BRIEF SUMMARY OF THE INVENTION

Embodiments of the present invention seek to provide a packaging system that utilizes a convection based cooling approach to eliminate the need for side refrigerants and increase packaging efficiency. Embodiments of the invention also seek to reduce the amount of refrigerants required.

According to a first aspect of the present invention, there is provided a packaging system for shipping a temperature sensitive payload, the packaging system comprising: a housing comprising a bottom panel, a top panel located above and in spaced vertical alignment with the bottom panel, side panels extending vertically between the bottom panel and the top panel, and end panels extending vertically between the bottom panel and the top panel, the housing defining a product compartment for holding a payload; and a channel member affixed to at least one of the side panels or end panels, the channel member comprising an inner facing panel, an outer facing panel connected to the inner facing panel by side panels, and one or more internal panels disposed between the inner facing panel and the outer facing panel; the inner facing panel, the outer facing panel and the one or more internal panels defining a series of alternating inner channels and outer channels configured to allow vertical air circulation in vertical flow paths that alternate between upward flow through the outer channels and downward flow through the inner channels.

According to a second aspect of the present invention, there is provided a packaging system for shipping a temperature sensitive payload, the packaging system comprising: a housing comprising a bottom panel, a top panel located above and in spaced vertical alignment with the bottom panel, side panels extending vertically between

the bottom panel and the top panel, and end panels extending vertically between the bottom panel and the top panel, the housing defining a product compartment for holding a payload; and a channel member affixed to at least one of the side panels or end panels, the channel member comprising one or more corrugated structures, the one or more corrugated structures defining a series of adjacent, laterally spaced outer channels having a rectangular cross section and designed to carry warmed air upward and a series of adjacent, laterally spaced inner channels having a rectangular cross section and designed to carry cooled air downward.

There is provided a packaging system is provided that comprises a housing defining a product compartment for holding a temperature sensitive payload, one or more bottom cooling layers and one or more top cooling layers. The housing comprises a bottom panel, a top panel located above and in spaced vertical alignment to the bottom panel, side panels extending vertically between the bottom panel and the top panel, and end panels extending vertically between the bottom panel and the top panel. The bottom cooling layers are located between the bottom panel and the payload. The top cooling layers are located between the payload and the top panel. The hollow vertical posts are disposed within the product compartment adjacent the side panels or end panels.

The packaging system comprises one or more channel members affixed to interior surfaces of the side panels and/or end panels to facilitate convective air circulation within the product compartment. Each channel member has an open top end and an open bottom end and defines a plurality of vertical channels.

The channel member may be made of folded and glued corrugated board, and may comprise an inner facing panel and an outer facing panel connected by side panels and defining an interior space. An internal panel is disposed within the interior space and is folded in accordion fashion along vertical inner fold lines and along vertical outer fold

CLAIMS

1. A packaging system for shipping a temperature sensitive payload, the packaging system comprising:

a housing comprising a bottom panel, a top panel located above and in spaced vertical alignment with the bottom panel, side panels extending vertically between the bottom panel and the top panel, and end panels extending vertically between the bottom panel and the top panel, the housing defining a product compartment for holding a payload; and

a channel member affixed to at least one of the side panels or end panels, the channel member comprising an inner facing panel, an outer facing panel connected to the inner facing panel by side panels, and one or more internal panels disposed between the inner facing panel and the outer facing panel;

the inner facing panel, the outer facing panel and the one or more internal panels defining a series of alternating inner channels and outer channels configured to allow vertical air circulation in vertical flow paths that alternate between upward flow through the outer channels and downward flow through the inner channels.

2. The packaging system of claim 1 wherein:

the one or more internal panels form two sides of each of a series of alternating inner tubes and outer tubes.

3. The packaging system of claim 2 wherein:

the one or more internal panels is a single internal panel folded in accordion fashion.

4. The packaging system of claim 3 wherein:

the internal panel is folded in accordion fashion along vertically oriented inner fold lines which define inner apexes and along vertically oriented outer fold lines which define outer apexes;

each of the inner tubes has a triangular cross sectional profile and comprises an inner facing base and two angled sides, the inner facing base is a part of the channel member inner facing panel and extends from an inner apex to an adjacent inner apex, each angled side is a part of the internal panel, and the angled sides extend from adjacent inner apexes to a common outer apex; and

each of the outer tubes has a triangular cross sectional profile and comprises an outer facing base adjacent the housing and two angled sides, the outer facing base is a part of the channel member outer facing panel and extends from an outer apex to an adjacent outer apex, each angled side is a part of the internal panel, and the angled sides extend from different outer apexes to a common inner apex.

5. The packaging system of claim 1 wherein:

each adjacent pair of tubes shares a common angled side.

6. The packaging system of claim 1 wherein:

the internal panel is made of corrugated board having flutes that run horizontally.

7. The packaging system of claim 1 wherein:

the distance between the inner panel and the outer panel is at least 2.54 centimeters.

8. The packaging system of claim 1 wherein:

the channel member includes an outer layer of material wrapped around the inner facing panel, the outer facing panel and the side panels.

9. The packaging system of claim 1 wherein:

the channel member is spaced from the top panel and from the bottom panel a sufficient distance to allow air to flow through the channel member.

10. The packaging system of claim 1 wherein:

a channel member is affixed to each of the side panels and end panels.

11. A packaging system for shipping a temperature sensitive payload, the packaging system comprising:

a housing comprising a bottom panel, a top panel located above and in spaced vertical alignment with the bottom panel, side panels extending vertically between the bottom panel and the top panel, and end panels extending vertically between the bottom panel and the top panel, the housing defining a product compartment for holding a payload; and

a channel member affixed to at least one of the side panels or end panels, the channel member comprising one or more corrugated structures, the one or more corrugated structures defining a series of adjacent, laterally spaced outer channels having a rectangular cross section and designed to carry warmed air upward and a series of adjacent, laterally spaced inner channels having a rectangular cross section and designed to carry cooled air downward.

12. The packaging system of claim 11 wherein:

the outer channels are larger in cross sectional area than the inner channels .

13. The packaging system of claim 12 wherein:

each outer channel has a lateral dimension greater than the lateral dimension of each inner channel.

14. The packaging system of claim 13 wherein:

each outer channel has a width twice the width of each inner channel.