April 12, 1949. G. MERKLE 2,467,268

SHIPPING PACKAGE USING DRY ICE

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Fig. 1.

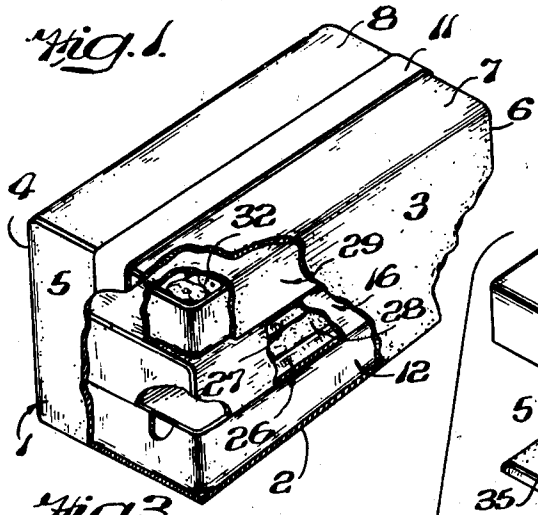


Fig. 3.

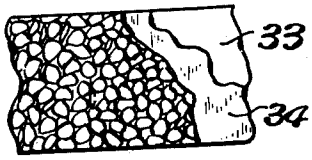


Fig. 4.

Fig. 5.

Fig. 6.

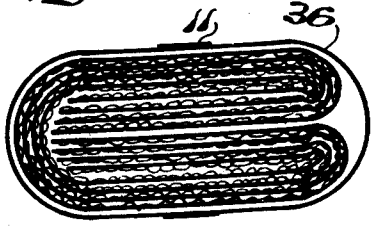
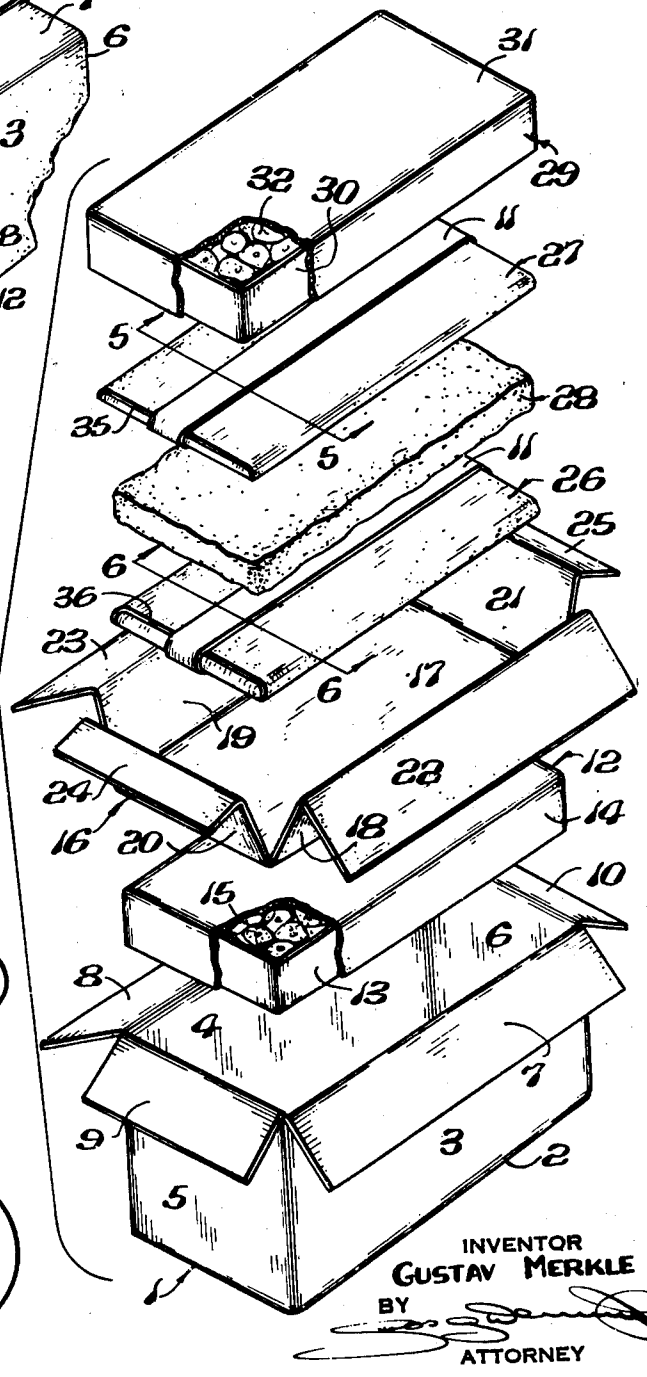


Fig. 2.



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SHIPPING PACKAGE USING DRY ICE

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7 Claims. (Cl. 62—1)

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My invention is an improved refrigerated shipping package for the transportation of perishable articles at a temperature substantially below that of the ambient atmosphere but substantially above the temperature of the refrigerant, and the primary object of my invention is the provision of a shipping package in which all of the perishable articles in the package are maintained at a substantially uniform temperature, and such temperature is maintained substantially constant over a considerable period of time.

My invention is particularly designed to provide a shipping package suitable for the shipment of perishable articles which retain their quality only within a relatively narrow temperature range and are subject to deterioration by freezing temperatures or by temperatures warm enough for bacterial growth.

The sensitivity of sea food, in particular, to deterioration by relatively slight variations in temperature has hitherto precluded the utilization of intense refrigerants, such as solidified carbon dioxide, commonly known as "dry ice," in the commercial transportation of such products, although many efforts have been made to provide fish and oyster shipping packages refrigerated by "dry ice."

My invention provides a light and strong shipping package by which fish, oysters, clams and other thermal sensitive products, as well as perishable products of less thermal sensitivity, may be economically shipped without danger of deterioration or spoilage and with a minimum consumption of "dry ice."

In accordance with my invention, a subliming refrigerant, preferably solidified carbon dioxide, is disposed between two layers of perishable products which are separated from the refrigerant by separators or thermal control pads of low and preferably unequal thermal conductivity, and the cold gas sublimed from the refrigerant is retained adjacent to the perishable products by a carton enclosing the refrigerant, the pads and the perishable products: the carton being so constructed and sealed as to retard the escape of the cold gas, at least until the carton is completely filled therewith. Preferably the refrigerant and the thermal pads on the opposite sides thereof are housed within an enclosure or folder having flaps forming corner joints permitting relatively free emission of gas therethrough, whereas the perishable articles are enclosed in boxes each comprising a telescoping body and lid limiting the ingress of cold gas into the interiors thereof.

The characteristic features and advantages of my improvements will further appear from the following description and the accompanying drawing of an illustrative embodiment of my invention.

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In the drawings, Fig. 1 is a perspective view of a shipping package embodying my invention, with parts broken away to show the interior; Fig. 2 is an exploded perspective view showing the components of my improved shipping package arranged in the order of their assembly as a shipping package, with parts broken away on some of the components; Fig. 3 is a fragmentary diagrammatic plan view of a thermal insulator embodied in thermal control pads utilized in the preferred form of my improved shipping package; Fig. 4 is a fragmentary enlarged diagrammatic sectional view of laminations of a thermal control pad; Fig. 5 is a cross sectional view of the upper thermal control pad utilized in my improved shipping package; and Fig. 6 is a transverse sectional view of the lower thermal control pad utilized in such package.

In the embodiment of my invention illustrated in the drawings, there is utilized a corrugated fibre board carton 1 comprising the bottom 2, the side walls 3 and 4, the end walls 5 and 6, and the overlapping flaps 7, 8, 9 and 10, which are overlapped and sealed by an adhesive strip 11 to form a top.

The carton 1 contains a bottom box 12 comprising telescoping body and lid members 13 and 14. The box 12 is preferably inserted in the carton 1, as shown in Fig. 1, so that the mouth of the edge slot between the members 13 and 14 opens upward, that is, toward the refrigerant chamber, so that cold gas admitted to the refrigerating chamber 15 formed by the box enters at the bottom thereof. The box may, however, be inserted in the opposite position, as shown in Fig. 2.

The refrigerating chamber 15 is packed with perishable products for transportation under controlled temperature conditions.

A cardboard folder 16 is formed with a base 17 having hinged thereto sides 18, 19 and ends 20 and 21, and top flaps 22, 23, 24 and 25 are hinged to the sides and ends to provide an enclosure for a plurality of thermal control pads 26 and 27 on opposite sides of the refrigerant 28; the refrigerant consisting of a slab of solidified carbon dioxide.

The lower pad 26 is of less thermal conductivity (viz., provides greater insulation) than the upper pad 27. When the pads and refrigerant are assembled, the flaps 22, 23, 24 and 25 are folded

over so as to provide a case containing a refrigerant chamber and forming a spacer between upper and lower refrigerated chambers. Such case permits controlled egress, through its open corner and top joints, of carbon dioxide gas sublimed from the refrigerant 28.

An upper box 29, comprising telescoping base and lid members 30 and 31, is placed above the refrigerant chamber formed by the case 16. The box 29 provides a second refrigerated chamber 32 for perishable products. Preferably the mouth of the edge slot between the base 30 and lid 31 opens downward, that is, toward the refrigerant chamber, so that cold gas passing between the telescoped members into the chamber 32 enters the top thereof.

It will be understood that the admission of cold gas to the portions of the refrigerating chambers remote from the refrigerant tends to compensate for the greater conductance between the refrigerant and the portions of the refrigerated chambers proximate to the refrigerant.

The pads 26 and 27 preferably consist of laminated and folded sheets of kraft paper, or other suitable fibrous sheet material 33, which is coated with a flexible binder 34 of low thermal conductivity, such as a moisture-resistant, odorless, thermoplastic mixture of petroleum asphalt and oil, in which, if desired, there may be mixed a small amount of wax and/or inert filler.

The binder is applied hot to the base 33. While the binder is still fluent and viscid, it is covered with concavo-convex, membranaceous particles of low inherent thermal conductivity, such as buckwheat hulls or similar chaff. The edges or small areas of the chaff become embedded in the binder, but the latter is sufficiently viscid to float the chaff and prevent the immersion thereof and its dispersion through the body of the binder. A sufficient quantity of chaff is scattered on the binder to cover it and form, when the binder has solidified, a porous or honeycombed layer containing numerous small pockets or cells providing dead air spaces. The porous, honeycombed layer of haphazardly arranged, cupular particles prevents or minimizes the formation of convection air currents and acts as a thermal control or insulator. The binder not only positions the membranaceous particles, but prevents precipitation or transmission of moisture and retards the transmission of heat.

Sheets so formed are folded into pads, which may be housed in sealed envelopes 35 and 36, as illustrated in Figs. 5 and 6.

With a package so constructed and assembled I am enabled to maintain perishable products in the refrigerated chambers 15 and 32 at a substantially uniform temperature throughout and at a substantially constant temperature for a considerable period of time.

For instance, twenty-three and a half pounds of solidified carbon dioxide, housed between pads 26 and 27 of unequal thermal conductivity, in a folder 16, as above described, was found sufficient to refrigerate 40 lbs. of fresh cod fillets placed in refrigerated boxes 12 and 29 on opposite sides of the refrigerant 28; the assembly being housed in a sealed shipping carton 1. The temperature of the room containing the package was maintained at approximately 70° F. continuously. At the start, the temperatures in various parts of the food compartments or refrigerated chambers were between 37 and 41° F.; at the end of twenty-four hours the temperatures in the various parts of the food compartments were between 30 and 38° F.; at the end of forty-eight hours the temperatures in the various parts of the food compartments were between 29 and 36½° F.; and at the end of sixty-seven hours the temperatures in the various parts of the food compartments were between 30 and 37½° F. Four pounds of Dry Ice remained at the end of the test and the appearance and odor of the fillets were unchanged.

Successful packaging tests for periods up to ninety hours duration have been made when the outside temperature varied from 65° to 75° F., and, under outside temperatures of 75° to 90° F., fresh fish fillets packaged in accordance with my invention were held at satisfactory temperatures for upwards of forty-eight hours with from 28 to 40 lbs. of Dry Ice.

Having described my invention, I claim:

1. A shipping package comprising a carton containing a refrigerant chamber and a pair of refrigerated chambers arranged one above and one below the refrigerant chamber, said chambers each having a length and breadth in excess of its height and each chamber superimposed upon another being removable to afford access to the underlying chamber, and separators of low and unequal thermal conductivity between the refrigerant chamber and the refrigerated chambers for controlling thermal transfer between the refrigerant chamber and the respective refrigerated chambers, and said package including a sealed closure.

2. A shipping package comprising a carton containing a refrigerant chamber and a pair of refrigerated chambers arranged one above and one below said refrigerant chamber, said refrigerated chambers being separated from said refrigerant chamber by thermal control pads of unequal thermal conductivity, the lower heat conducting pad being located below said refrigerant chamber.

3. A shipping package comprising a carton containing a plurality of superposed refrigerated chambers and a refrigerant chamber between said refrigerated chambers, said refrigerated chambers being separated from the refrigerant chamber by thermal control pads of laminated sheet material, and the thermal control pad separating the refrigerating chamber from one of said refrigerated chambers located beneath said refrigerant chamber containing a greater number of laminations than the number of laminations contained in the thermal control pad separating the refrigerant chamber from other of the refrigerated chambers.

4. A shipping package comprising a hollow receptacle containing refrigerant and refrigerated chambers separated from one another, a separator between such chambers comprising a layer of moisture-resistant asphalt and a porous, rough surfaced layer of cupular membranaceous particles of low thermal conductivity having edges anchored in said asphalt and bodies projecting therefrom, each of said refrigerated chambers being subject to refrigeration from one face only thereof from said refrigerant chamber.

5. A shipping package comprising an external carton, a plurality of cartons adapted for receiving perishable articles and housed within said external carton and having respectively a top and a bottom engaging the top and bottom of said external carton, a further carton disposed between said plurality of cartons, one face of said further carton facing each of the cartons first named and said further carton enclosing a plu-

rality of thermal control pads adapted to receive a refrigerant between them, said further carton and pads limiting the thermal conduction and convection between a refrigerant between said pads and said plurality of cartons.

6. A shipping package comprising a plurality of thermal control pads adapted to receive a subliming refrigerant between them, an enclosure surrounding said pads and forming therewith a refrigerant chamber, a carton on each side of said refrigerant chamber and forming refrigerated chambers, and a carton enclosing said cartons first named and means for sealing said package.

7. A shipping package comprising a corrugated-board carton, a plurality of boxes within said carton and each comprising telescoped body and cover members, said boxes being spaced from one another, a plurality of thermal control pads between said boxes and adapted to receive between them a subliming refrigerant, and a folder housing said control pads and having flaps forming joints for controlling the flow of subliming refrigerant to said boxes.

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