

Collapsible Insulated Grocery Tote with Removable Phase-Change Cold Panel and Visual Temperature Indicator

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Cross-Reference to Related Applications

This non-provisional utility patent application is filed by Dana Whitlock of Madison, Wisconsin, assigned to Northfield Home Labs, Inc. This application does not claim priority to or the benefit of any earlier-filed U.S. provisional, non-provisional, or international patent applications. No related applications are pending or have been issued that form a basis for continuity-in-part, continuation, or divisional status. The subject matter disclosed herein is presented as an original invention without reliance on prior filing dates for priority purposes.

Field of the Invention

The present invention relates generally to portable insulated containers for transporting temperature-sensitive goods. More specifically, the invention pertains to a collapsible grocery tote incorporating a removable phase-change cold panel configured to maintain an internal temperature of approximately 4 degrees Celsius for at least six hours, and an external color-changing temperature indicator strip.

The invention falls within the technical domain of insulated flexible carriers, distinguishable from rigid coolers and single-use packaging, and is classified under CPC classes B65D 81/34 and B65D 33/00.

Background of the Invention

Portable insulated containers for transporting groceries and other temperature-sensitive items are well known in the art. Traditional rigid coolers provide effective thermal insulation but suffer from significant drawbacks regarding storage and portability when not in use. To address these issues, collapsible fabric totes with insulating liners have become popular. However, existing collapsible totes often rely on generic ice packs or frozen gel packets that are loosely placed within the main compartment.

A primary deficiency in current collapsible tote designs is inadequate thermal hold time. Without a structured thermal mass integration, cold air escapes rapidly through the flexible walls and opening, failing to maintain safe temperatures for perishable goods during extended transit. Existing solutions typically lack real-time external temperature verification. Users cannot determine if the contents remain within a safe temperature range without opening the tote, which further compromises thermal integrity.

Another limitation is the use of non-replaceable or poorly secured cooling elements. Many prior art devices integrate cooling gels directly into the liner, preventing replacement or recharging, or utilize loose packs that shift during transport and create uneven cooling zones. There remains an unmet need for a collapsible tote that integrates a removable, standardized phase-change cold panel capable of maintaining specific temperatures, such as 4 degrees Celsius, for extended periods, coupled with an externally visible indicator to verify thermal status without breaching the insulation.

Summary of the Invention

The present invention addresses the limitations of conventional collapsible grocery totes by integrating a removable phase-change cold panel and an external visual temperature indicator. Existing solutions often

fail to maintain safe temperatures for perishable goods during extended transport or lack mechanisms for users to verify thermal status without opening the container.

This invention provides a collapsible insulated tote comprising a flexible shell with reinforced sidewalls, a base, and an open top. A key feature is a dedicated insertion channel configured to receive a removable phase-change material (PCM) panel. The PCM panel is engineered to maintain an internal temperature of approximately 4 degrees Celsius for a duration of at least six hours under standard ambient conditions.

Additionally, the tote includes a color-changing temperature indicator strip affixed to an exterior wall. This strip provides a real-time, non-invasive visual cue regarding the internal thermal environment, transitioning between distinct colors to signal whether the contents remain within a safe temperature range. The combination of the collapsible structure for storage efficiency, the standardized removable cooling element for consistent performance, and the external indicator for user confidence represents a significant advancement in portable thermal containment systems.

Brief Description of the Drawings

FIG. 1 is a perspective view of the collapsible insulated grocery tote in an expanded, operational configuration, showing the exterior wall, the handle assembly, and the location of the color-changing temperature indicator strip.

FIG. 2 is a perspective view of the collapsible insulated grocery tote in a collapsed, storage configuration, illustrating the foldable side panels and the base structure.

FIG. 3 is a cross-sectional view taken along line 3-3 of FIG. 1, detailing the insertion channel for the removable phase-change cold panel and the alignment of the thermal conductive interface between the panel and the indicator strip.

FIG. 4 is an exploded perspective view of the removable phase-change cold panel, showing the sealed containment vessel, the phase-change material core, and the rigid outer casing.

FIG. 5 is a front elevational view of the exterior wall of the tote, highlighting the position and dimensions of the color-changing temperature indicator strip relative to the panel insertion zone.

FIG. 6 is a schematic diagram illustrating the thermal response curve of the phase-change material and the corresponding color transition thresholds of the indicator strip over a six-hour period at an ambient temperature of 25 degrees Celsius.

Detailed Description of the Preferred Embodiment

Referring now to the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views, FIG. 1 illustrates a perspective view of a collapsible insulated grocery tote 10 in an expanded, operational configuration. The tote 10 comprises a flexible outer shell 12 constructed from a durable, water-resistant fabric such as polyester or nylon, and an inner lining 14 formed of a thermally reflective material, such as aluminum foil laminated to polyethylene foam. The outer shell 12 and inner lining 14 define an interior cavity 16 configured to receive grocery items. A plurality of structural supports

18, preferably rigid plastic or metal stays, are integrated into the side walls of the tote 10 to maintain the expanded shape during use while allowing the tote 10 to collapse flat for storage when the supports 18 are folded.

As shown in FIG. 2 and FIG. 3, the tote 10 includes a dedicated panel receptacle 20 located on an interior wall of the cavity 16. The panel receptacle 20 is defined by a sleeve or pocket formed between the outer shell 12 and the inner lining 14, or alternatively, as a distinct compartment accessible via a zipper or Velcro closure 22. A removable phase-change cold panel 30 is sized to fit snugly within the panel receptacle 20. The cold panel 30 comprises a sealed housing 32 containing a phase-change material (PCM) 34. The PCM 34 is selected to have a phase transition temperature of approximately 4 degrees Celsius. In one embodiment, the PCM 34 is a eutectic salt solution or a specialized gel formulated to maintain a temperature of 4 degrees Celsius plus or minus 1 degree Celsius for a duration of at least six hours when exposed to ambient temperatures of up to 25 degrees Celsius. The housing 32 is made of a high-density polyethylene (HDPE) or similar food-safe, leak-proof plastic.

Thermal Performance Specification. The phase-change material is engineered to hold 4 degrees Celsius for six hours. This performance metric is indicative based on standard thermal testing conditions; actual duration may vary based on ambient temperature and frequency of tote opening. Confirm specific PCM formulation data with supplier before mass production.

FIG. 4 and FIG. 5 illustrate a color-changing temperature indicator strip 40 affixed to an exterior surface of the outer shell 12. The indicator strip 40 is positioned adjacent to the panel receptacle 20 such that it is thermally coupled to the cold panel 30 when inserted. The indicator strip 40 comprises a liquid crystal display (LCD) or thermochromic ink layer 42 that changes color in response to temperature variations. For example, the strip 40 may display a blue color when the temperature of the cold panel 30 is at or below 4 degrees Celsius, indicating optimal cooling, and shift to green, yellow, or red as the temperature rises above 4 degrees Celsius, providing a visual cue to the user regarding the remaining efficacy of the cooling element. The indicator strip 40 is visible from the outside of the tote 10, allowing users to verify the internal temperature status without opening the tote 10.

FIG. 6 shows a cross-sectional view of the assembly. The tote 10 further includes handles 50 attached to the upper rim of the outer shell 12 for carrying. The handles 50 may be padded for comfort. The collapsible nature of the tote 10 is facilitated by hinge points 52 in the structural supports 18. When the cold panel 30 is removed via the closure 22, the tote 10 can be cleaned more easily. The modularity of the cold panel 30 allows users to freeze multiple panels and rotate them, ensuring continuous cooling capability. The integration of the indicator strip 40 directly on the exterior wall provides a non-intrusive monitoring system that does not compromise the insulation integrity of the inner lining 14.

What is claimed is:

1. An apparatus for transporting temperature-sensitive items, comprising: a collapsible shell formed from a flexible insulated material, said shell defining an interior volume and having an open top; a rigid support frame integrated within walls of said collapsible shell to maintain structural integrity when expanded; a removable phase-change cold panel configured to be inserted into a dedicated pocket within said interior

volume, wherein said panel contains a phase-change material calibrated to maintain a temperature of approximately 4 degrees Celsius for at least six hours under standard ambient conditions; and a color-changing temperature indicator strip affixed to an exterior wall of said collapsible shell, said strip being thermally coupled to said interior volume to provide a visual indication of the internal temperature.

2. The apparatus of claim 1, wherein the phase-change material comprises a water-based gel encapsulated in a leak-proof polymer casing.

3. The apparatus of claim 1, wherein the dedicated pocket includes a zipper closure to secure the removable phase-change cold panel.

4. The apparatus of claim 1, wherein the color-changing temperature indicator strip changes from blue to red when the internal temperature exceeds 10 degrees Celsius.

5. The apparatus of claim 1, wherein the flexible insulated material comprises a layer of closed-cell foam laminated between two layers of polyester fabric.

6. The apparatus of claim 1, further comprising a handle attached to the open top of the collapsible shell.

7. The apparatus of claim 1, wherein the rigid support frame comprises plastic ribs embedded within the side walls of the collapsible shell.

8. A removable phase-change cold panel for use in an insulated container, comprising: a sealed enclosure formed from a durable polymer; a phase-change material contained within said sealed enclosure, said material having a freezing point of approximately 4 degrees Celsius; and a flat geometric profile configured to slide into a complementary pocket within an insulated grocery tote, wherein the panel is sized to provide thermal mass sufficient to maintain an internal temperature of 4 degrees Celsius for six hours.

9. The panel of claim 8, wherein the sealed enclosure includes a textured surface to enhance thermal contact with items placed adjacent thereto.

10. The panel of claim 8, wherein the phase-change material is non-toxic and biodegradable.

11. The panel of claim 8, further comprising a handle molded into one edge of the sealed enclosure for easy removal.

12. The panel of claim 8, wherein the sealed enclosure is resistant to puncture and leakage under normal use conditions.

13. A method of using a collapsible insulated grocery tote, comprising: expanding a collapsible shell having insulated walls and a rigid support frame; inserting a removable phase-change cold panel into a dedicated pocket within the shell, wherein the panel is pre-chilled to activate a phase-change material calibrated to 4 degrees Celsius; placing temperature-sensitive items into the shell adjacent to the panel; closing the open top of the shell; and monitoring a color-changing temperature indicator strip on an exterior wall of the shell to determine if the internal temperature remains within a safe range.

14. The method of claim 13, further comprising removing the panel after use and refreezing it for subsequent use.

15. The method of claim 13, wherein monitoring the indicator strip involves visually checking for a color change from blue to red.
16. The method of claim 13, further comprising collapsing the shell for storage when not in use.
17. The apparatus of claim 1, wherein the collapsible shell includes a base reinforced with a rigid insert.
18. The apparatus of claim 1, wherein the color-changing temperature indicator strip is reversible.
19. The panel of claim 8, wherein the phase-change material has a latent heat of fusion of at least 200 kJ/kg.
20. The method of claim 13, wherein the dedicated pocket is located on a bottom wall of the collapsible shell.

Abstract

A collapsible insulated grocery tote includes a flexible outer shell, an insulating liner, and a removable phase-change cold panel configured to maintain an internal temperature of approximately 4 degrees Celsius for at least six hours. The tote features a color-changing temperature indicator strip mounted on an exterior wall, providing a visual confirmation of the internal thermal state without opening the container. The phase-change panel is inserted into a dedicated sleeve within the liner, allowing for replacement or recharging. The shell collapses for storage when the panel is removed. This configuration addresses the need for portable, reusable thermal transport with real-time external temperature verification.