material like stiff paper sheets. (A single fold is a particular case of a bellow). The restraint means is different from embodiment 1 & 2. Space saving is accompanied by reduction of footprint.

[0008] Embodiment 4 is the application of the concept with the volume shrinkage taking places transverse to the ground or the seat of the container. This application shows its adaptation to solids like ice cream containers. Space saving is through reduced container height without change of footprint.

[0009] The embodiments are aimed at creating space outside even as the contents are progressively depleted. The FIG. 23 contrasts the front of a refrigerator shelf and an ice box laden with space saver containers on day 1, when the contents are full, to day 4 when it is assumed that more than
half the contents are gone. Typically such containers would be loaded with milk, fruit juice, water, yogurt and ice creams.

DESCRIPTION OF THE DRAWINGS


[0011] FIG. 1 is the perspective of freestanding space saver container applied to a ½ gallon milk carton.

[0012] FIG. 2 is the side elevation of FIG. 1. The shape is naturally biased to stretch to a shape of maximum volume shown in this figure.

[0013] FIG. 3 is the exterior side profile of bias restraint of space saver container.

[0014] FIG. 4 is the view of space saver container compressed laterally. This is the view when a portion of the content is removed the remaining space is eliminated by shrinking the container.

[0015] FIG. 5 is the elevation of space saver container compressed further over the shrunk figure shown in FIG. 4.

[0016] FIG. 6 is view of FIG. 1 with the bias restraint, as it would normally be assembled with the container.

[0017] FIG. 7 is the elevation of the space saver container as seen along direction x-x shown in FIG. 2.

[0018] FIG. 8 is the elevation of the space saver container as seen along the direction y-y shown in FIG. 2.

[0019] FIG. 9 is the magnified alternate view of the section of FIG. 6 depicting the restraint means placement in the air tunnel tube and its application as a balance to bias with latch and anchor combination.

[0020] Embodiment 2 FIGS. 10 to 13 and 23.

[0021] FIG. 24 is the perspective view of embodiment 2.

[0022] FIG. 10 is the side elevation of the embodiment 2.

[0023] FIG. 11 is the side elevation of FIG. 10 along the direction a-a.

[0024] FIG. 12 is the side elevation of the restraint means called the ball chain.

[0025] FIG. 13 is the bottom view of the seat of the FIG. 10 along the direction b-b.

[0026] Embodiment 3 FIG. 14 to FIG. 18.

[0027] FIG. 14 is the perspective of embodiment 3.

[0028] FIG. 15 is the side elevation of the restraint means of embodiment 3. It has a ball and loop arrangement to enable it to arrest the outward expansion of the container under the influence of its natural bias.

[0029] FIG. 16 depicts the restraint means latching, ball and loop arrangement.

[0030] FIG. 17 is the plan of the embodiment with the restraint means forming a belt around the embodiment to prevent the container from fill expansion.

[0031] FIG. 18 is side elevation of the embodiment showing its freestanding position with the restraint means.

[0032] Embodiment 4 FIG. 19 to FIG. 20.

[0033] FIG. 19 is the perspective view of the embodiment 4. It is two component assembly. The sealed tunnel bellow and the lid form the container.

[0034] FIG. 20 is the side elevation of the embodiment 4. 405 is one surface represented by the lid cover. 410 is the tunnel bellow and 415 is the second surface represented by the bottom seat.

[0035] FIG. 21 is the side elevation of FIG. 19 when the lid 405 bears down on the walls 410 of the tunnel bellow. The figure shows the reduced volume. The figure in this reduced volume mode is placed in confined enclosure like a closet or an icebox. The tunnel bellow expands due it’s natural bias into the free space if it is available. If not it expands until it meets a restraining force provided by the reaction due an immovable surface or an object. An adjacent object or surface provides the restraint means in this embodiment. It is possible to provide the restraint means of embodiment 3 if so required.

[0036] FIG. 22 is the plan of the lid derived from FIG. 20. The lid has diameter proportioned to fit the tunnel bellow.

DETAILED DESCRIPTION OF THE EMBODIMENTS SHOWN

[0037] FIGS. 1 to 9 describe embodiment 1 of about half gallon container that can be used as milk/fruit juice or any other fluid container. The embodiment is made from elastic material.

[0038] FIGS. 10 to 13 & 24 describe embodiment 2 of about one gallon carton that can be used for milk/fruit juice or as any other fluid container. The embodiment is made from elastic material.

[0039] FIGS. 14 to 18 describe embodiment 3 of about half gallon container for fluids that uses folds in sheet to collapse the container. It is built out of sheets that use folds as a mechanism to collapse.

[0040] FIGS. 19 to 22 represent embodiment 4 as container that shows bellow as walls between the lid (surface 1) and the seat of the container as (surface 2) to create an enclosure that can collapse into the free space within the container.

[0041] FIG. 23 shows the space utilization with space saver containers in a typical use in refrigerator.

[0042] The techniques for manufacturing these embodiments are the same as the ones used for the conventional containers namely blow mold and injection molding and differences if any are well within the skills of one trained in these processes.


[0044] FIG. 1 is the perspective view of the concept of space saver container as applied to a half-gallon milk container.

[0045] FIG. 2 is a side elevation of the first embodiment of the space saver container. 2, 3 are pair of parallel sides of the container referred to as surfaces.

[0046] 14 is the entire tunnel bellow that connects the surface 2 to 3. 40 is the air tunnel tube that creates a passage between the surfaces 2 to 3.
Surfaces 2 and 3 are rectangular, parallel and form two sides of the container.

The container storage space is created between the inner walls of 14, surfaces 2 and 3 and the outer walls of 40.

The construction is such that when the surfaces 2,3 are compressed together the tunnel bellow and the air tunnel tube act like coiled springs and provide the bias to restore the original distance between the surfaces.

10 is the snout or access to the container storage space. 12 is the lid to the snout that secures the contents from spillage.

15 through 22 and 23 through 30 are the folds of the tunnel bellow 14.

Edges 15 through 22 and 23 through 30 are planar edges that form two parallel planes orthogonal to the walls 2 and 3.

The air tunnel tube two ends are 4 and 5. The distance between them is equal to the bellow tunnel and its surface is composed of folds that number equal to the folds on the tunnel bellow. The folds in the air tunnel tube co-operate with the folds of the tunnel bellow to enable the surfaces 2,3 to come together or apart without affecting the integrity of the container as an enclosure.

The end 4 of the air tunnel tube has a funnel mouth that is referred to as anchor seat 13. The end 5 of the air tunnel tube has a blister latch 6 with four slits.

The blister latch is proportioned to cause an interference with the latch balls 31 to 38. The interference is sufficient to enable the balls to pass through with reasonable force.

FIG. 3 is the side elevation of the restraint means called the ball chain. The ball chain is used to prevent the surfaces 2,3 from springing back to their original distance between them.

The ball chain has a larger ball on one end and multiple smaller balls all linked together. The larger ball 30 is the anchor ball and the other balls 31 through 38 are the latch balls.

Ball 30 has a diameter larger than the diameter of the bellow tubes 4 to 5. Balls 31 through 38 are 8 latch balls of the ball chain connected through links to form a chain. Balls 31 to 38 have a diameter that enables them to force an entry through the blister latch slits. The diameters are smaller than the diameter of the bellow tube 4,5. Between one of the balls 31 to 38 and the anchor ball 30 the restraint means balances the natural bias of the bellow tunnel and the bellow tube.

The ball chain is placed in the air tunnel tube with anchor ball 30 seated on the anchor seat 13 and the latch ball 38 latched into the blister latch 6 when the container is at maximum volume. FIG. 6 Once the surfaces 2,3 are compressed together the ball 38 is pulled along the axis of air tunnel tube to take up the slack of the ball chain. The ball chain is pulled enough till the slack is taken up and the next latch ball latches into the blister latch.

FIG. 4 is the side elevation of the structure FIG. 2 with surfaces 2,3 shrunk along the axis 4,5 of the bellow tube.

FIG. 5 is the side elevation of the structure FIG. 2 with surfaces 2,3 shrunk along the axis 4,5 of the bellow tube. The shrinking is limited by the thickness of the pleats 15 through 30.

FIG. 6 is the same as FIG. 2 but showing the placement of the ball chain in the air passage of the bellow tube. Ball 30 anchored on the end 4 and ball 38 latched into the blister latch slits.

FIG. 7 is the front elevation of FIG. 2 as seen from direction x-x. Blister Latch 6 is shown with slits 40, 41, 42, 43. The perimeter of the wall 3 in FIG. 2 is seen from the front. 12 is the front elevation of the screw cap sealing the snout 10 of the space saver container.

FIG. 8 is the rear elevation of the space saver container as seen along y-y shown in FIG. 2. The wall 2 along with the mouth of the bellow tube end 4 is seen in this view. 13 is the anchor seat for the anchor ball 38 (FIG. 2)

FIG. 9 is the elevation of a magnified view of the air tunnel tube with the ball chain. The ball 30 is anchored while seated in anchor seat 13. Latch ball 38 is latched into the blister latch 6.

Embodiment 2

Embodiment 2 has all the elements of embodiment 1 above which are: tunnel bellows, air tunnel tube, ball chain, anchor and latch restraint means, access to the enclosure for fluid loading and unloading and lid to seal the access.

The differences are that container has a handle 70 and a pair of bellows symmetrically disposed around the handle. A main conduit 80 that connects to the pair of tunnel bellows that have sealed ends.

The container volume can be reduced by compressing the two sealed ends of the tunnel towards each other similar to the functionality of embodiment 1 above.

FIG. 24 is the perspective of embodiment 2.

FIG. 10 is the elevation of the space saver container embodiment 2. It has all the elements of embodiment 1 described above with the addition of handle (70). 74 is the anchor seat for the anchor ball.

FIG. 11 is the elevation of FIG. 10 as seen along a-a. 81 and 85 are two tunnel bellows that form wings to the main section of the container that has a fixed main conduit 80 connected to the tunnel bellows.

74 is the anchor seat for the anchor ball.

95 is the Blister Latch with Slits.

90 to 95 is the bellow tube that houses the ball chain restraint.

FIG. 12 is the elevation of the Ball Chain restraint that shows the Anchor Ball 100 and Latching Balls 101 to 115.

FIG. 13 is the view of FIG. 10 seen along the arrow b-b. This is also the seat of the space saver container on which the space saver container can stand upright. The elements 81, 80 and 85 are substantially planar.
Embodiment 3

This illustrates the concept of the space saver container by using a single pleat bellow that is formed by creating a fold in a stiff paper sheet. The choice of paper material can provide the natural bias for the container to hold on to the maximum volume of the designed shape and volume of the container.

FIG. 14 is the perspective of a collapsible container. For ease of viewing and understanding how this design enables the container to reduce in volume the critical lines of fold and angles between edges are labeled.

Surfaces 300 and 301 by application of force directed towards each other can be forced to approach each other causing the structure to fold along lines c1, c2, c3, c4, f1, f2, 13, & 14. This causes the angles t1, t2, t3, t4, t5, t6, t10, t11, t12, t13, t14, t15t0 reduce thus the volume of the container can be reduced until the surface 300 touches surface 301 which is when the volume of the container content is nearly zero.

A restraint in the form of a loop ball belt is tightened around the sides as shown in subsequent figures (FIGS. 17, 18).

FIG. 15 is the side elevation of the restraint means called the ball loop chain that has a loop (305) on one end connected to a chain of balls. The ball diameters are dimensioned to be able to pass through the loop but large enough for the loop to capture them if the chain is under tension. The loop under tension becomes elliptical thereby creating interference with the balls and in the process latching them.

FIG. 16 is the side elevation of the restraint means with the end ball inserted through the loop of the ball chain.

FIG. 17 is the plan of the embodiment 3 with the ball loop chain belted around the embodiment 3 with the ball end latched to the loop of the chain. The ball end can be tightened like a belt to enable any of the reduced volumes to be stable.

Embodiment 4

This embodiment is presented to show the application of the concept to an ice cream container. The two surfaces that can be compressed towards each other are the lid 405 and the bottom seat 415 of the container. The walls 410 of the container form the tunnel bellow. The contents being frozen allow only the portion of the tunnel bellow free of the frozen material to compress until the lid touches the frozen surface of the contents. The embodiment retains its footprint but shrinks along the vertical axis. The benefit to this design is the ability to stack items over the package since the container through compression releases space over the structure. The restraint means is obtained by external means through the top surface of the icebox or the stacking weight of other containers placed over it. The design enables the container to be compressed into a tight fit enclosure. If required a restraint means similar to embodiment 3 can be incorporated.

Embodiment 5

FIG. 19 is the perspective of embodiment. The press fit lid captures the bellow tunnel to seal the contents. The bellow tunnel is biased to attain maximum extension.

FIG. 20 is the side elevation of embodiment 4. 405 is the side elevation of the lid that acts as one of the surfaces of the enclosure formed between the bottom seat 415 (the second surface), tunnel bellow 410 and the lid 405.

FIG. 21 is the side elevation of FIG. 20 after the top surface is compressed. The container is shown empty so the bellow is shown compressed uniformly. When the container has frozen ice cream it compresses only in the empty space above the frozen ice cream.

FIG. 22 is the plan of the lid or 405 viewed along the direction e-e in FIG. 20.

What is claimed is:

1. A container for storage capable of volume adjustment when partially loaded comprising:
   a. at least a pair of surfaces,
   b. at least one reversibly collapsible tube means connecting the two surfaces forming a sealed enclosure,
   c. biasing means to enable the collapsible enclosure to assume maximum volume,
   d. at least one access means to the enclosure for loading and unloading material,
   e. restraint means to stabilize the collapsible enclosure in any of the altered shapes.

2. The container according to claim 1 wherein the enclosure is provided with a sealing means to seal the access to the enclosure.

3. The container according to claim 1 wherein the enclosure is provided with a handle means to be able to lift the container for loading and unloading the contents.

4. The container according to claim 1 wherein the enclosure is provided with a seat means to enable the container to be self supporting structure.

5. A volume adjustable storage container comprising:
   a. a pair of opposite surfaces
   b. at least one compressible collapsible bellow having a variable length, the bellow joining the opposite surfaces to form a sealed enclosure and urging the surfaces apart to define a maximum volume configuration and
   c. restraint means for stabilizing the container in at least one altered volume configuration.

6. The container according to claim 5, wherein the restraint means comprises
   a. a chain
   b. first means coupling the chain to one of the surfaces of the container at a first position along the chain; and
   c. second means coupling the chain to the other of the surfaces of the container at a second position located at a variable distance from the first position along the chain, wherein the distance between the first and second position on the chain determines the length of the bellow.

7. The container according to claim 5, wherein the bellow is contoured to have substantially planar edges enabling the container to stand on horizontal surface in at least one reduced configuration.
8. The container according to the claim 5, wherein the container comprises an opening for receiving a product and a closure for sealing the opening.

9. The container according to claim 5 further comprising a handle for facilitating lifting and tilting of the container.

10. A volume adjustable storage container comprising:
   a pair of surfaces connected to each other through at least one compressible collapsible bellow biased for maximum extension forming a sealed enclosure and the surfaces being detachable to create an access to the enclosure, the enclosure capable of maintaining enclosure integrity in the altered volume and in any of the altered positions of the bellow when any suitable restraint is applied to the bellow.

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