(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 December 2020 (30.12.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/263150 A1

(51) International Patent Classification:
B65B 25/00 (2006.01) *B65D 77/04* (2006.01)
B65D 21/02 (2006.01) *B65D 81/38* (2006.01)
B65D 30/08 (2006.01)

(21) International Application Number:
PCT/SE2020/000017

(22) International Filing Date:
24 June 2020 (24.06.2020)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

1900114-8	24 June 2019 (24.06.2019)	SE
1900171-8	18 October 2019 (18.10.2019)	SE
1900184-1	05 November 2019 (05.11.2019)	SE

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,

(54) Title: METHOD OF DELIVERING CHILLED GOODS

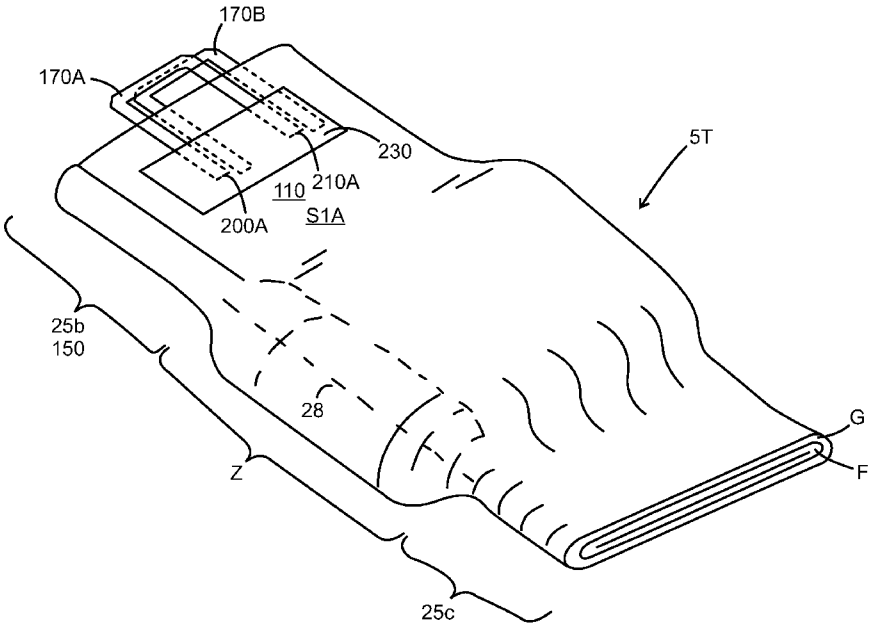

FIG. 17

(57) Abstract: A method of delivering chilled goods in a bag (20) for transporting goods in an air environment having an air humidity; the bag having a collapsed state (20A) for enabling transportation of the bag in a substantially flat state, and an expanded state (20B) such that the collapsible bag (20), in its expanded state, provides an interior storage space for transporting goods, the collapsible bag comprising: • at least one wall panel; the wall panel comprising an outer material layer; and an inner material layer; and a thermally insulating intermediate space between the outer material layer and the inner material layer; and a bag opening; wherein the bag has an open expanded state (20C) for loading and/or unloading said goods via the bag opening, and a closed expanded state (20D) such that the collapsible bag (20), in its closed expanded state (20D), provides a closed interior storage space for transporting goods; wherein • the bag opening is a closable opening which, in the closed expanded state (20D) of the collapsible bag cooperates with said at least one

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MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

wall panel so as to minimize or prevent exchange of air between the environment and the interior storage space.

METHOD OF DELIVERING CHILLED GOODS

Transport Packaging

Technical Field of the Invention

The present application relates to a system for transporting goods.

The present application also relates to a container, such as a bag, for transporting goods, such as e.g. chilled goods and/or frozen goods. The present application also relates to a collapsible temperature retaining bag. It also relates to a method for providing a collapsible bag, and to a method for providing a bag. The present application also relates to a method of delivering goods. The present application also relates to a handle-carryable carrier bag package.

It also relates to a kit of parts including a bag, and to a transport system. It also relates to a kit of parts including a box, and to a transport system wherein such a box may be used.

Description of Related Art

The transport of goods, such as e.g. fragile goods, often require some sort of packaging for wrapping and enclosing the goods. The goods may include one or several articles, an article being for example a book, an electronic device, a piece of clothing, and/or a Compact disc. There are a number of known shipping or mailing envelopes, i.e. envelopes that are provided with packing or cushioning material to help protect fragile or breakable articles. Cushioning material is often used to help protect articles that are shipped or mailed in envelopes. For instance, a person may wrap an article inside cushioning material and then place the wrapped article inside an envelope.

Also, envelopes may be manufactured with cushioning material secured in the envelope, commonly in the form of a liner or inner envelope inside an outer envelope. In use, a person inserts an article inside the liner or inner envelope and then closes and mails the outer envelope. Plastic sheets impregnated with a

multitude of bubbles are a common cushioning material used in the above-discussed situations. This packing material, commonly referred to as bubble wrap, has several disadvantages, however. For example, toxic wastes are produced when these materials are made. In addition, the disposal of these materials has become a significant environmental problem. Further, bubble wrap is somewhat bulky, and it is often not practical to store large quantities of bubble wrap for extended periods of time.

Small, pieces of styrofoam are also used as packing material. However, important environmental problems are associated with the manufacture and disposal of these styrofoam pieces.

US5,544,473 discloses a protective envelope comprising an outer envelope forming an interior and a top back edge; and a packing material secured in the interior of the outer envelope and forming a pocket for receiving an article. The packing material is comprised of a flexible and expandable paper material forming a multitude of slits arranged to allow the packing material to be pulled into a three-dimensional honeycomb shapes, and the packaging material extends above the top back edge of the outer envelope to facilitate pulling the packing material into said three-dimensional shape. In order to obtain the three-dimensional honeycomb shapes, a person, i.e. a user, must pull sections of the flexible and expandable paper material upwards relative to the outer envelope to twist those sections into three-dimensional honeycomb shapes, and the user can threafter place an article between the expanded sections.

In some instances the goods to be transported has an initial temperature which it is desirable to maintain during transport of the goods. Moreover, the goods-to-be-transported may be both fragile and temperature sensitive. This is often the case e.g. in relation to food items, i.e. groceries. Once the customer in a grocery store has purchased a number of collected food item packages, the customer faces the problem of transporting the collected grocery items from the grocery store. Accordingly,

grocery stores commonly provide carrier bags for enabling their customers to carry the groceries from the store in a convenient manner.

The German Utility Model Application DE 89 04 678 discloses a bag for groceries. The bag according to DE 89 04 678 is made solely of paper and it has handles attached to the open upper part of the side walls for enabling convenient carrying of the grocery carrier bag. According to DE 89 04 678, the production of a paper bag involves forming a tubular paper web from a planar piece of paper by placing two edges so that they overlap. The overlapping area is glued so as to form the tubular paper web. The tubular paper web is folded to form a carrier bag having four sides and a square bottom. The carrier bag example disclosed in DE 89 04 678 also has two handles made of reinforced paper strips. Each handle is made by a folding a paper strip to form a U-shape. The two end portions of the U-shaped handle strip of a handle are glued, at a distance **a** from each other, to the exterior surface of one side wall of the carrier bag.

Additionally, there is a growing market for delivery of goods for on-line market customers. Again, the transport of the ordered goods requires packaging of the goods during transport. In the current logistics market, various goods, such as e.g. foods requiring different storage temperatures are separately delivered using specially designed logistic vehicles. That is, some goods to be kept at room temperature is delivered using a logistic vehicle providing a room temperature storage space, and goods that needs to be kept at low temperature is delivered using a logistic vehicle providing a refrigerating or a freezing storage space, i.e. the specially designed logistic vehicle for goods that needs to be kept at low temperature includes an active energy consuming refrigerator device or active energy consuming freezer device. Additionally, the refrigerating or a freezing storage space of such a logistic vehicle is typically provided with modified walls, ceiling and floor in order to thermally insulate the refrigerating or a freezing storage space from the environment.

However, it is inefficient and ineffective to deliver logistic articles using so many vehicles providing different storage space requirements, particularly when there are so many different types of less than load articles to be delivered. With these difficulties, the investment and transit costs in the logistics business is largely increased. Moreover, the conventional insulated logistic container does not withstand high temperature and high-pressure washing water and tends to grow bacteria, which obviously adversely affects the service quality of the logistics business for delivering temperature-controlled foods.

US 2007/087087 teaches that it was desirable to develop an improved insulated logistic container having good insulating performance and capable of withstanding disinfecting and washing, so as to facilitate the logistics management. US 2007/087087 discloses an insulated logistic container having an insulating material disposed in an insulation space between an outer case and an inner case. The outer case and the inner case are made of a plastic material, and the insulating material disposed in the insulation space between the outer case and the inner case may be independently replaced. US 2007/087087 also discloses a delivery system using the insulated container. Moreover US 2007/087087 also teaches that the effect attained, according to the solution presented in US 2007/087087, is preventing washing water from entering the insulation space to adversely affect the performance of the insulating material. This effect is achieved by an airtight structure which is sandwiched between a first and a second engaging section to effectively seal the insulation space.

Summary

In view of the state of the art, a problem to be addressed by an aspect of the invention, is how to achieve an improved, yet cost-efficient, transportation of goods using a bag and/or a rigid container.

This problem is addressed by solutions according to examples and claims disclosed in this disclosure, and it is also addressed by a method of delivering chilled and/or frozen goods, comprising the steps of

providing (S6375) a rigid container (6420) to be used in an air environment having an air humidity, the rigid container comprising

a bottom wall (6430); and

a side wall (6440);

said side wall (6440) cooperating with said bottom wall (6430) to form a rigid container interior storage space (6465) of at least 60 metric litres; and wherein

a rim portion (6445) of said side wall (6430) facing away from the bottom wall (6430) provides a container opening (6450) for enabling packing of articles into said rigid container interior storage space (6465) and for enabling removal of articles from said rigid container interior storage space (6465), wherein

said side wall, and/or said bottom wall, comprises expanded polypropylene (EPP) having a density in the range from 40 kg/cubic metre to 90 kg/cubic metre, and a thermal conductivity in the range from 0,035 W/(m*K) to 0,045 W/(m*K); and wherein

said side wall, and/or said bottom wall, comprises expanded polypropylene (EPP) being substantially water vapour impermeable, and/or substantially water impermeable; wherein

said side wall, and/or said bottom wall, has an external surface facing said air environment, and an internal surface facing said rigid container interior storage space (6465);

the material of the wall stretching from the external surface to the internal surface; wherein

the material of the wall stretching from the external surface to the internal surface is expanded polypropylene (EPP); wherein

said side wall (6440) has a first wall portion, adjacent to said bottom wall (6430); and

said side wall (6440) has a second wall portion, adjacent to said container opening (6450);

said side wall comprises a shoulder portion, the shoulder portion being positioned between said first wall portion and said second wall portion; wherein

the rigid container exhibits a first outer width between the shoulder portion and the bottom wall (6430); and

the rigid container exhibits an inner width between the shoulder portion and said container opening (6450); said first outer width being smaller than said inner width so that said rigid container is stackable;

the method further comprising the steps of

cleaning and/or disinfecting the rigid container using hot liquid and/or a disinfectant;

drying the cleaned and/or disinfected rigid container;

placing said chilled and/or frozen goods in the rigid container interior storage space (6465) of the rigid container;

placing said lid over said opening so as to close said container opening (6450);

transporting said rigid container to a delivery destination.

Whereas the insulated logistic container disclosed in US 2007/087087 includes an insulating material that is adversely affected by washing water when the performance of the airtight structure deteriorates after aging so as to allow an amount of washing water to enter into the insulation space, the rigid container (6420) advantageously comprises a material that acts not only as a sturdy outer material, but it also provides a very good insulation, and it it is substantially water vapour impermeable, and/or substantially water impermeable.

According to an embodiment, the above problem is also adressed by

providing a bag (20) for transporting goods in an air environment having an air humidity; the bag being a collapsible bag having

a collapsed state (20A) for enabling transportation of the collapsible bag in a substantially flat state, and

an expanded state (20B) such that the collapsible bag (20), in its expanded state, provides a bag interior storage space for transporting goods, the collapsible bag comprising:

at least one wall; and

a bag opening; and wherein

the collapsible bag has

an open expanded state (20C) for loading and/or unloading said goods via the bag opening, and

a closed expanded state (20D) such that the collapsible bag (20), in its closed expanded state (20D), provides a closed interior storage space for transporting goods; wherein

the bag opening is a closable opening which, in the closed expanded state (20D) of the collapsible bag, cooperates with said at least one wall so as to minimize or prevent exchange of air between the environment and the interior storage space;

said wall (110, S1A, 120, S1B, 130A, S2A, 130B, S2B, 140) comprising:

an outer paper layer; and

an inner paper layer; and

a thermally insulating intermediate space beween the outer paper layer and the inner paper layer; said wall being shaped and folded so as to form

a front wall panel (110, S1A),

a back wall panel (120, S1B),

and

a bottom panel (140); wherein the wall panels and the bottom panel cooperate to form said interior storage space (100) to a volume of between four metric litres and fifty metric litres in the expanded state of the chill bag (20);

wherein a rim portion of the wall panels facing away from the bottom panel provides the a bag opening (160, 420); the bag opening being closable by folding said rim portion (150, 25b) of the bag (20) such that the chill bag (20) in its closed state seals, or substantially seals, the interior storage space (100) from the environment so as to minimize or prevent entry of air from the environment into the interior storage space (100);

and wherein the method further comprises the steps of

placing said chilled and/or frozen goods in the interior storage space of the chill bag, and

closing (S370) said closable opening of the chill bag (20) so as to seal said packed amount of chilled or frozen goods from said air atmosphere environment; and then

performing the above step of placing said chilled and/or frozen goods in the interior storage space (6465) of the rigid container by placing the closed and sealed chill bag (20) in the interior storage space (6465) of the rigid container.

This solution advantageously provides a very good thermal insulation between the chilled and/or frozen goods and the air environment.

The above problem is also addressed by solutions according to examples and claims disclosed in this disclosure, and it is also addressed by a method of delivering chilled and/or frozen goods, comprising the steps of

providing a bag (20) for transporting goods in an air environment having an air humidity; the bag being a collapsible bag having

a collapsed state (20A) for enabling transportation of the collapsible bag in a substantially flat state, and

an expanded state (20B) such that the collapsible bag (20), in its expanded state, provides an interior storage space for transporting goods, the collapsible bag comprising:

at least one wall; and

a bag opening; and wherein

the collapsible bag has

an open expanded state (20C) for loading and/or unloading said goods via the bag opening, and

a closed expanded state (20D) such that the collapsible bag (20), in its closed expanded state (20D), provides a closed interior storage space for transporting goods; wherein

the bag opening is a closable opening which, in the closed expanded state (20D) of the collapsible bag, cooperates with said at least one wall so as to minimize or prevent exchange of air between the environment and the interior storage space;

said wall (110, S1A, 120, S1B, 130A, S2A, 130B, S2B, 140) comprising:

an outer paper layer; and

an inner paper layer; and

a thermally insulating intermediate space beween the outer paper layer and the inner paper layer; said wall being shaped and folded so as to form

a front wall panel (110, S1A),

a back wall panel (120, S1B),

and

a bottom panel (140); wherein the wall panels and the bottom panel cooperate to form said interior storage space (100) to a volume of between four metric litres and fifty metric litres in the expanded state of the chill bag (20);

wherein a rim portion of the wall panels facing away from the bottom panel provides the a bag opening (160, 420); the bag opening being closable by folding said rim portion (150, 25b) of the bag (20) such that the chill bag (20) in its closed state seals, or substantially seals, the interior storage space (100) from the environment so as to minimize or prevent entry of air from the environment into the interior storage space (100);

and wherein the method further comprises the steps of

closing (S370) said closable opening of the chill bag (20) so as to seal said packed amount of chilled or frozen goods from said air atmosphere environment; and

providing (S6375) a rigid container (6420) to be used in an air environment having an air humidity, the rigid container comprising

a bottom wall (6430); and

a side wall (6440);

said side wall (6440) cooperating with said bottom wall (6430) to form a rigid container interior storage space (6465) of at least 60 metric litres; and wherein

a rim portion (6445) of said side wall (6430) facing away from the bottom wall (6430) provides a container opening (6450) for enabling packing of articles into said rigid container interior storage space (6465) and for enabling removal of articles from said rigid container interior storage space (6465), wherein

said container opening (6450) is closeable by placing a lid (6460) over the rigid container rim portion (6445) so as to provide a closed state of the rigid container (6420), wherein

the rigid container rim portion (6445), in the closed state of the rigid container, co-operates with the lid such that the rigid container seals, or substantially seals, said interior storage space (6465) from the environment so as to minimize or prevent exchange of air between the environment and the rigid container interior storage space (6465);

and wherein the method further comprises the steps of

placing (S6380) the packed and closed bag (20) inside the rigid container (6420);

closing and sealing the rigid container (6420);

transporting the closed chill bag (20) to a delivery destination (DD) while keeping the closed chill bag (20) inside of the rigid container (6420) during the transport; and wherein the method further comprises the steps of

opening the rigid container (6420) and

removing the packed and closed chill bag (20) from the inside of the rigid container (6420), e.g when the delivery destination (DD) has been reached.

In view of the state of the art, a problem to be addressed by an aspect of the invention, is how to achieve an improved, yet cost-efficient, transportation of goods using a bag and/or a transportation container.

This problem is addressed by solutions according to examples and claims disclosed in this patent application.

In view of the state of the art, a problem to be addressed is to provide an improved bag.

This problem is addressed by a protective bag for transporting goods comprising

at least one wall panel being shaped and adapted to form an interior storage space (100) for transporting said goods; the at least one wall panel including

an outer yield-able material layer;

an inner yield-able material layer; and

a cushioning layer disposed between the outer layer and the inner layer; wherein the protective bag has

a collapsed state (20A) for enabling transportation of the protective bag in a substantially flat state, and

an expanded state (20B) such that the protective bag (20), in its expanded state, provides said interior storage space for transporting goods, the protective bag further comprising:

a bag opening; wherein

the protective bag has

an open expanded state (20C) for loading and/or unloading said goods via the bag opening, and

a closed expanded state (20D) such that the protective bag (20), in its closed expanded state (20D), provides a closed interior storage space for transporting goods; wherein

the bag opening is a closable opening which, in the closed expanded state (20D) of the protective bag cooperates with said at least one wall panel so as to protect said goods, when placed in the interior storage space, against impact damage.

This solution advantageously provides a protective bag that may be produced at low cost while enabling the transportation of goods, such as fragile goods and/or impact sensitive goods, in the interior storage space. The at least one wall panel of the protective bag may be adapted to enclose said goods so that said cushioning layer thereby protects the goods against impact damage and/or breakage by impact during transport of the protective bag.

Further advantageous features are described in the following disclosure and appended claims.

Brief Description of the Drawings

For simple understanding of the present invention, it will be described by means of examples and with reference to the accompanying drawings, of which:

Figure 1 is a side perspective elevational view showing an example assembly operation 11 used in making a laminated paper protective strip 5.

Figure 2 is a side diagrammatic perspective view of the cut off section of the strip 5 as produced by the procedure of Figure 1.

Figure 3 is a transverse fragmentary sectional view upon the line 3-3 of Figure 2, upon an enlarged scale as compared to Figure 2.

Figure 4 is a longitudinal fragmentary sectional view upon the line 4-4 of Figure 2 upon an enlarged scale as compared to Figure 2.

Figure 4A illustrates an example on how the thermal conductivity of paper materials depend on density.

Figure 5 is a side diagrammatic perspective view of an alternative example of the front edge portion 25b of the protective strip.

Figure 6 is a partially sectioned perspective view of a part of an example of a bag 20 that may be based on the tubular protector strip 5T of Figure 7.

Figure 7 is a diagrammatic perspective view of the front edge portion 25b of the protective strip 5 of Figure 5 in the folded state forming a tubular protector strip 5T.

Figure 8 is a longitudinal fragmentary sectional view upon the line 8-8 of Figure 5, but extending further to right than shown in Figure 5, so as to illustrate not only the front edge portion 25b but also a portion of the filler area Z.

Figure 9 is a longitudinal fragmentary sectional view upon the line 9-9 of Figure 5 but extending further to right than shown in Figure 5 so as to illustrate not only the front edge portion 25b but also a portion of the filler area Z (compare Figure 2 and Figure 7).

Figure 10 is an illustration of an alternative example wherein the flap 26 is formed by layers G and F.

Figure 11 illustrates the example of Figure 8, but before removal of frontmost portion of layer F.

Figure 12 is a side perspective elevational view showing another example of assembly operation 15 that may be used in making a tubular protector strip 5T.

Figure 13 is diagrammatic a side perspective view of an example of a bag based on a tubular protector strip 5T as produced by the assembly of Figure 12.

Figure 14 is a diagrammatic side perspective view of another example of a tubular protector strip 5T as produced by the assembly of Figure 12.

Figure 14A is an illustration of an example of a part of the filler area Z provided with an intermediate material comprising a plurality of interconnected superposed sheets of a yieldable material.

Figure 15 is a diagrammatic side perspective view of another example of a tubular protector strip 5T, or semi-manufactured bag 20, similar to that shown in Figure 14.

Figure 16 is a diagrammatic side perspective view of yet another example of a tubular protector strip 5T, or semi-manufactured bag 20, similar to that shown in Figure 14.

Figure 17 is a diagrammatic side perspective view of yet another example of a tubular protector strip 5T, or bag 20, similar to that shown in Figure 14.

Figure 17A shows a table with measurement data from comparative test, comparing temperature retaining capacity for different bags and comparing temperature retaining capacity for bags with mutually different intermediate materials.

Figure 18A is an illustration of a flat state of a bag 20 based on any one of the examples of tubular protector strip 5T described in this disclosure.

Figure 18B is an illustration of an expanded state of the bag 20 in Figure 18A.

FIG. 18C shows some different exemples of handle embodiments.

FIG. 18D shows is an illustration of a bag 20 comprising a string, the string being provided as a handle for the bag 20.

FIG. 18E shows a bag provided with a rope handle, or a cord handle.

FIG. 18F illustrates a method for forming a bottom panel of a bag.

FIG. 18G illustrates another example of a bag 20.

Figure 18H is a view in the direction of the arrow 6040 in figure 18G.

Figure 18I is a view in the direction of the arrow 6050 in figure 18G.

Figure 18J is an illustration of the bag 20 during the process of folding in the direction of arrows 6062 and 6064.

Figure 19 is a schematic illustration of an environment 10 in which examples of a bag 20 for goods may be used.

Figure 20 is an elevational view of an example of a single collapsed goods carrier bag 20A.

Figure 21 is a front view of the collapsed goods carrier bag 20A; and

Figure 22 is a rear view of the collapsed goods carrier bag 20A.

Figure 22A is an illustration of an example of providing a closure element.

Figure 22B is a side view of an elongated closure element.

Figure 22C-D are illustrations of examples of closure elements.

Figure 22E illustrates a bag having a cut-out handle.

Figure 22F and **Figure 22G** illustrate a manner of closing a bag 20 by folding a rim portion of the bag, adjacent to the bag opening.

Figure 23 is a side view of the collapsed bag 20A, as seen in the direction of arrow A in figure 22.

Figure 24 is an elevational view of the expanded goods carrier bag 20 in an open expanded state 20B.

Figure 25 is another elevational view of the expanded goods carrier bag 20 in an open expanded state 20B, illustrating an exterior look of an example of the expanded goods carrier bag 20, 20B.

Figure 26 is a top plan view of the expanded goods carrier bag 20 in an open expanded state 20B.

Figure 27 is an elevational view of the expanded goods carrier bag 20 in a closed expanded state 20C, illustrating an exterior look of an example of the expanded goods carrier bag 20 in its closed state 20C.

Figure 28 is a top plan view of the expanded goods carrier bag 20 in the closed expanded state 20C.

Figure 29 is a front view of the expanded goods carrier bag 20 in the closed expanded state 20C.

Figure 30 is a side view of the expanded goods carrier bag 20 in the closed expanded state 20C, as seen in the direction of arrow B in figure 29.

Figure 31 is an illustration of an example of the closure device 240.

Figure 32 is an illustration of Kraft Pulp Fibres.

Figure 33 is an illustration of an example of a first elongated closure element, and a second elongated closure element.

Figure 34A is a perspective view of a part of the closure device 240 shown in figure 31.

Figure 34B is a side view of the closure device 240.

Figure 35 is an illustration of an example of an insulator device.

Figure 36 is an elevational view of an example of a bag 20 in an open expanded state 20B, placed next to an example of a collapsible inner chill bag 400.

Figure 37 is an elevational view of an example of a handle-carryable goods carrier chill bag package 450.

Figure 38 shows a schematic block diagram of an example of a system for delivering goods, such as e.g. groceries, according to an example of the invention.

Figure 39 is a schematic block diagram of an example of a storage facility comprising plural storage rooms for storing goods.

Figures 40A and **40B** and **40C** show a schematic block diagram of an example of a method of delivering chilled goods and/or frozen goods.

Figure 41 is an illustration of a bag 20 including a a neck portion of flexible material at the rim portion of the bag wall(s), the flexible material being shaped and sized to allow a string being placed around the neck portion so as to strangle the neck portion such that the bag 20 becomes sealed or substantially sealed.

Figures 41A and 41 B are an illustration of a method of determining a bag wall area over which a lifting force force F is distributed.

Figure 41C is a schematical representation of a coated paperboard F,G according to an example.

Figure 41D is a schematical representation of another coated paperboard according to an example.

Figure 41E is a schematical representation of a coated paper 1008, G, F according to an example.

Figure 41F illustrates an example of a manner of heat sealing by placing a first portion of a meltable membrane adjacent to second portion of a meltable membrane.

Figures 42A and 42B in conjunction with figure 40A illustrate an alternative example of a method of delivering chilled goods and/or frozen goods.

Figure 43 is an illustration of an example of a rigid container 6420.

Figures 44A and 44B are illustrations of a closure device or lid 6460 that may be used to cover an opening 6450 of the rigid container 6420 so as to provide a closed state of the rigid container 6420.

Figure 45 is an illustration of the rigid container 6420 in a closed state with the lid 6460 placed to cover the opening.

Figure 46 is an illustration of the rigid container 6420 in a closed state with the lid 6460 placed to cover the opening, and loaded with two bags 20.

Figure 47 is a diagrammatic illustration of a goods transport system comprising a first rigid container 6420A and, optionally also comprising a second rigid container 6420B.

Figure 48 is an exploded perspective view of another example of an insulated rigid container box 6425.

Figure 49 is also an exploded perspective view of the insulated rigid container box of Figure 48, but with less reference numerals.

Figure 50 is an example illustration of how thermal conductance and weight of the insulated rigid container box 6425, 6420C, 6460C depends on wall thickness.

Figure 51 is a perspective view of the insulated rigid container box 6425 of figure 48, wherein the lid 6460C is placed over the opening 6450.

Figure 52 is a sectional view upon the line A-A of Figure 48 of the insulated rigid container 6420C.

Figures 53A, 53B, and 53C illustrate the stacking of two identical insulated rigid containers 6420C of the type shown in figure 52.

Figures 54A, 54B, and 54C also illustrate the stacking of two identical insulated rigid containers 6420C of the type shown in figure 52.

Figure 55 illustrates that a large number of insulated rigid containers 6420C can be stacked.

Figure 56 illustrates that a large number of insulated rigid containers 6425, when fully loaded with goods and having the lid covering the opening, can be stacked one above the other in a manner achieves mechanically stable storing, and/or transport.

Figure 57 is a schematic general view of insulated rigid container boxes 6425 having protrusions 6510 and corresponding recesses 6520.

Figure 58 a schematic general view of an outer bottom surface 6525 of an insulated rigid container box 6425, the outer bottom surface being provided with protrusions 6510.

Figure 59 a schematic general view of an outer top surface of the lid 6460C of an insulated rigid container box 6425, the outer top surface of the lid 6460C having circular recesses 6520 configured to receive the outer bottom surface protrusions 6510 of another insulated rigid container box 6425.

Figure 60 a schematic general view of another example of an outer top surface of the lid 6460C of an insulated rigid container box 6425, the outer top surface of the lid 6460C having elongated recesses 6520E that may be configured to receive external elongated bottom surface protrusions 6510E of another insulated rigid container box 6425.

Figure 61 a schematic general view of an example of an elongated protrusion 6510E for attachment to an external bottom surface of an insulated rigid container box 6425.

Figure 62 is a sectional side view of a part of an insulated rigid container box 6425 having a bottom wall 6430C having an external bottom surface 6525 and an internal bottom surface 6570.

Figure 63 is a sectional side view of anexample of an insulated rigid container box 6425 including a grippable surface 6595 between the narrower lower part of the insulated rigid container box 6425 and the wider upper part of the insulated rigid container box 6425.

Detailed Description

In the following description similar features in different examples will be indicated by the same reference numerals.

This disclosure relates i.a. to a laminated rectangular protector strip 5 for wrapping and enclosing goods. The goods may include one or several articles, an article being for example a book, an electronic device, and/or a Compact disc.

Such a protector strip 5 may be used for producing a bag 20, including a bag of the kind which may be also be referred to as "envelope". Hence, the term "bag" is used herein to include bags of a variety of size, including a bag of the kind which may be also be referred to as an "envelope". Such a protective bag 20, or protective envelope 20, includes a cushioning material. A bag 20 may also be referred to as container 20 in this disclosure and/or in accompanying drawings.

The rectangular protector strip 5 may comprise parallel, elongated sheets of strong paper, of which one sheet may be wider than the other sheet, adhesive coatings on the opposed faces of said sheets holding the sheets together adjacent their margins T1, T2 fragmented stuffing material disposed between said coated faces, said stuffing material being adhesively attached to at least one of said coatings, said stuffing material being lightly compressed and applied across an area which is less than the width of said other sheet, said one sheet having outwardly projecting longitudinal side extension portions folded inwardly over said other sheet and outwardly lapping the marginal edges thereof, said extensions being secured in said folded over position by said adhesive.

To manufacture the protector strip it has been found most satisfactory to provide a continuous method, according to which rolls of a relatively heavy strong paper are fed to an assembly position so that they may be laminated or joined together to form a protector strip which, if desired, may be further formed into a package such as an envelope or bag.

The disclosure also relates to a package made from a laminated rectangular protector strip as defined herein. Desirably, before the sheets are brought together on their

adjacent faces or at least on one adjacent face, they may be suitably covered with an adhesive e.g. a hot resinous adhesive material, or less preferably with glue, asphalt or similar adhesives, which will retain its adhesiveness for a predetermined period of time.

During this predetermined period of time the stuffing material, whether it be cut up paper or paper fragments, waste paper material, fibrous material or like fragmented stuffing material, is fed between the sheets, and desirably, so that each fragment will adhere to that adhesive before it is converted into a dry flexible material.

Generally the adhesive is applied to the opposed inner faces of the paper sheets by roller coating, and after the fragmented stuffing material has been dropped, or sprayed onto, or inserted, between the meeting sheets as they come together, there is a substantial compression so that the adhesively connected sheets will be compressed whereby the inserted stuffing material will also be compressed so as to assure contact of the stuffing material with the adhesive surfacings. Thereupon the pressure is released and the sheets spring apart so that in the finished protector strip the stuffing material is lightly compressed. After this compression and release with resultant expansion, the edges of the combined sheets may be folded over so that there will be a smooth non-cutting edge.

One, two or more thin facing sheets, as of a tissue or other paper of light weight may optionally be added to the protector strip, which will be folded into the adhesive edge bond when the edges are folded over. These facing sheets should be wider than the other sheet but narrower than the one sheet, so that they are independently adhesively connected.

After assembly the laminated protector strip may be cut into sections, and this is desirably done by forcing a serrated knife transversely through the protector strip into a slot formed in a receiver positioned at the opposite side of said strip with the

result that a serrated pointed edge will be formed which is less likely to cut the hands of a person handling the strip.

Figure 1 is a side perspective elevational view showing an example assembly operation 11 used in making a laminated paper protective strip 5.

Figure 2 is a side diagrammatic perspective view of the cut off section of the strip 5 as produced by the procedure of Figure 1.

Figure 3 is a transverse fragmentary sectional view upon the line 3-3 of Figure 2, upon an enlarged scale as compared to Figure 2.

Figure 4 is a longitudinal fragmentary sectional view upon the line 4-4 of Figure 2 upon an enlarged scale as compared to Figure 2.

Referring to Figure 1 an upper paper roll A and a lower paper roll B both feed sheets of kraft or other strong paper toward the left over and under adhesive coater rollers C and D, which apply a thin layer of a flexible adhesive E to the opposed faces A_{OF} and B_{OF} of the paper sheets F and G. As an alternative to adhesive coater rollers C and D, the layers of flexible adhesive E may be applied e.g. by spraying or sprinkling an adhesive onto the opposed faces A_{OF} and B_{OF} of the paper sheets F and G, the spraying or sprinkling being performed by controllable adhesive appliers C_S and D_S, respectively. The controllable adhesive appliers C_S and D_S, respectively, may be controllable sprayers. The provision of controllable adhesive appliers C_S and D_S, respectively, enables controlled provision of adhesive onto selected portions of the opposed faces A_{OF} and B_{OF} of the paper sheets F and G.

Between the sheets F and G, as they come together, is spread an intermediate material H. The intermediate material H may be a fragmented stuffing material H e.g. that is spread from a hopper feed J. The fragmented stuffing H may be provided to hopper feed J with a screw feed means, as well as suitable shaker means to assure uniform distribution for the lateral width of the strip as it is being assembled. It is noted that the fragmented stuffing material H may be applied by any suitable device,

and it may be sprayed onto the adhesive E covered faces A_{OF} and B_{OF} of the paper sheets F and/or G. As an alternative to hopper feed J, the fragmented stuffing material H may be applied e.g. by spraying or sprinkling fragmented stuffing material H onto the opposed faces A_{OF} and B_{OF} of the paper sheets F and G, the spraying or sprinkling being performed by a controllable stuffing material applier J_S. The provision of controllable stuffing material applier J_S enables controlled provision of the fragmented stuffing material H onto the selected portions of the opposed faces A_{OF} and B_{OF} of the paper sheets F and G.

The sheets F and G with the stuffing material H therebetween are then lightly compressed without substantial flattening between pressure rollers K and L, assuring compression of the material H, as well as contact of the material H with the thin layers of adhesive E before it hardens. In position M the material H will spring back and expand. It will be noted that, since the upper sheet F is narrower than the lower sheet G, there will be provided extensions N which are then coated by adhesive by means of optional roller coaters P1, P2.

Where it is desired to have extra surfacing paper sheets, rolls of such extra surfacing paper may optionally be provided at Q to supply sheets thereof, indicated at R, on top of the uppermost sheet F or terminating short of the edges of the sheet G, so that the adhesive applied by the optional roller coaters P1, P2 will be effective to hold them in position when the sheets are acted upon by optional in-folders S to optionally form folded smooth edges T1 and or T2.

A vertical reciprocating cutter U has a serrated edge V, which extends into a slotted receiver W so as to cut and downwardly deflect the end edges of the protector strip. The final laminated protector strip 5 is shown in Figure 2 and it has serrated cut end edges Y.

An area Z of the laminated protector strip 5 is centrally located to contain the intermediate material H also referred to as stuffing material H, the area Z thereby constituting a filler area Z (See Figure 2, Figure 3, and Figure 4, as well as Fig 14A).

Referring particularly to Figure 2, Figure 3, and Figure 4, the stuffing material H between the inside faces of the upper sheet F and the lower sheet G is held together by the adhesive E, which is desirably applied when liquid but in heated condition so that it will adhere to the sheet in the form of a thin layer and be depressed into contact with the filler material H by means of the nip rollers K and L. The cut-off by the blade U will leave a series of projections Y projecting downwardly into the slotted member W, with the result that the bent down edges of the projections Y will not be a cutting edge but will be a smooth, non-shearing surface which will not cut or abrade or injure the hands of a person touching the edge of the protector strip 5.

The optional extra surfacing paper facings may be movable relatively to each other and to the surface of the upper sheet F so as to prevent abrasion or scuffing of the articles disposed thereagainst. As the result of the pressure which has been applied between the rollers K and L, the stuffing material H will have some adhesive connection to either the adhesive E on the upper sheet F or to the adhesive E on the lowermost sheet G. Moreover, the folding over of the lowermost sheet G, as indicated at 19 in Figs. 2 and 3, by reason of the adhesive E will hold the edges 21 (See Figure 3) of the extra surfacing paper layers R in position and will also hold the edge 22 of the upper lamination F in position. This folding over, as indicated at T, gives a smooth non-cutting edge T1, T2 and also reinforces the strip on each side of the filler area Z.

A controller 23 may be provided to control the operation of adhesive sprayers C_S and D_S, and stuffing material applier JS, as well as the speed V_{PF} of protector strip paper layers, and the operation of the reciprocating cutter U. The coordinated control 23_{CS}, 23_{DS}, 23_{JS}, 23_{VPF}, 23_U of the adhesive sprayers C_S and D_S, stuffing material

applier JS, speed of transport of protector strip paper layers, and operation of the reciprocating cutter U, advantageously enables control of the length of the centrally located filler area Z as well as control of the lengths of the protector strip front edge portion 25b and a protector strip back edge portion 25c. It is to be understood that control of the transport speed V_{PF} is illustrated in a very simplified manner, and that the control of the transport speed V_{PF} involves controlling e.g. the drive speed of the various rollers illustrated in Figure 1 and in Figure 12 as well as controlling e.g. the drive speed of the relevant paper rolls.

The protector strip 5 described may be used for making paper bags, paper envelopes, boxes or other enclosures. The protector strip described may also be used for making multi-laminar sheet materials where paper is to be provided with filling or stuffing H so that it may be used for a protective envelope, protective bag or protective cover.. The back edge portion 25c of protector strip 5 may be folded so as to form at least a part of a flat bottom panel, or substantially flat bottom panel. The protector strip 5 may form at least one wall of a bag so that a protector strip front edge portion 25b the wall panel 110, 120 facing away from a bag bottom panel 140 may provide a bag opening 160, described and illustrated elsewhere in this document, e.g. in Figure 6 and/or Figure 13, 14, 15, 16, 17.

Moreover, the described protector strip may be used to form a package in which the laminated paper material having stuffing or protective material enclosed therein, the edges of which have been so formed as not to cause any cutting or abrasion of the section in contact therewith and so that the filling material will be held securely in position without undue shifting or movement and without too great loss if the package may be ruptured.

Furthermore, the described protector strip is simple to make, involves a minimum of manual labour and a maximum of production at low cost, and can provide packages without serrating or cutting edges likely to cause injury to the hands or fingers of

those who prepare said packages. A stuffed protective envelope or laminated paper package or cover made from the described protector strip will have its stuffing material held securely in place without displacement or lumping up during usage, and with a reduced fall-out of stuffing material upon ripping of the package.

Figure 4A illustrates an example on how the thermal conductivity of paper materials depend on density (the graph shows typical/average values, and thus certain paper qualities may deviate from the illustrated example). The graph in figure 4A is based on data from Kartoaara et. al. 1985. In this connection it is noted that the thermal conductivity of paper materials depends on density; paper of lower density typically having a lower thermal conductivity.

As indicated by figure 4A, paper having a density of about 1000 Kg/cubic metre typically has a thermal conductivity of less than 0,2 W/(m*K) when established at 23°C and 50% RH (Relative Humidity), i.e. this is when the paper is relatively dry. More precisely, the graph in figure 4A indicates that paper having a density of about 1000 Kg/cubic metre typically has a thermal conductivity of less than about 0,15 W/(m*K) when established at 23°C and 50% RH (Relative Humidity), and the thermal conductivity is typically lower for paper of lower density.

According to an example, the paper F may be 60 grams per m^2 and the paper G may be 90 grams per m^2.

In one embodiment of the bag 20, the outer material layer F of the bag is formed by kraft paper having the following characteristics:
kraft paper Basis weight = 110.7 g/m2

kraft paper layer Thickness = 123 µm

kraft paper Density 901 kg/m3

Thermal conductivity of the kraft paper layer: 0.086 W/(mK)

The thermal conductivity was established in accordance with ISO standard 22007-2:2008. The thermal conductivity was established at 22°C and 50% RH.

Kraft paper layer air permeability: 0.5 µm/(Pa·s).

The above Kraft paper layer example may also be used for forming the inner material layer G of the bag.

According to an example, the paper sheets F and G may be of a water resistant paper quality. Basis weight of the water resistant paper F and/or G may be 60 grams per m^2 or more. Hence, the paper sheets F and/or G, respectively, may form an outer material layer, and/or an inner material layer, respectively, of a bag. As mentioned above, the term "bag" is used herein to include bags of a variety of size, including a bag of the kind which may be also be referred to as an "envelope". When air in the environment is humid and goods in the interior of the bag is chilled and/or frozen, there may be water generated by condensation on the outside surface of the bag. This solution, i.e. providing a water resistant paper quality for forming an outer material layer of the bag, advantageously eliminates or minimizes seepage of such water into the wall. Thereby, the integrity of the bag is maintained or substantially maintained. Moreover, the water resistant paper quality on the outer material layer of the bag, advantageously reduces or eliminates an increased thermal conduction in the wall which may otherwise occur due to water having a high thermal conductivity of about 0,6 W/(m*K).

According to another example, the water resistant paper F and/or G may be supercalendered paper, thus having a high density, the supercalendered paper being a glassine paper. The glassine paper is a smooth and glossy paper that is air, water and grease resistant. The glassine paper is manufactured by supercalendering: after pressing and drying, the paper web is passed through a stack of alternating steel and fiber-covered rolls called a supercalender at the end of the paper machine such that the paper fibres flatten facing in the same direction. Hence, the upper paper roll A and/or the lower paper roll B may feed sheets of kraft or other strong paper that is water resistant. The upper paper roll A and/or the lower paper roll B may feed sheets of kraft paper that is glassine, manufactured by supercalendering.

Additionally, the supercalendered paper F and/or G may optionally be treated in a size press to fill pores or treat the paper chemically to make it fat repellent.

As mentioned above, the adhesive E and the fragmented stuffing material H may be applied onto part of faces A_{OF} and B_{OF} of the paper sheets F and/or G so as to leave other parts of faces A_{OF} and B_{OF} without fragmented stuffing material H and without adhesive E. Thus, the provision of controllable adhesive sprayers C_S and D_S, respectively, enables controlled provision of adhesive onto **selected portions** of the opposed faces A_{OF} and B_{OF} of the paper sheets F and G. Moreover, the provision of controllable stuffing material applier JS enables controlled provision of the fragmented stuffing material H onto **the selected portions** of the opposed faces A_{OF} and B_{OF} of the paper sheets F and G, **the selected portions** of the opposed faces A_{OF} and B_{OF} corresponding to the centrally located filler area Z, as illustrated in Figure 4.

With reference to Figures 1 and 5 in conjunction with Figure 4, the stuffing material applier JS may be controlled to turn off and on so as to not provide any fragmented stuffing material H onto certain portions 25 of the opposed faces AOF and BOF of the paper sheets F and G, thereby allowing the certain portions 25 to form a protector strip front edge portion 25b (see Figure 4) and a protector strip back edge portion 25c. Hence, the opposed faces of said sheets F and G hold the sheets together at the protector strip front edge portion and at the protector strip back edge portion. The back edge portion 25c may be shaped and formed in the same manner as the front edge portion 25b.

Figure 5 is a side diagrammatic perspective view of an alternative example of the front edge portion 25b of the protective strip. Whereas the protector strip front edge portion 25b (see Figure 4) includes the extra surfacing paper layers R, Figure 5 illustrates an example of a protector strip front edge portion 25b wherein the front edges of paper sheets F and G form the protector strip front edge portion 25b. As

illustrated in Figure 5, the protector strip front edge portion 25b may provide a flap 26.

With reference to Figure 5, the far edge portion T2 and the close edge portion T1 may be folded up, as indicated by arrows AF, so that the protector strip 5 is folded to form a bag 20. The far edge portion T2 may be folded along a fold line 27 and the close edge portion T1 may be folded along a fold line 28. Thus, a protective strip 5 may be folded along fold line 27 and along fold line 28 in order to produce a bag 20 (See figure 5 in conjunction with e.g. figure 7 and/or figure 13 and/or figure 14 and/or figure 18F).

Figure 6 is a partially sectioned perspective view of a part of an example of a bag 20 that may be based on the tubular protector strip 5T of Figure 7. Figure 6 is somewhat simplified in that the edge portions T1 and T2, shown in Figure 7, are not shown in Figure 6. The bag 20 has a bag opening 160 which may be closable by the flap 26 which may be folded over and secured to the body of the bag and retained in position by adhesive 29, conveniently exposed by the use of a peel-off strip 31. The adhesive layer 29 may extend across the whole width of the bag 20. The bag 20 has a front wall 110 and a back wall 120, the fold lines 27 and 28 (See Figure 5), respectively, joining the front wall 110 to the back wall 120 (See Figure 7 and figure 6). In other words, the tubular protector strip 5T forms a bag having a wall, and the fold lines 27 and 28 (See Figure 5 and fig 13) can be regarded as indicating borders between a front wall and a back wall.

Whereas Figure 6 illustrates the flap 26 to extend from the back wall 120, the flap 26 being shown to be folded over and secured to adhesive 29 on the front wall 110, it is to be understood that the flap 26 may alternatively extend from the front wall 110 so that it may be folded over and secured to an adhesive strip 29 on the back wall 120. The front wall 110 may also be referred to as front wall panel 110. Likewise, the back wall 120 may also be referred to as back wall panel 120.

Thus, one or several pieces of goods may be inserted into an interior storage space 100 of the bag 20 through the opening 160, and the flap 26 may be folded down and secured in position by the use of the adhesive layer 29. As illustrated by the partially sectioned view, provided by Figure 6, the filler area Z of the protector strip 5 advantageously encloses the interior storage space 100 of bag 20. Hence, the combination of the inner layer F, the fragmented stuffing material layer H and the outer layer G effectively provide the protective bag 20 with excellent insulation qualities, enabling the bag 20 not only to protect article against damage by breakage, but also to prevent damage to the article by undue temperature variations.

Figure 7 is a diagrammatic perspective view of the front edge portion 25b of the protective strip 5 of Figure 5 in the folded state forming a tubular protector strip 5T. A bag 20 may be produced based on the tubular protector strip 5T. As illustrated in Figure 7, the edge portion T2 may be placed to overlap with the edge portion T1, so that the edge portion T2 may be attached on the edge portion T1 e.g. by an adhesive layer (See disclosure relating to Figure 12). Thus, the protective strip 5, or the tubular protector strip 5T, may be folded into the shape of a bag 20 having a bag opening 160 and a flap 26 for closing opening 160 of the bag 20.

Figure 8 is a longitudinal fragmentary sectional view upon the line 8-8 of Figure 5, but extending further to right than shown in Figure 5 so as to illustrate not only the front edge portion 25b but also a portion of the filler area Z (compare Figure 7). As illustrated in Figure 8 the flap 26 may be formed by the layer G.

Figure 9 is a longitudinal fragmentary sectional view upon the line 9-9 of Figure 5 but extending further to right than shown in Figure 5 so as to illustrate not only the front edge portion 25b but also a portion of the filler area Z (compare Figure 2 and Figure 7).

Figure 10 is an illustration of an alternative example wherein the flap 26 is formed by layers G and F. Thus Figure 10 is an illustration of an alternative as compared to Figure 8. In the example flap 26 of Figure 10 the paper layers G and F are glued together e.g. by adhesive E on the relevant portions of opposing faces A_{OF} and B_{OF}. As mentioned above, the adhesive E may be applied onto selected parts of faces A_{OF} and B_{OF} of the paper sheets F and/or G. Thus, with reference to Figure 1, the provision of controllable adhesive sprayers C_S and D_S, respectively, enables controlled provision of adhesive onto **selected portions** of the opposed faces A_{OF} and B_{OF} of the paper sheets F and G.

Figure 11 illustrates the example of Figure 8, but before removal of frontmost portion of layer F. Hence, Figure 11 is a longitudinal fragmentary sectional view illustrating the front edge portion 25b and a portion of the filler area Z. As illustrated in Figure 8 the flap 26 may be formed by the layer G after removal of the corresponding portion of layer F. As mentioned above, the adhesive E may be applied onto part of faces AOF and BOF of the paper sheets F and/or G so as to leave other parts of faces AOF and BOF without adhesive E. Thus, the provision of controllable adhesive sprayers CS and DS, respectively, enables controlled provision of adhesive so that e.g. the flap-to-be portions of the opposed faces AOF and BOF of the paper sheets F and G can be provided without adhesive, allowing simple removal of a portion of layer F so as to render the example illustrated in Figure 8 and 11.

Figure 12 is a side perspective elevational view showing another example of assembly operation 15 that may be used in making a laminated paper protective strip 5. The assembly operation 15 of Figure 12 operates essentially in the same manner as described above in connection with Figure 1. However, as illustrated in Figure 12, there is provided a tubular folder S2 operating to fold the rectangular protector strip 5 in a tubular shape so as to form a tubular protector strip 5T.

The adhesive applied by the roller coater P2 on the far edge T2 of upper surface of the rectangular protector strip, as shown in Figure 12 (Compare Figure 5 and Figure 6) will attach that edge surface T2 to the corresponding edge portion T1 of opposite side of the rectangular protector strip, so that the edges T2 and T1 overlap. Thus the tubular folder S2 may apply pressure to effectively glue the overlapping edges such that a tubular protector strip 5T may be formed.

Figure 6 illustrates an example of a portion 25b of such a tubular protector strip 5T in which adhesive applied by the roller coater P2 on the far edge T2 of upper surface of the rectangular protector strip, as shown in Figure 12 (Compare Figure 5 and Figure 7) will attach that edge surface T2 to the corresponding edge portion T1 of opposite side of the rectangular protector strip. The tubular protector strip 5T of Figure 7 provides the paper layer G as an outer layer of the tubular protector strip 5T facing the environment, whereas the paper layer F is provided as an inner layer of the tubular protector strip 5T, so that the paper layer F will be facing the interior storage space 100 of the bag 20.

Figure 6 also illustrates an example of a portion of such a tubular protector strip 5T.

It is to be noted that the assembly operation 15 may alternatively operate to produce a tubular protector strip 5T having paper layer G as inner layer facing the interior storage space 100 of the bag 20, and paper layer F as outer layer. With reference to Figure 12, this alternative assembly operation 15 may operate to use the roller coater P1 to apply adhesive on the upper surface of the edge T1 (i.e. the upper left hand side edge T1 as seen in the direction of travel V_{PF} of the elongate protector strip) of the elongate protector strip. The tubular folder device S2 may then operate to bend the elongate protector strip so that the mid portion is bent upwardly, as seen in Figure 12, and to form the elongate protector strip in a tube form so that the paper F, originating from the roll A, faces outwards. The tubular folder device S2 may also attach that upper edge surface T1 to the corresponding lower edge portion T2 of opposite side of the elongate protector strip.

It is noted that the tubular elongate protector strip, when traveling out of the tubular folder device S2, has not yet been cut. By appropriate and co-ordinated control, via controller 23, of the adhesive sprayers C_S and D_S, stuffing material applier JS, speed of transport of protector strip paper layers, and operation of the reciprocating cutter U, the assembly operation 15 machinery illustrated in Figure 12 enables control of the length of the centrally located filler area Z as well as control of the lengths of the protector strip front edge portion 25b and a protector strip back edge portion 25c. Hence, the tubular elongate protector strip can be made in many various sizes, enabling the production of a variety of sizes of bags and/or envelopes from the tubular elongate protector strip. It is to be understood that control of the transport speed V_{PF} is illustrated in a very simplified manner, and that the control of the transport speed V_{PF} involves controlling e.g. the drive speed of the various rollers illustrated in Figure 1 and in Figure 12 as well as controlling e.g. the drive speed of the relevant paper rolls.

Figure 13 is diagrammatic a side perspective view of an example of a bag based on a tubular protector strip 5T as produced by the assembly of Figure 12. The tubular protector strip 5T has a flap 26 adapted to close a bag opening 160 provided at the front edge portion 25b of the tubular protector strip 5T. The front edge portion 25b may also be referred to as the rim portion 150. The tubular protector strip 5T has, at an opposite end, a back edge portion 25c. The tubular protector strip 5T has, between the front edge portion 25b and the back edge portion 25c a filler area Z containing stuffing material H, as explained above (See Figure 2, Figure 3, Figure 4 and Figure 6). The back edge portion 25c of Figure 13 is open as illustrated by reference 33, thereby providing access to the interior storage space 100 provided in the filler area region Z of the bag-to-be. Hence, the tubular protector strip 5T of Figure 13 may be an example of a semi-manufactured bag 20.

Figure 14 is a diagrammatic side perspective view of another example of a tubular protector strip 5T as produced by the assembly of Figure 12. In the example

according to Figure 14, the front edge portion 25b of the tubular protector strip 5T is shaped and formed substantially in the same manner as the back edge portion 25c. Hence, the tubular protector strip 5T of Figure 14 may be another example of a semi-manufactured bag 20. The size relations between the bag portions, i.e. front edge portion 25b, filler area Z, and back edge portion 25c, may be very different from the example illustrated in Figure 14. In a real bag 20 the length of the filler area Z enclosing the interior storage space 100 may typically be much larger than the length of edge portions 25b, 25c.

It is noted that the the filler area Z, also referred to as intermediate space Z, may be provided with different intermediate materials H, as discussed elsewhere in this document and as discussed herebelow (See figure 14 in conjunction with e.g. Figures 6, 13, 14A, 15, 16, 17, 20, 21, 22, 22A – 22E). It is within the scope of this disclosure to exemplify with alternative intermediate materials H that are suitable pendent on the purpose of use of the bag-to-be. According to an example, the intermediate material comprises a biodegradable pulp based material. This solution advantageously provides a biodegradable intermediate material. According to another example, the intermediate material comprises fluff pulp. Fluff pulp, which may also be referred to as comminution pulp or fluffy pulp, is a type of pulp, which may be made from long fibre softwoods.

This solution advantageously provides a biodegradable intermediate material. According to another example, the the intermediate material comprises flax fibers. Flax fiber can be extracted from the bast beneath the surface of the stem of the flax plant. The flax fibres form soft, lustrous, and flexible bundles of fiber, and hence this solution advantageously provides a good biodegradable intermediate material.

According to another example, the the intermediate material comprises hemp refined into a thermally insulating material. It is noted in this connection, that hemp, or industrial hemp, is a strain of the Cannabis sativa plant species that is grown specifically for industrial uses of its derived products. The plant is spun into usable

fibres, and the fibres are then refined into a thermally insulating material. Hence, this solution advantageously provides a biodegradable thermally insulating material.

According to another example, the intermediate material comprises shredded paper. This solution advantageously allows for a low cost insulating material that is also very high in air content, and since air has a very low thermal conductivity, the shredded paper also provides very good insulation properties. According to another example, the shredded paper is shredded recycled paper. This solution advantageously adds to the environmental friendlieness of the bag in that the carbon dioxide print of the bag production is reduced by using a recycled paper as source material instead of making the intermediate material from a freshly produced source material.

According to another example, the intermediate material (H) comprises fibres made from pine tree wood. This solution advantageously provides a biodegradable intermediate material. According to another example, the intermediate material (H) comprises cellulose wadding. This solution advantageously provides a biodegradable intermediate material. According to another example, the intermediate material (H) comprises cotton wool. This solution advantageously provides a biodegradable intermediate material. According to another example, the intermediate material (H) comprises a plurality of interconnected superposed sheets (SY) of a yieldable material wherein such a superposed sheet is provided with a multiplicity of adjacent lengthwise and widthwise offset discrete areas of embossed, three dimensional patterns defined by mounds and recesses, the patterns of mounds and recesses in adjacent discrete areas being different, the superposed sheets being so disposed relative to each other that areas having identical patterns are at least partly offset from the identical patterned areas in the adjacent sheets so that air filled spaces are formed between adjacent interconnected superposed sheets. This solution advantageously provides a large number of three-dimensional spaces that are filled with air and separated by the interconnected superposed sheets of a yieldable material. The large number of air filled spaces, formed by the interconnected superposed sheets, in combination with the fact that air has a very low thermal conductivity, as mentioned elesewhere in this

document, advantageously renders an intermediate material that has excellent thermally insulating properties. Thus, the bag, provided with this type of intermediate material has excellent thermally insulating properties. Additionally, this type of intermediate material enables the bag to provide excellent protection for fragile objects in the goods placed in the interior storage space of the bag. **Figure 14A** is an illustration of an example of a part of the filler area Z provided with an intermediate material (H) comprising a plurality of interconnected superposed sheets (SY) of a yieldable material.

The intermediate material H is indicated in an enlarged fragmentary view in Fig. 14A and it has a series of embossed offset sheets SY. The embossed offset sheets SY are enclosed in between the outer material layer, F,G and the inner material layer, G, F (See figure 14A in conjunction with e.g. figure 3, 4, 6, 8, 9, 10, or 11).

The sheets SY from one side may each have a series of mounds MU and recesses RV which are next to each other and arranged in rows extending longitudinally or diagonally. Instead of diagonally, they may also extend at varying angles of 30 to 60° or even other intermediate angular displacements. The intermediate material comprising a plurality of inter-connected superposed sheets of a yieldable material may be as described in GB1373428, the content of which is hereby incorporated by reference.

With reference to figure 14A, the mounds and recesses are frusto-conical when viewed in section perpendicular to the plane of the sheet. It is noted that the mounds and recesses of adjacent sheets may be in partially nested interengagement. There is a glued connection at the engaging portions of the mounds and recesses of adjacent sheets (SY) to prevent them from moving lengthwisely relative to each other. According to an example the interconnected superposed sheets comprise paper. This solution advantageously provides a biodegradable intermediate material,

According to another example, the intermediate material comprises dried plant material which is shaped and arranged to provide multiple air pockets while keeping

at least a portion of the outer material layer separated from the inner material layer so as to thermally insulate the interior storage space from the air environment. According to an example, the dried plant material comprises mosses. This solution advantageously provides a renewable and biodegradable intermediate material. In this connection it is noted that mosses are small flowerless plants that typically form dense green clumps or mats, often in damp or shady locations. The individual plants are usually composed of simple leaves that are generally only one cell thick, attached to a stem that may be branched or unbranched. The irregular shape of mosses renders, also in a dried state of the mosses, to the formation of multiple air pockets.

In this connection it is noted that air has a very low heat conductivity of about 0,024 W/(m K), and thus an increased proportion of air in the intermediate layer proves to have a dramatic effect in terms reducing heat conductivity of the intermediate layer.

Figure 15 is a diagrammatic side perspective view of another example of a tubular protector strip 5T, or semi-manufactured bag 20, similar to that shown in Figure 14.

Figure 16 is a diagrammatic side perspective view of yet another example of a tubular protector strip 5T, or semi-manufactured bag 20, similar to that shown in Figure 14. The tubular protector strip 5T, or semi-manufactured bag 20, of Figure 16 is provided with a handle 35 for grabbing and transporting it.
The handle 35 is built into the body of the bag 20, formed by a die cut opening 37 in the edge portion 25b of the bag 20. The die cut opening 37 located at sufficient distance from the top edge of the bag to enable a users fingers to conveniently go through the die cut opening 37 in order to carry the bag. The die cut opening 37 may be only partly cut so as to allow the cut out portion of the outer paper layer to fold into the opening so as to allow a users fingers to rest against a folded paper surface. This solution advantageously enables a comfortable handle 35 and eliminates the risk of injury to hands, since the fingers do not have to touch any paper edge.

As mentioned above, the bag 20 has a bag opening 160 which may be closable. The example bag 20 of Figure 16 is provided with a strip of adhesive 39 positioned on the inward facing surface of the inner paper layer. When the bag is delivered, in its collapsed state, the adhesive strip 39 is covered by a peel-off strip 41 (not shown in Figure 16) similar to the peel-off strip 31 shown in Figure 6 and Figure 13. The peel-off strip 41 may be conveniently removed so as to expose the adhesive strip 39 thereby allowing the opposing surfaces of the inner paper layer F, or G, to be glued to each other, forming a seal so that the interior storage space 100 may be sealed from the environment. Thus, the bag 20 may be conveniently closed and sealed. It is noted that the bag opening is thus closable and that closure device 39 for closing the bag opening is located between the die cut handle opening 37 and the interior storage space 100.

According to an example, the adhesive layer 39 may extend across the whole inner circumference of the initially tubular protector strip 5T. With reference to Figure 41F, the closure device 39 the closure device may alternatively be achieved by melting a meltable layer placed at least on the part indicated by 39 of the inner material layer in the part 25b, 150 in Figure 16.

Figure 17 is a diagrammatic side perspective view of yet another example of a tubular protector strip 5T, or bag 20, similar to that shown in Figure 14. As shown in Figure 17, a first handle 170A may comprise a paper strip formed in a U-shape and having two paper strip end portions 200A and 210A. The paper strip end portions 200A and 210A of the first handle 170A may be attached to the edge portion 25b of the bag 20, the edge portion 25b constituting a rim portion 150 of the front wall panel 110, S1A. A first substantially planar reinforcement sheet 230 (See Figure 17) having a certain size may be provided in order to distribute the lifting force from the first handle paper strip end portions to a larger surface area of the front wall panel 110, S1A. The first reinforcement sheet 230 may be attached to the paper strip end portion 210A of the first handle 170A and to said rim portion 150 of said front wall

panel 110, S1A such that said paper strip end portion 210A of the first handle 170 is located between the front wall panel 110, S1A and the reinforcement sheet 230.

A first surface 230A of the first reinforcement sheet 230 faces the paper strip end portion 210A of the first handle 170A and said rim portion 150 of the front wall panel 110, S1A. The first surface 230A of the first reinforcement sheet 230 may be bonded to the paper strip end portion 210A and to said rim portion 150 of said front wall panel 110 S1A so as to distribute lifting force from said paper strip end portions to said front wall panel via said first reinforcement sheet.

Figure 18A is an illustration of a flat state of a bag 20 based on any one of the examples of tubular protector strip 5T described in this disclosure. The bag 20 of Figure 18A comprises a handle and bottom panel. With reference e.g. to Figure 13 it is noted that the tubular protector strip 5T has a back edge portion 25c. The bag portion 25c may be folded so as to form a flat bottom panel, or substantially flat bottom panel 140. The rim portion 150,25b of the wall panels 110, 120 facing away from the bag bottom panel 140 may provide a bag opening 160.

Figure 18B is an illustration of an expanded state of the bag 20 in Figure 18A. In this example, a handle 4610 and a support sheet 4620 are preferably complementary in their shape. In a flat state of the carrier, as shown in Figure 18A, the handle 4610 and the support sheet 4620 are arranged in a flattened state as well. In this flattened state the handle 4610 and the support sheet 4620 are oriented so that the handle 4610 is situated at its complementary part of the support sheet 4620. The thickness of the combination of the handle 4610 and the support sheet 4620 will then equal the thickness of the handle 4610 and/or the support sheet 4620 alone. The support sheet 4620 is in one example attached to the front panel 110, S1A and/or the back panel 120, S1B. The handle 4610 is attached to the support sheet via a folding edge 4630. Preferably, the handle is not directly attached to the front panel 110, S1A and/or the back panel 120, S1B. This allows a user to fold up and use the handle when the bag

is in an expanded state, as is shown in Figure 18B. In an example, the handle support sheet 4620 and the handle 4610 are parts of the same separate kraft paper sheet 4610, 4620, and the handle part 4610 is separable from the handle support sheet 4620 by breaking a perforation 4625. The perforation is indicated in figure 18A as full lines between handle support sheet 4620 and handle 4610, whereas the dotted lines at 4630 indicate a folding edge. As shown in Figure 18B, the folding edge 4630 connects the handle part 4610 with the handle support sheet 4620 when the handle is in position for receiving a human hand for carrying the bag 20. Hence, the handle support sheet 4620 and the handle 4610 may be parts of the same support and handle kraft paper sheet, the handle 4610 being separable from the handle support sheet by breaking the perforation. Referring to figure 18A, the perforation may for example form two perforated lines 4625A, 4625B in the support and handle kraft paper sheet, wherein a first perforated line 4625A runs from a **first end of said at least one folding edge** 4630, said first perforated line 4625A forming the shape of an edge of the handle 4610, and said first perforated line 4625A running to a first end of another folding edge 4630. Moreover, a second perforated line 4625B may run from a **second end of said at least one folding edge** 4630 to a second end of the first folding edge.

FIG. 18C shows some different exemplary handle embodiments. An example bag according to FIG. 18C comprises a wall panel S1A, S1B having a rim portion 25b by a bag opening. Thus, a wall may comprise a front panel S1A and a back panel S1B, provided with a first and a second handle, respectively, adapted to allow gripping by a human hand.

The first handle comprising a material layer strip formed in a U-shape 4530, 4520 and having two material layer strip end portions, the material layer strip end portions of the first handle being attached to said rim portion 25b of one of the wall panels. The second handle comprising a material layer strip formed in a U-shape and having two material layer strip end portions, the material layer strip end portions of the second handle being attached to said rim portion 25b of the other one of the wall

panels. The first and the second handle are in cooperation with each other for enabling carrying the bag when used in an expanded state.

Further, the material layer strip end portions are attached to said rim portions 25b by means of a glue layer. The glue layer may be any kind of adhesive material inclusive self-adhesive tape, glue, etc.

The material layer strips end portions may be glued to at least one adhesive reinforcement sheet 4620 as shown in FIG. 18B placed on the rim portion 25b and adapted to reinforce and adhesively attach the handles to the rim portion 25b of the respective wall panel.

The shown shape of the handle 4520 is only an example. Other form of a handle, for example the handle 4530 may also be used and would thus provide an opening similar to the opening 4510. As long as the opening 4510 is large enough for introducing fingers of a human hand, the shape may be of any form.

The providing of the handle and/or a closure may be quite independent of how the other parts of the bag 20 have been provided. It should thus be understood that everything which is discussed in relation to the handle and/or the closure can be easily interchanged and/or combined between different embodiments and/or examples of bags which are described in this disclosure.

FIG. 18D shows is an illustration of a bag 20 comprising a string, the string being provided as a handle for the bag 20. In one example shown in FIG. 18D, the provided handle is formed by a string 4710. The string 4710 can, for example, be attached close to the rim portion 25b of the front panel S1A and/or the back panel S1B. In this connection it is to be understood that the bag 20 shown in figure 18D comprises a rim portion 25b, similar or same as the rim portion 25b shown in FIG. 17. The string 4710 can be placed substantially parallel to the edge of the rim portion 25b of the front panel S1A and/or the back panel S1B. The string 4710 can have a length that exceeds the width of the edge of the front panel S1A and/or the

back panel S1B. The string 4710 may have a length that exceeds twice the width of the edges of the front panel S1A and/or the back panel S1B. In one example, the string 4710 is arranged to provide a closed loop 4713. This can, for example, be done by providing a knot 4720 between the two ends of the string 4710. The string can then be arranged substantially parallel to the upper side or edges of the rim portion 25b of the front panel S1A and/or the back panel S1B, so that the looped string has two portions 4711, 4712 of the string 4710 substantially parallel and preferably close to each other at the upper side of the front panel S1A and/or the back panel S1B. When the length of the string exceeds twice the width of the upper side of the front panel S1A and/or the back panel S1B, two loops 4714, 4715 will be provided at each side of the upper side of the front panel S1A and/or the back panel S1B.The length of the string is preferably so long that said two loops 4714, 4715 can be extended by moving the string which forms said two loops 4714, 4715, so that preferably at least a human hand, or at least four fingers of a human hand can then grab through said two loops 4714, 4715.

In alternative embodiments only one if the loops 4714, 4715 is provided. In one embodiment the string is attached vertically to the front panel S1A and/or the back panel S1B. The material of the string is in one example cotton twine. In one example the string comprises plastics.

FIG. 18E shows a bag provided with a rope handle, or cord handle. The bag in FIG. 18E comprises a wall panel 4811 as shown in FIG.15, where the long side edges of the wall panel 4811 are glued or adhesively attached to each other. The wall panel 4811 has a top portion 4810, 25b and a bottom portion 4818, 25c, each at opposite ends along the length of the bag (See fig. 18E in conjunction with Figures 5,6, 13, 14, 20, 21, 22, 22A – 22E).

The top portion 4810 is an inturned portion folded towards a front side of the wall panel 4811. The top portion 4810 has a pair of openings formed on the front side of the wall panel 4811 and on a rear side of the wall panel 4816, which are adapted to receive at least one cord 4813 or tape configured to form a cord handle attached to a

rim portion 4810 for carrying the bag in the expanded state. The cord handle is slidably attached to the rim portion. The cord handle is formed by introducing the cord into a pair of openings, wherein the ends of the cord may be fastened with blocking means. The blocking means maybe made of plastic or similar and be of any geometrical shape with a radius larger that the radius of the openings to avoid siding all the cord of the handle to the bottom.

The rest of the cord is extending on the external surface of the bag and attached with slidably attached means. When the bag is not used, it may be practical to carry it in a collapsed state by pulling the cord of the cord handle. The two pairs of openings are at the same position on the top portion 4810 so the at least one cord 4813 may easily be passed through.

As shown in FIG. 18E and 18F, the bottom portion 4818 is folded to form a bottom panel 4820. The bottom panel 4820 is surrounded by the at least one cord adapted to be extended in a lengthwise direction from the bottom panel 4820 to the rim portion 4810. The bottom panel 4820 is configured to be collapsable e.g. towards the front side 4811 of the wall panel. when the cord handle is pulled.

The bottom panel 4820 may further comprise as shown in FIG 18E, an extra supporting layer 4823 for strengthen the bag at the bottom when transporting goods.

The bottom portion 4818 of FIG. 18E is defined by the wall panel 4811, folded and adhesively secured together in a specific manner to form a bottom panel 4820.

FIG. 18F illustrates a method for forming a bottom panel of a bag 20.

Thus, FIG. 18F shows different folding steps of forming a bottom panel of the bag according to an exemplary embodiment of the present disclosure. Thus, with reference to Figure 18F it is noted that the front wall panel S1A of the bag (see Figure 18F in conjunction with Figures 5,6, 13, 14, 20, 21, 22, 22A – 22E), is joined to said back wall panel (S1B) along a first fold line FL1, 28 that runs from said bag opening to said bottom panel 140. The bag wall edge portion 25c is provided with a second fold line FL2; the second fold line FL2 being perpendicular

to said first fold line FL1, or substantially perpendicular to said first fold line FL1, 28 (See figure 18F in conjunction with Figure 13). Hence, in step S1, the bottom portion 4818 is folded, along the second fold line FL2, upwards against the side wall panel 4811 (See Figure 18F in conjunction with Figure 18E).

The width of the folded bottom portion 4818, 140 may be adjusted according the desired width of the bottom of the bag. Preferably, the bottom portion 4818, 140 has a width of at least 8 cm.

In step S2, the bag wall edge portion 25c is folded so that opposing triangles TR1 and TR2 are formed on each side of the bottom-portion-to-be 140, 4818.

In step S3, a third fold line FL3 is formed on the front wall part of edge portion 25c, and another third fold line FL3 is formed on the back wall part of edge portion 25c. The third fold lines FL3 are parallel with the second fold line FL2, or substantially parallel with the second fold line FL2. After the folding along the third fold lines FL3, a part of the front wall part of edge portion 25c may overlap a part of the back wall part of edge portion 25c, as illustrated in Figure 18F, See S3 in Figure 18F. After folding joints may be adhesively secured.

Thus, with reference to Figure 18F (See S3 and S4 in Figure 18F), the front wall panel S1A, 4811 is joined to said bottom panel 140 along one of the third fold lines FL3.

It is also noted that the second fold line FL2 is parallel with the third fold lines FL3; and the second fold line FL2 is a fold line on said front wall. Alternatively the second fold line FL2 is a fold line on said back wall.

It is also noted that the bag is collapsible into said collapsed state 20A by folding said front wall and/or said back wall along the second fold line FL2.
When the bag is folded into the collapsed state 20A, a first angle between a plane of said bottom panel 140 and a plane of said front wall and/or said back wall is between zero and 45 degrees when the bag is in the collapsed state 20A.

FIG. 18G illustrates another example of a bag 20. The bag 20 of figure 18G comprises three rectangular protector strips 5 attached to each other so as to form a single bag.

With reference to figure 18G in conjunction with figure 2, a first rectangular protector strip 6010, 5 forms a bag bottom wall, a second rectangular protector strip 6020, 5 forms a bag front wall 110, S1A, and a third rectangular protector strip 6030, 5 forms a bag back wall 120, S1B. The bag of figure 18H has an opening 160 at a rim portion 150, the rim portion of the bag being defined by the front edge portion 25b of the second rectangular protector strip 6020 and the third rectangular protector strip 6030. The second and third protective strips are joined, e.g. by an adhesive, along their respective margin edges T1, T2.

Figure 18H is a view in the direction of the arrow 6040 in figure 18G. As illustrated in figure 18H, the second and third protective strips are joined, e.g. by an adhesive, along their respective margin edges T1, T2, the margin edge T1 of the second protective strip being attached to the margin edge T2 of the third protective strip.

Figure 18I is a view in the direction of the arrow 6050 in figure 18G. As shown in Figure 18I, the first rectangular protector strip 6010, 5 forming the bag bottom wall, has its filler area Z positioned to cover the bag bottom wall. Thus, in the bag of figures 18 and 18H and 18I there is advantageously provided stuffing material H in the front wall panel 110, S1A, 6020 and in the back wall panel 120, S1B, 6030 as well as in the bottom wall panel.

As illustrated in Figure 18I, the first rectangular protector strip 6010, 5 may be provided with a fold line 6060 so as to enable folding the bottom panel in the direction of arrows 6062 and 6064 (See fig 18I in conjunction with fig 18G). When folded in this manner the bag 20 can be provided in a collapsed state.

Figure 18J is an illustration of the bag 20 during the process of folding in the direction of arrows 6062 and 6064.

As mentioned elsewhere in this disclosure, a rectangular protector strip 5 may comprise parallel, elongated sheets of strong paper, of which one sheet may be wider than the other sheet, adhesive coatings on the opposed faces of said sheets holding

the sheets together adjacent their margins T1, T2 fragmented stuffing material disposed between said coated faces, said stuffing material being adhesively attached to at least one of said coatings, said stuffing material being lightly compressed and applied across an area which is less than the width of said other sheet, said one sheet having outwardly projecting longitudinal side extension portions folded inwardly over said other sheet and outwardly lapping the marginal edges thereof, said extensions being secured in said folded over position by said adhesive.

Figure 19 is a schematic illustration of an environment 10 in which examples of a bag 20 for goods may be used. According to an example, the bag 20 is a container 20. A bag 20 may also be referred to as container 20 in this disclosure and in accompanying drawings. The environment may include a grocery store 30, wherein a large number of grocery items 40 are provided. A piece of grocery 40, or a food item 40, in a modern grocery store 30 may be provided in a separate package 40A, the size of a grocery package 40A being adapted to contain an amount of packaged food 40B intended to be convenient for the customer. The grocery store 30 may have an entry 42 for allowing a grocery store customer 60 to enter the grocery store, and it may have an exit 44 for allowing customers 60 to leave the grocery store 30.

Thus, a grocery store customer 60 may select to purchase food by selecting a plurality of food item packages 40. The purchasing process may typically involve the customer walking through the grocery store while collecting several food item packages 40 in a physical transportation cart 70, and transporting the cart to a check-out 80, or cash register 80, for paying.

The grocery packages 40 collected by a customer 60 may comprise fresh produce, such as fruit or mushroom, which may be provided in separate portion sized packages or containers 40A. Fresh produce may be provided at a cool temperature of about 15-18 degrees Centigrade, being held in a slightly cooled part of the grocery store. Thus, some grocery goods may be provided at a first, cool, temperature range of about 15-18 degrees Centigrade.

The grocery may comprise dairy products, such as milk, cream and butter. The dairy products may be provided in separate individual packages, and they may be provided in fridges at a temperature of about 6- 8 degrees Centigrade. An individual

dairy product package may typically range in size from around 100 grams to about 4 kg. Dairy product packages intended for use in private household commonly have a size of between 200 grams to 2 kg. For example milk may be provided in a carton package, such as a Tetra Pak® package containing e.g. 1 litre of milk, weighing about 1 kg. Thus, some grocery goods may be provided at a second, cold non-freezing, temperature range. The cold non-freezing temperature range may be a range of about +6 to +8 degrees Centigrade. Alternatively, the cold non-freezing temperature range may be a range of about +1 to +4 degrees Centigrade.

The grocery, which may be collected by the customer, may also comprise frozen food packages 40, provided in a freezer within the grocery store. Thus, the frozen food items 40B, for delivery at a temperature of e.g. about -18 degrees Centigrade, may be collected by the customer directly from a freezer. The frozen food 40B may be separately packaged e.g. in a carton box 40A. The frozen food may, for example include frozen fish, meat, or vegetables. The frozen food may have been frozen in a raw state, or, alternatively, it may be provided in a prepared manner such that it is ready to eat after thawing or heating. Thus, some grocery goods may be provided at a freezing temperature range of about -18 degrees Centigrade, or colder. In general, frozen goods does not suffer any harm from being chilled to a lower temperature than -18 degrees Centigrade, and accordingly frozen grocery goods may be provided at a freezing temperature in a range of between -25 to -40 degrees Centigrade. Providing frozen goods within such a low temperature range advantageously extends the time required for the frozen goods to warm towards minimum freezing temperatures, such as e.g. -10 or -4 degrees Centigrade.

In order to achieve cost-efficient handling of the goods 40, sold in the grocery store, the grocery store typically receives a large variety of food items, each food item typically being received in bulk, i.e. an individual received food item type is received as a large number of smaller packages. As mentioned above, the smaller packages are adapted to contain an amount of packaged food 40B intended to be

convenient for the customer, who typically buys just one or a few packs of each item.

Similarly, it is important to provide the collapsible bags 20 in bulk to the grocery store, so as to allow cost-efficiency. Accordingly, the collapsible bag 20 may be a collapsible grocery bag 20. The collapsible bag 20 may advantageously be delivered in bulk to the grocery store, thus requiring a very small storage volume, thereby contributing to cost-efficiency. Hence, a large plurality of collapsible bags may advantageously be delivered in a collapsed state 20A, thereby enabling transportation of the carrier bag in a substantially flat state 20A. In this manner, a large plurality of collapsible bags may be conveniently provided at a location in the grocery store. In this manner, customers can conveniently collect and bring a desired number of collapsible bags for transporting groceries.

According to another example, the bag 20 may be shaped in such a manner that plural bags 20 can be piled on top of each other in a space conservative manner. An example of such a space saving shape is a cone shaped container. In this manner plural cone shaped containers may be stacked by placing one cone container on top of the other such that the space required for storing ten containers is only slightly larger than the space required for storing one cone container. According to an example the bag may be shaped as a truncated cone such that there is provided a substantially flat bottom area inside the truncated cone container, the cone wall leaning outwardly from the bottom area. In this manner the truncated cone container may also be stacked or piled so that one container fits inside the next substantially identical container, thus enabling transport of a large number of stacked bags within a very small space. This feature of the bag advantageously contributes to enable transporting bags 20 in bulk at a low cost.

The collapsed collapsible bag 20A comprising kraft paper, as described below, has a balanced rigidity and flexibility allowing it to be easily expanded. In its expanded state 20C the carrier bag provides an interior storage space which is sufficiently

large for transporting a plurality of grocery packages, even when the individual grocery packages are larger than 1 litre. According to some examples, the carrier bag 20 has a volume of between 10 litres and 50 litres in the expanded state of the carrier bag.

Having collected the desired combination of grocery packages 40 in the physical transportation cart 70, the customer 60 may transport the cart to a check-out 80, or cash register 80, for paying.

With reference to Figure 19, the customer 60 may collect a collapsed goods carrier bag 20A from a pile 90 of collapsed goods carrier bags 20A. The customer 60 may then unfold the goods carrier bag 20A it to its open expanded state 20B (See Fig 24, Fig 25 and Figure 26), so that it is ready be loaded with groceries.

Figure 20 is an elevational view of an example of a single collapsed goods carrier bag 20A.

Figure 21 is a front view of the collapsed goods carrier bag 20A; and

Figure 22 is a rear view of the collapsed goods carrier bag 20A.

Figure 23 is a side view of the collapsed goods carrier bag 20A, as seen in the direction of arrow A in figure 22.

Figure 24 is an elevational view of the expanded goods carrier bag 20 in an open expanded state 20B. In Figure 24 the folds of the paper walls are illustrated, and several parts on the inside of the carrier bag are also indicated.

Figure 25 is another elevational view of the expanded goods carrier bag 20 in an open expanded state 20B, illustrating an exterior look of an example of the expanded goods carrier bag 20, 20B.

Figure 26 is a top plan view of the expanded goods carrier bag 20 in an open expanded state 20B.

When the expanded goods carrier bag 20 has been filled with chilled or frozen grocery packages 40, the expanded goods carrier bag 20 can be closed.

Figure 27 is an elevational view of the expanded goods carrier bag 20 in a closed expanded state 20C, illustrating an exterior look of an example of the expanded goods carrier bag 20 in its closed state 20C.

Figure 28 is a top plan view of the expanded goods carrier bag 20 in the closed expanded state 20C.

Figure 29 is a front view of the expanded goods carrier bag 20 in the closed expanded state 20C.

Figure 30 is a side view of the expanded goods carrier bag 20 in the closed expanded state 20C, as seen in the direction of arrow B in figure 29.

As illustrated in Figure 30, the expanded goods carrier bag 20 in the closed expanded state 20C may have a larger cross-sectional area A1 near the bottom panel 140 and a smaller cross-sectional area A2 near the closed opening, i.e. in the vicinity of the rim portion 150. As schematically illustrated in Figure 1, the goods carrier bag 20 in its closed expanded state 20C may have a generally tapered shape, having a larger cross-sectional area near the bottom panel and a smaller cross-sectional area near the opening.

Accordingly, an example of the collapsible handle-carryable goods carrier bag 20 is suitable for use in an air atmosphere environment. The carrier bag has a collapsed state 20A (See Figs 20, 21 and 22) for enabling transportation of the carrier bag in a substantially flat state.

As mentioned above, the carrier bag may also have an expanded state 20B, 20C such that the carrier bag, in its expanded state, provides an interior storage space 100 (Fig 24 and 26) for transporting chilled and/or frozen grocery packages 40 (See Fig 26).

The carrier bag may comprise a protector strip 5, as described in this disclosure, being shaped and folded so as to form a bag.

The wall panels may cooperate to form said interior storage space 100. The interior storage space 100 may be of a volume larger than 10 litres, or larger than four litres, in the expanded state of the carrier bag. The volume depends on the dimensions of the bottom panel and the wall panels.

A rim portion 150 of the wall panels 110, 120, 130A and 130B facing away from the bag bottom panel 140 may provide a bag opening 160 (Fig 24 & 25). The carrier bag may further comprise a first handle 170A being associated with said rim portion 150, 150A of said front wall panel S1A. The first handle 170A may be shaped and dimensioned to allow gripping by a human hand such as to enable convenient carrying of the goods carrier bag. In some businesses where carrier bags are utilized, it is considered necessary for a carrier bag to be provided with a handle, since a handle-carryable goods carrier bag is considered to be a fundamental customer convenience requirement. Thus, in some cases, a collapsible bag which is capable of being carried by means of a handle, or a pair of handles, is considered to be a fundamental customer convenience requirement. According to some examples, the carrier bag is therefore advantageously provided with an integrated handle, or an integrated pair of handles such that a handle-carryable goods carrier bag is supplied. This solution advantageously allows a person to carry the loaded bag by the built-in handle, or handles, in a convenient and ergonomically advantageous manner.

As mentioned above, the carrier bag may have an **open expanded state** 20B (Figs 24 & 25) for loading and/or unloading grocery packages to be transported, and a **closed expanded state** 20C (See Figs 27 & 28). In its closed expanded state 20C, the carrier bag may provide a substantially closed interior storage space 100. The bag opening 160 (Fig 24 & 25) is a closable opening which, in the closed expanded state (Fig 27) of the carrier bag may cooperate with the wall panels and the bottom

panel so as to minimize or prevent entry of air from the environment into the interior storage space. Hence, the substantially closed interior storage space may advantageously be used for transporting chilled and/or frozen grocery packages, since the carrier bag, in its closed expanded state 20C, may exhibit a very good ability to maintain a low temperature of chilled or frozen items that are stored in the closed interior storage space.

In the bag 20, the choice of material forming the wall panels and the bottom panel contributes to the advantageous cold keeping properties. It is to be noted that the design of the bag walls is not limited to the shapes described above. Instead, the term "wall" is to be understood as a material forming the boundaries of the interior storage space of the bag 20. A bag 20 may also be referred to as container 20 in this disclosure and in accompanying drawings. The wall or walls of the bag 20 forms the boundaries of the interior storage space for transporting chilled and/or frozen goods.

According to some examples the walls of the bag 20 comprise a paper layer. Paper is a material which is available at a reasonable cost, and it is readily available in large quantities. Paper is advantageous in that it is biodegradable and environmentally friendly. According to some examples the walls of the bag 20 comprise a kraft paper layer. Kraft paper is a material which is available at a reasonable cost, and it is readily available in large quantities. Kraft paper is advantageous in that it is biodegradable and environmentally friendly.

The kraft paper layer may have a surface weight in the range between 40 and 240 grams per square metre, and a density lower than 1200 kg per cubic metre. The surface weight of the kraft paper may be selected in dependence on the tensile strength to which the bag will be exerted when in use. In this connection it is noted that a carrier bag may be produced in various sizes, such as e.g. a five litre bag, a ten litre bag, a twenty litre bag, a thirty litre bag, a forty litre bag, or a fifty litre bag. It is possible to use kraft paper with as low surface weight as 40 g/square metre and a

density lower than 1200 kg/cubic metre, at least for the small size bags of five, ten or twenty litre storage space, when the small size bag will be used for carrying lower weights. The maximum weight of the goods to be transported will, to some extent, be limited by the size of the bag.

Thus, the walls, including the bottom panel, may comprise protector strip 5 as disclosed in relation to Figures 1 to 18B above. The protector strip 5 may include a kraft paper layer. It has been found that a collapsible bag having a protector strip 5 including a Kraft paper layer having a surface weight of between 60 and 160 grams per square metre generally provides a satisfactory strength while also providing sufficient flexibility so as to be user friendly. Paper of selected types, such as some kraft paper qualities also has a relatively low thermal conductivity value λ .

Measurements have been made so as to establish the thermal conductivity λ of kraft paper layer used in a bag prototype, as dicussed in connection with Figure 4A. Such a kraft paper layer may be used as a wall for the bag 20.
Alternatively, a wall of the bag 20 may comprise plural material layers, i.e. an outer yield-able material layer F; an inner yield-able material layer G; and an intermediate material layer H disposed between the outer layer and the inner layer.

In order to achieve a good balance between the mechanical properties of the kraft paper while also achieving a relatively high thermal resistance of the kraft paper wall, it has been concluded that the kraft paper density may be as low as 350 kg/m^3. The tensile strength needed is generally higher for a larger bag, since a larger bag will enclose a larger volume, i.e. a higher weight, of goods. Thus, when transporting a certain amount of frozen or chilled goods, an appropriate size bag should the selected. The bag size should be selected sufficiently large that the chilled goods fits inside, of course, but for optimum chill conserving ability of the bag, the chilled or frozen goods should preferably fill more than 30 % of the inside volume of the bag 20. Hence, when packing chilled goods into the bag, the bag size should be selected

sufficiently small so that, when packed with the cold or frozen goods, the cold or frozen goods fill up more than 30 % of the inside volume of the selected bag 20. The selection of an appropriate size container contributes to the chill conserving properties of the packed container, since the thermal resistance of the wall is decreased in dependence on an increased wall surface area.

According to an example of the disclosure it was found that a good filling degree of a bag 20 is between 25% and 75%. In terms of designing the bag, the step of determining the desired tensile strength therefore may begin by assuming a 100% filling degree of goods having a mean density of about 0,5 kg per cubic decimetre or 50% filling degree of goods having a mean density of about 1 kg per cubic decimetre.

Thus, in one example it is assumed that a bag with an interior storage space of X litres should be designed to enable carrying a mass of at least 0,5*X kg. Therefore, in one example it is assumed that a bag with an interior storage space of 10 litres should be designed to enable carrying a mass of at least 5kg. Likewise, a bag with an interior storage space of 20 litres may be designed to enable carrying a mass of 10kg, and so on. A bag with an interior storage space of four litres would according to this example be able to carry a mass of 2 kg.

In one example, the bag comprises walls with a layer of wall material, the layer having a pre-determined tensile strength. For a bag designed to carry 5kg, said pre-determined tensile strength exceeds 0.133 N/mm^2. For a bag designed to carry 10kg, said pre-determined tensile strength exceeds 0.267 N/mm^2. For a bag designed to carry 15kg, said pre-determined tensile strength exceeds 0.399 N/mm^2. For a bag designed to carry 20kg, said pre-determined tensile strength exceeds 0.533 N/mm^2. For a bag designed to carry 25kg, said pre-determined tensile strength exceeds 0.667 N/mm^2.

This can be seen in the following way: The tensile strength δ is defined as $\delta=F/A$, where F denotes a force and A an area. The force F which a mass m will exhibit can be determined as $F=g \cdot m$, where g denotes the acceleration due to gravity, which in

one example is assumed to be $g=9,82m/s^2$. The mass m is in principle the added mass of the bag and the goods carried in it. In practice, the mass of the goods might be predominant. The area A is an area over which the force F is distributed.

A principle of determining the relevant area is shown in Fig. 41A and Fig. 41B. Fig 41A shows schematically a bag to illustrate the principle of determining the area A. The bag has a rectangular bottom with length and width of d_1 and d_2, respectively. The bag comprises two handles. The bag further comprises two sheets for distributing the forces applied to the handles to the outer walls of the bag. The handles and the sheets for distributing the forces applied to the handles to the outer walls of the bag are the same on the front side and on the back side of the bag. Each sheet for distributing the forces applied to the handles to the outer walls of the bag is substantially rectangular and has a length and a width of d_4 and d_3, respectively. Fig.41B shows, schematically, a side view of the handle, the bag and the sheet for distributing the forces applied to the handles to the outer walls of the bag. The sizes in Fig. 41B are not to scale in relation to each other. In Fig. 41B three thicknesses are illustrated, wherein a first thickness d_5 denotes the thickness of the handle, d_6 denotes the thickness of the sheets for distributing the forces applied to the handles to the outer walls of the bag, and d_7 denotes the thickness of the wall of the bag. It should be understood that the sheet for distributing the forces applied to the handles to the outer walls of the bag and the outer wall of the bag will in reality touch each other, opposite to what is shown in Fig. 41B.

In the example of Fig. 41A and Fig. 41B the relevant area A can be defined as $A=d_3*(d_5+ d_6+ d_7)$. In one example $d_3=180mm$, $d_5=0.8mm$, $d_6=0.1mm$, and $d_7=0.123mm$. With these input values, and assuming the force is equally distributed over both handles, the above values for the tensile strength will be achieved. In practice, an attachment of the handle often might be the weakest point. If, however, no handle is present, other values need to be taken into account for determining the relevant area A. Even when a handle is present, the other parts of the bag have to be taken into account to check that there tensile strength does not have to be stronger than the tensile strength at the part of the bag where the handle is attached.

Especially the tensile strength of the bottom portion has to be taken into account. In practice, however, the tensile strength of the bottom can in principle be orders of magnitudes weaker than the tensile strength at the part of the bag where the handle is attached.

Another example protector strip 5 comprises a plastic material and/or a rubber material as wall material, e.g. in the cushioning layer H disposed between the outer layer F and the inner layer G, and /or as material in the the outer layer F and/or the inner layer G. Here below there is a list of some example materials that may be comprised in the wall panels and/or bottom panel of the bag 20:

- Film of foamed/porous thermoplastic. The thermoplastic may be a conventional oil-based plastic such as polyethylene, polypropylene or polyurethane. It is also possible to use a bio-based plastic, polylactic acid (PLA)

- Film of foamed/porous rubber (rubber can be of many types, but neoprene (chloroprene rubber) are preferred.

Another example protector strip 5 comprises non-woven as wall material, e.g. in the cushioning layer disposed between the outer layer and the inner layer. Hence, the at least one wall panel of the bag 20 may include

an outer yield-able material layer F;

an inner yield-able material layer G; and

a cushioning layer H disposed between the outer layer and the inner layer, the cushioning layer comprising non-woven. This advantageously enables a non-expensive bag with a material having high air content, and it is therefore a good alternative. Non-woven material may comprise slender fibers which are not woven or knitted but are kept together in other ways, such as by entanglement. Non-woven materials may include textile-like materials. Here below there is a list of some

example materials that may be comprised in the wall panels and or bottom panel of the bag 20:

- Conventional textiles

- paper, such as e.g. kraft paper

Non-woven

Said non-woven materials and conventional textiles have a tensile index value exceeding 50 kNm/kg. All these container wall materials are selected to have a thermal conductivity value less than 0,15 W/(m·K):

$\lambda < 0{,}15$ W/(m·K).

Hence, according to examples of the disclosure the wall panels and/or bottom panel of the bag 20 may comprise one, or several, of the above listed materials, i.e. paper, a Non-woven material, a Conventional textile, a film of foamed or porous thermoplastic, a film of foamed or porous rubber.

An insulating air gap

Preferably, bag size should be selected such that an air gap is allowed to form between the inner surface of the bag and the outer surface of the cold or frozen goods. Such an air gap is advantageous in that the air gap renders extra insulation against the exterior environment, which may be warm. According to an example, the middle portion of interior the surface of the bag bottom may be marked so as to indicate that it is a loading zone for chilled goods. This advantageously indicates to the user of the chill container that goods to be transported should preferably be placed within the indicated area for optimum chill conserving effect during transport. In this manner a simple marking of the bag bottom will be indicative of a three-dimensional bag loading zone volume within the bag, the bag loading zone volume being separated from the side wall(s) of the bag by an air gap.

According to another example, there is provided a number of strips, e.g. kraft paper strips, having lengths commensurate with a width and a breadth of the paper bag; the strips being attached to the inner surfaces of the walls such that, when the bag is in its expanded state, the strips are arranged to stretch from wall to wall. In this manner the strips may advantageously provide a visual indication of the loading zone volume of the bag. The strips may also advantageously provide support for goods to be transported so as to prevent such goods from leaning against the bag wall when the bag is transported.

According to an example, the middle portion of interior the surface of the bag bottom may be marked so as to indicate that it is a loading zone for chilled goods (as described above), and the strips may be attached and positioned to the bag walls so that when goods-to-be-transported is stacked on the marked loading zone on the bag bottom (which may lead to the marked bottom area being covered), the paper strips will still indicate the loading zone volume of the bag.

Thus, for optimum cold conserving properties of the packed bag, the bag size should be selected sufficiently small so that, when packed with the cold or frozen goods, the cold or frozen goods fill up more than 30 % of the inside volume of the selected bag 20, while also allowing for an air gap to be formed between the cold or frozen goods and the inner surface of the bag wall or walls.

Moreover, the protector strip 5 may have a substantially water vapour impermeable membrane 190 bonded to at least one side of the protector strip 5. The substantially water vapour impermeable membrane 190 may be bonded to the outer surface of the protector strip 5.

A Membrane 190 on the Wall

As mentioned above the bag 20 may be based on a protector strip 5, and/or on a tubular protector strip 5T, both of which are described elsewhere in this document. Thus, at least one of the wall panels, comprises

an outer material layer F; and

an inner material layer G; and

a thermally insulating intermediate material H between the outer material layer and the inner material layer.

Some example bags may comprise a substantially water vapour impermeable membrane 190. The substantially water vapour impermeable membrane 190 may be provided on one or both of the surfaces of outer material layer F. Alternatively, the substantially water vapour impermeable membrane 190 may be provided on one or both of the surfaces of the inner material layer G.

According to an example the substantially water vapour impermeable membrane 190 may comprise a polymer membrane layer 190, which may comprise Low-density polyethylene (LDPE). The LDPE membrane may have a density in the range from 910 to 940 kg/m3. The LDPE- membrane layer may have an air permeability of less than 0,35µm/(Pa·s) in accordance with ISO 5636-3:2013.

According to a preferred example the polymer membrane layer 190 may comprise a biodegradable plastic, such as e.g. Polylactic acid (PLA), polyhydroxyallkanoates (PHAs) such as poly-3-hydroxybutyrate (PHB). The polymer membrane layer 190 may alternatively comprise a biodegradable plastic such as polyhydroxyvalerate (PHV) , or polyhydroxyhexanoate (PHH), polybutylene succinate (PBS), polycaprolactone (PCL), polyvinyl alcohol (PVA). The polymer membrane layer 190 may alternatively comprise biodegradable plastics such as a starch based plastics, plastics based on natural oils and fats (fatty acid esters obtained by transesterification of naturally occurring fats and oils).
The polymer membrane layer 190 may alternatively comprise a biodegradable plastic such as a cellulose-based plastics (eg cellulose acetate).
The polymer membrane layer 190 comprising a biodegradable plastic as defined above may be extrusion coated on a kraft paper layer.

Alternatively a biodegradable plastic as defined above may be dispersion coated on a kraft paper layer. The dispersion coated biodegradable plastic can advantageously be recycled in a conventional paper recycling process.

The use of biodegradable plastic for the polymer membrane layer 190 is preferred since it may be combined with a wall material having a sufficient tensile strength and also being biodegradable, such as e.g. kraft paper, thus rendering a kraft paper bag which, not only provides outstanding chill retaining properties, but also is fully biodegradable.

According to an example the an outer material layer F; and/or an inner material layer G may comprise paper, as mentioned elsewhere in this disclosure. Moreover, a substantially water vapour impermeable membrane 190 may be provided on one or on both of the surfaces of outer material paper layer G, or F. Alternatively, the substantially water vapour impermeable membrane 190 may be provided on one or on both of the surfaces of the inner material paper layer F, or G. The substantially water vapour impermeable membrane 190 may be a polymer coating as described in EP 1,094,944, the content of which is hereby incorporated by reference.

Figure 41C is a schematical representation of a coated paperboard F,G according to an example. In fig. 41C can be seen a layered structure of a paperboard F,G which is on one side provided with a compostable polymer coating. The fiber layers of the paperboard are in the figure marked commonly with the reference number 1002 whereas the polymer coating is marked with the reference number 1003. A fiber layer 1002 may, for example, be a Kraft paper layer. According to an example, the fiber layers 1002 are composed of a trilayered paperboard the thicker middle layer 1004 of which is a mixture of sulfate mass and CTMP; while the outer layers 1005 on both sides of the middle layer 1004 are of sulfate mass. The middle layer 1004 may form about 60% of the weight of the fiber layer 1002 while each of the above mentioned sulfate mass layers 1005 may form about 20%. The total weight of the

fiber layer 1002 without coating layers may be about 350 - 400 g/m2, or more. The polymer coating 1003 according to fig. 41C is composed of an outer layer 1006, which comprises polylactide (PLA) and of an adhesive layer 1007 which is coextruded with the former and is of biodegradable polymer and binds the polylactide layer onto the sulfate mass layer 1005. According to this example, the weight of the polylactide layer 1006 is 20 g/m2 at the most, while it is preferred that the total weight of the polymer coating 1003 be about 30 g/m2 at themost. Alternatively, the amount of polylactide may be about 10 g/m2 and that of the adhesive polymer 1007 may be about 5 g/m2.

Figure 41D is a schematical representation of another coated paperboard according to an example. The coated paperboard F, G according to fig. 41D is structurally similar to the one represented in fig. 41C except that the paperboard (fiber layers 1002) are on both sides provided with a compostable polymer coating 1003. The fiber layers 1002 are thus composed of a similar trilayered paperboard as in the application according to fig. 41C, and even the polymer coatings 1003 on each side of the paperboard F,G may in relation to material and surface weight correspond to the one represented in fig. 41C. However, in some examples the polymer coating layers 1003 may be made even thinner, e.g. such that the amount of polylactide in each layer is about 5 g/m2 and the amount of the polyester 1007 underneath, functioning as adhesive material, is likewise about 5 g/m2. In paperboard intended for heat-sealable bags 20 the polymer coating 1003 may be somewhat thicker, as of a total surface weight of about 15 - 30 g/m2.

Figure 41E is a schematical representation of a coated paper 1008, G, F according to an example. In the polymer coated paper 1008, G, F according to fig. 41E the weight of the base paper 1009 manufactured e.g. of sulfate mass may be 30 - 100 g/m2. On one side of the paper is laminated by coextrusion adhesive polymer and polylactide layers 1007, 1006, on top of each other, in the same way as in the paperboard applications according to fig. 41C and fig 41D. The total weight of

coating layers 1003 may be 5 - 10 g/m2. The polymer coated paper 1008 according to fig. 41E is as such well suited as inner wall material for a bag 20 for transporting e.g. food stuffs, since even if the polymer coating 1003 comes into contact with moist food stuff, the polymer coating 1003 protects the paper from getting wet.

According to an example a water impermeable and water vapour impermeable membrane 190 may be provided on the surface the kraft paper layer facing the interior of the bag. In this connection it is noted that the closeable opening of the bag 20 may be closed and sealed by heat sealing 39HS. For example, when the inner paper layer G,F of the bag 20 comprises a coated paperboard according to fig. 41D, then the closeable opening of the bag 20 may be closed and sealed by heat sealing 39HS.

Figure 41F illustrates an example of a manner of heat sealing by placing a first portion 190:1 of a meltable membrane 190 adjacent to second portion 190:2 of a meltable membrane 190. The bag 20 can closed and sealed by heat-sealing from the paperboard F,G according to fig. 41D which is coated on both sides. With reference to Figure 16 in conjunction with Figure 41F, it is sufficient that the inner layer F has its surface facing the interior storage space 100 being provided with the PLA layer 1006 for the purpose of enabling heat-sealing 39HS.
According to another example, the polymer membrane layer 190 comprises a non-biodegradable plastic which may be produced from fossil oil. Such a plastic membrane advantageously provides a good water vapour barrier. Such a plastic membrane may also be used for heat sealing 39HS, as discussed above.

According to an example, the water vapour impermeable membrane 190 is distributed over substantially all of the surface on one side of the paper layer. According to an example the water vapour impermeable membrane 190 comprises a polymer. According to an example the polymer layer 190 may be a layer of PE or Polyethylene.

As shown, e.g in Figure 24, the first handle 170A may comprise a paper strip formed in a U-shape and having two paper strip end portions 200A and 210A. The paper strip end portions 200A and 210A of the first handle 170A may be attached to said rim portion 150 of said front wall panel 110, S1A. The paper strip end portion 210A may be attached to the membrane 190 by means of a glue layer 220.

A first substantially planar reinforcement sheet 230 (See Fig 24) having a certain size may be provided in order to distribute the lifting force from the first handle paper strip end portions to a larger surface area of the front wall panel 110, S1A. The first substantially planar reinforcement sheet 230 may have a first sheet surface 230A and a second sheet surface 230B on opposite sides of the substantially planar reinforcement sheet 230. The first reinforcement sheet 230 may be attached to the paper strip end portion 210A of the first handle 170A and to said rim portion 150 of said front wall panel 110, S1A such that said paper strip end portion 210A of the first handle 170 is located between the front wall panel 110, S1A and the reinforcement sheet 230.

The first surface 230A of the first reinforcement sheet 230 faces the paper strip end portion 210A of the first handle 170A and said rim portion 150 of the front wall panel 110, S1A. The first surface 230A of the first reinforcement sheet 230 may be bonded to the paper strip end portion 210A and to said rim portion 150 of said front wall panel 110 S1A so as to distribute lifting force from said paper strip end portions to said front wall panel via said first reinforcement sheet.

With reference to Figure 24 in conjunction with Figure 27, the bag opening 160 is closable by means of a mechanical interlock 240, or closure device 240 attached to said rim portion 150. The closure device 240, in the closed expanded state of the carrier bag, cooperates with the wall panels and the bottom panel to minimize or prevent air from the environment from entering the interior storage space. The

closure device 240 includes a first elongated closure element 240A, and a second elongated closure element 240B.

Figure 31 is an illustration of an example of the closure device 240. The first elongated closure element 240A is integrated with a second substantially planar reinforcement sheet 250A, the second reinforcement sheet 250A having a predetermined area extension which is larger than the above mentioned **certain size of the** first substantially planar reinforcement sheet 230. The second substantially planar reinforcement sheet 250A may be attached to the first reinforcement sheet 230 and to the rim portion 150 of said front wall panel 110, S1A such that the first reinforcement sheet 230 is located between the front wall panel 110, S1A and the second substantially planar reinforcement sheet 250A. The second substantially planar reinforcement sheet 250A may be attached by a glue layer 260. According to an example the second substantially planar reinforcement sheet 250A comprises polymer material. According to another example the second substantially planar reinforcement sheet comprises paper.

The second substantially planar reinforcement sheet being bonded to the second sheet surface of the first substantially planar reinforcement sheet advantageously achieves two effects. On the one hand, the elongated closure device is thereby attached to the bag wall, and on the other hand the second substantially planar reinforcement sheet 250A also acts to distribute lifting force from said first substantially planar reinforcement sheet to said front wall panel via said second reinforcement sheet, the lifting force originating from the handle when the bag is carried by lifting the handle170A (See Fig 24). As illustrated in Figures 31 and 24, the second substantially planar reinforcement sheet 250A may have a lower edge 270, and the second substantially planar reinforcement sheet 250A may have a physical extension of between 10% and 30% of the height of a wall panel 110.

The second substantially planar reinforcement sheet 250A may be attached to an interior surface of the rim portion 150 of the front panel 110 and to a part of an interior surface of the rim portion 150 of a side panel, as shown in Figure 24.

The paper strip end portions of the first handle and said first reinforcement sheet are sized and dimensioned so as to withstand a force exceeding 100 Newton.

The kraft paper layer comprises a certain amount of air being trapped within the kraft paper layer. This trapped air is believed to contribute to good insulating property of the bag walls and bag bottom. In fact, examples of the carrier bag have been tested and the tests included a measurement with an Infra-red camera for a duration of more than 24 hours, while the closed carrier bag was placed in a warm room at a temperature of 25° Centigrade. The bag was placed such that the bottom panel 140 was placed on the floor, and the bag was standing with the rim portion 150 facing upwards. During this testing, the temperature on the outer surface of a closed carrier bag was detected and the temperature development was registered as time passed. The closed carrier bag was packed with a number of chilled and frozen grocery packages. Whereas, these measurements indicated that outer surface of the lower part of the bag side walls stayed colder than the outer surface of the upper rim portion 150, the tests also indicated that it was not possible to detect, from the outer surface temperature as detected with the IR camera the shape of the collapsible bag contents. In other words, individual frozen or chilled packages 40 which were positioned in the interior storage space 100 (Fig 26) could not be distinguished by measurements of the outer surface temperature of the bag wall. This was considered to indicate that the material of the wall is an efficient isolator for infrared radiation i.e. heat radiation.

A Kraft paper layer of more than 140 grams per square metre may be advantageous for certain uses of the carrier bag, but the example of the goods carrier bag intended for use in grocery stores, allowing end user customers to pack their groceries into the

bag, will preferably have a Kraft paper layer of 140 grams per square metre, or less than 140 grams per square metre. This is because the Kraft paper layer of more than 140 grams per square metre may be experienced to be a bit too stiff, whereas a Kraft paper layer of 140 grams per square metre or less than 140 grams per square metre will be more flexible, and thus more convenient to handle.

Figure 32 is an illustration of Kraft Pulp Fibres. According to an example the kraft paper layer may comprise a plurality of Kraft Pulp Fibres 270 which are arranged one above the other so as to form plural air gaps within the kraft paper layer. According to one example the kraft paper layer comprises a plurality of Kraft Pulp Fibres which are arranged one above the other so as to form plural air gaps within the kraft paper layer, and at least some of the Kraft Pulp Fibres have a length in the range between 1 and 3 mm and/or a width in the range between 10 and 50 micrometer. At at least some of the plural air gaps have a volume exceeding 200 000 cubic micrometers according to that example.

According to an example the substantially water vapour impermeable membrane is bonded to the side of the kraft paper layer facing the outside of the bag. This solution advantageously allows user to place bag on ground even when its rainy and wet without causing deteriorated strength of the bag, since the water vapour impermeable membrane may prevent or minimize the absorption, by the kraft paper, of any water deposited on the exterior surface of the bag.

Closability of Container Opening

Figure 33 is an illustration of an example of the first elongated closure element 240A, and the second elongated closure element 240B. The first elongated closure element 240A, and the second elongated closure element 240B are adapted to mate with each other in the closed state. According to an example the first elongated closure element 240A comprises an elongated cavity having lips forming a slit along its length, so as to enable a mating protrusion to enter the slit between the lips. The

lips of the elongated cavity may be compliant so as to close around the protrusion so as to hold once it has entered into the cavity. According to an example the first elongated closure element 240A comprises at least two elongated cavities provided in parallel so as to receive at least two corresponding elongated protrusions of the second elongated closure element 240B which are provided in parallel.

According to an example an elongated cavity of the first elongated closure element 240A forms an elongated tubular hollow which is adapted to receive the protrusion of the second elongated closure element 240B.

Figure 34A is a perspective view of a part of the closure device 240 shown in figure 31. **Figure 34B** is a side view of the closure device 240.

A movable pressure device 280, also referred to as "runner" 280, may be provided, according to an example, for the purpose of forcing the protrusion of the second elongated closure element 240B to enter into the elongated cavity of the first elongated closure element 240A. This solution provides for an advantegeosly simple handling of the bag 20. In particular, a customer, having loaded chilled groceries into the bag 20, may easily close the bag by simply sliding the movable pressure device 280 from one edge 290 to the other edge 300 (see Figure 31 in conjunction with Figure 26 or 25) . In this manner, the customer may easily close and substantially seal the interior storage space from the environment so as to minimize or prevent entry of air from the environment into the interior storage space

In this connection it is noted that the collapsible bag 20 exhibits an ability to maintain the frozen state of initially frozen groceries during a remarkably long time, thereby maintaining the initial quality and/or flavour of the frozen food stored in the bag.

With reference to Figures 19, 25 and 26 a customer 60 may easily close the carrier bag 20, e.g. by sliding the "runner" or slider 280, thereby achieving a closed and sealed state 20C of the carrier bag, as shown in Figure 27. With reference to Figure 19 the customer 60 may then carry the bag 20 by lifting the handles 170 and thus bring the frozen or chilled groceries to a destination 330, such as e.g. a freezer 310 or fridge 320 in the customer's home.

Figure 22A is an illustration of an example of providing a closure element.
Figure 22B is a side view of an elongated closure element.
Figure 22C-D are illustrations of examples of closure elements.
Figure 22E illustrates a bag having a cut-out handle.

Another example of providing a closure device 4910 is shown in FIG. 22A-22B. The bag according to the present disclosure comprising a protrusion or rim portion by the bag opening and at least two wall panels. As seen in FIG. 22A, the bag comprises a

a closure device 4910 including a first elongated closure element 5010 attached to an interior surface of the rim portion of one of the wall panels, and a second elongated closure element 5020 attached to an interior surface of the rim portion of the other wall panel. The elongated closure elements 5010, 5020 are positioned and adapted for mating with each other so as to achieve closing of the bag opening as shown in FIG. 22B.

The first elongated closure element 5010 may comprise an elongated cavity with lips forming a slit along its length so as to enable a mating protrusion provided by the second elongated element 5020 to enter the slit between the lips.

The closure device 4910 may further comprise a movable pressure device (not shown) adapted to force the mating protrusion of the second elongated closure element 5020 to enter the elongated cavity of the first elongated closure element 5010.

In embodiments, the bag may comprise a substantially planar reinforcement sheet attached to the interior surface of the rim portion of one of the at least one wall so as to withstand gravity of the goods when loaded in the bag.

In other embodiments, the elongated closure elements 5010, 5020 may comprise permanent magnets of different polarities adapted to be attractive to each other.

The closure device 4910 is provided at the inner and/or outer side of the front panel S1A and/or the back panel S1B. This closure device can have the size of a stripe and has preferable substantially the width of the upper side of the front panel S1A and/or the back panel S1B. The closure device 4910 can be attached to the front panel S1A and/or the back panel S1B. The attaching can be done by gluing or bonding. The closure element 4910 can be a glue strip. The closure device 4910 can be an adhesive tape. Thus, when pressing the front panel S1A to the back panel S1B, the glue strip and/or the adhesive tape can keep the front panel S1A and the back panel S1B close to each other, thus providing a closing of the transport container.

In one example the front panel S1A and the back panel S1B are kept attached to each other by the closure device 4910 once they touch each other via the closure device 4910. In one example the closure element 4910 is only at the front panel S1A or only at the back panel S1B. This might be enough for providing a closure of the bag via adhesive forces. The closure element 4910 can comprise an additional strip 29 of protection material shown in FIG 13. This strip can have substantially the same size as the glue strip/the adhesive tape. The additional strip 29 can be provided in such a way that it has to be removed before allowing the glue strip/the adhesive tape to provide its adhesive force between the front panel S1A and the back panel S1B. This prevents the front panel S1A and the back panel S1B to stick permanently together when the transport container is in a flat state.

In one example the closure element 4910 is on the outside of the front panel S1A and/or the back panel S1B. Assuming the closure element 4910 being on the outside of the front panel S1A, the back panel S1B could have a larger vertical height than the front panel S1A. A folding edge could be provided at the back panel S1B. The

folding edge can be substantially parallel to the upper side of the back panel S1B. The folding edge could be situated at a distance from the upper side of the back panel S1B. Said distance could be approximately the distance of which the vertical height of the back panel S1B differs from the vertical height S1A of the front panel. One could then fold the back panel S1B along the folding edge in the direction of the front panel S1A. The folded section of the back panel S1B can then be put over the front panel S1A so that it covers the outer part of the front panel which comprises the closure device 4910. In that way a closure of the bag can be provided as well. Of course the closure device 4910 could also or instead be situated at the inner side of the folded part of the back panel S1B. The role of the front panel S1A and the back panel S1B can also easily be interchanged.

The closure device 4910 can also be an element which allows closing the transport element with the help of an external closure device. As an example, the closure device 4910 can comprise a welding strip. The welding strip can be formed from a layer of PE. The welding strip can be made of a weldable material so as to enable closing the bag opening by heat welding such that entry of air into the bag interior is minimized or prevented. Said external element is in one example a sealing element, for example a hot sealing element. It could also be an impulse sealing element. The external element could be a welding element. The external element could be a so-called hot weld pistol. One could, for example, attach said external element at the upper side of the front panel S1A and the back panel S1B so that it encloses said upper side of the front panel S1A and the back panel S1B at the part where the closure device 4910 is situated. One could thus close the transport container at a later state with the help of the external element. In one example, the closure device is part of sheet which is provided for being cut in a method like method 1305. Thus, in one example the closure device 4910 is not an additional element which has to be attached to the front panel S1A and/or the back panel S1B, but is already part of the front panel S1A and the back panel S1B. The closure device 4910 is in one example of the same material as the front panel S1A and/or the back panel S1B. According to

an embodiment a part the water vapour impermeable membrane 190 forms the welding strip . .

The closure device 4910 can also be provided at the outside of the front panel S1A and/or the back panel S1B when the front panel S1A and the back panel S1B have the same size. This might be advantageous when providing a closure as described in relation to FIG 22F and FIG. 22G.

Other examples of closure devices are presented in FIG. 22C-D. In FIG. 22C the closure device 5170a is provided by a tape or another adhesive material. This tape could be folded over the upper side of the bag after the upper sides of the front panel S1A and the back panel S1B are brought together. This provides an easy method to close the bag. The length of the tape could be longer than the width of the bag. Then the outer edges of the tape could be put together to attach each other. This provides a better closing of the bag. In Fig. 22D the closure device 5170b is provided by a clamp. The clamp 5170b could, for example, press the upper parts of the front panel S1A and the back panel S1B together. This pressing together could for example be caused by the form and the stiffness of the clamp 5170b. The clamp 5170b can have a width which is longer than the upper width of the bag. The form of the clamp 5170b can be different from what is shown in FIG.22D. Although shown without a handle, it would be no problem to provide a handle in FIG. 22C and FIG. 22D, for example a handle as in FIG 18C.

What is said in relation to FIG.22C and FIG. 22D can also be combined with other examples of the disclosure. A tape 5170a or a closure device 5170b could, for example, be combined with a folded closing as described in relation to FIG. 22F and FIG. 22G In that case it might in one example be advantageous to provide one or several clamps with shorter widths than the upper width of the front panel S1A and/or the back panel S1B. This is due to the fact that such a clamp might be enough to keep a closing as indicated in FIG. 22G at its place so that it will not unfold automatically.

Yet another possibility is described in FIG 22E.

The front panel S1A and/or the back panel S1B could have a rim portion 5110c extending to its upper side. This rim portion 5110c could be substantially rectangular. The rim portion of each wall panel of the bag in FIG. 22E comprises at least one die cut opening so as to form a handle adapted to allow gripping by a human hand. The rim portion could have an opening 5120c. The opening 5120c could be such that it provides a handle. How openings can provide handles has been described before. At a part of the protrusion or rim portion 5110c which is between the opening 5120c and the front panel S1A and/or back panel S1B a closure device 5170c could be provided. The closure device on the rim portion 5110c of each wall panel, wherein said die cut opening is formed above the closure device.

This closure device 5170c could have any of the properties of the closure device 4910 which has been described before. Especially the closure device 5170c could provide adhesive force. The closure device 5170c could also be thus that a closure could be provided with the help of an external element which has been described before.

The front panel S1A and/or the back panel S1B could have a protrusion or rim portion 5110c extending to its upper side. This protrusion 5110c could be substantially rectangular. The protrusion could have an opening 5120c. The opening 5120c could be such that it provides a handle. How openings can provide handles has been described before. At a part of the rim portion 5110c which is between the opening 5120c and the front panel S1A and/or back panel S1B a closure device 5170c could be provided. This closure element 5170c could have any of the properties of the closure element 4910 which has been described before. Especially the closure element 5170c could provide adhesive force. The closure device 5170c could also be thus that a closure could be provided with the help of an external element which has been described before.

The location of the closure device advantageously enables the provision of a handle formed by a die cut opening in the wall panels above the closure elements while also enabling the closing and sealing of the interior storage space.

Figure 22F and **Figure 22G** illustrate a manner of closing a bag 20 by folding a rim portion of the bag, adjacent to the bag opening. Hence, an example of a manner of closing the closeable opening, includes repeated folding of a top part of the rim portion 25b, as illustrated by figure 22F and figure 22G in conjunction with e.g. figure 15 . . Thus the bag opening is first brought to a closed state by putting the rim portion 25b of the back panel S1B in contact with the rim portion 25b of the front panel S1A. Thereafter rim portion 25b of the front wall and the back wall are repeatedly folded so as to obtain a closed state, e.g. as illustrated in Figure 22G. The closed state of the bag may be secured by placing some glue in one or several of the folds. Alternatively the closed state of the bag may be secured e.g. by clamping , 5170b, as illustrated in Figure 22D.

The folding of FIG. 22F is one example in the direction of the first sheet surface of the front panel S1A/ or the rim portion 25b of FIG. 15. In another example, the folding may be in the direction of the second sheet surface of the front panel S1A/the rim portion 25b.

In one example, before starting the now described folding scheme, the back panel S1B is put into contact with the front panel S1A. This could be done by putting the upper side of the back panel S1B in contact with the upper side of the front panel. In one example there are enclosed areas FS1, FS2, FS3, ... between two adjacent folding edges F11/F12 and/or between a folding edge F11/F12 and the upper side of the front panel S1A/ the upper side of the rim portion 25b. Preferably, the contact between the back panel S1B and the front panel S1A is along the enclosed areas FS1, FS2, FS3. What is said regarding bringing the back panel S1B in contact with the front panel S1A applies in one example also to the rim portion 25b, which could be brought into contact with a corresponding rim portion 25b at the back panel S1B, for example the rim portion 25b of Fig. 15.

The folding is in one example done in the way that the enclosed area FS1 between the upper side of the rim portion 25b/the upper side of the front panel S1A and the uppermost folding edge, in the shown example F11.1, faces the enclosed area FS2

between the uppermost folding edge F11/F12, in the shown example F11.1, and the second most upper folding edge F11/F12, in the shown example F11.2. When folding edges corresponding to F11/F12 exist at the back panel S1B/at rim portions from the back panel S1B, and when a folding along these corresponding folding edges is performed in the same direction as a folding at the front panel S1A/the protrusion 4320, a closure of the transport container is provided. The term same direction thus implies that the folding at the back panel S1B has to be towards the second sheet surface of the back panel S1B when the folding at the front panel S1A is towards the first sheet surface of the front panel S1A, and vice versa. The contact between the front panel S1A and the back panel S1B and/or the corresponding rim portions is preferable kept throughout the folding procedure, so that the first sheet surface of the front panel S1A and the back panel S1B and/or the corresponding rim portions always touch each other.

In a next folding step, an enclosed area FS2 between the uppermost folding edge F11.1 and the second uppermost folding edge F11.2 is folded towards the enclosed area FS3 between the second uppermost folding edge F11.2 and the third uppermost folding edge F11.3. The enclosed area FS1, and preferably its counterpart on the back panel S1B, will thus be situated between the areas FS2 and FS3.

The folding can be continued along several or all of the folding edges F11/F12. Fig. 22G shows a schematic example of how the result of thus a folding can look like. Fig. 22G can be obtained when looking into the direction of the arrow D in Fig. 22F. In Fig. 22G it is shown how the enclosed areas FS1, FS2, ... can be arranged after the folding procedure. The horizontal lines in Fig. 22G are only sketched for clarity reason to provide an intermediate space between the enclosed areas FS1, FS2, ... The horizontal lines are in reality preferably not there, or at least much more narrow in relation to the vertical lines. In one example there is basically no space between the enclosed areas FS1, FS2, ... The lines in Fig. 22G present preferably the front panel S1A and the back panel S1B together, i.e. every line represents both the front panel S1A and the back panel S1B, where the front panel S1A is on one side of the line and the back panel S1B on the other side of the panel. As can be seen, such a

folding provides a closure of the bag. This has the advantage that no additional closing element is needed. It is, however, possible to combine such a folding with a closure element as well.

Figure 35 is an illustration of an example of an insulator device. The insulator device may be arranged and positioned on at least a portion of the bottom panel in the interior storage space 100 of the bag 20 so as to reduce heat transfer through the bottom panel. According to an example the insulator device comprises a piece of material being shaped and adapted to provide cellular air cushions so as to reduce heat transfer through said bottom panel.

According to an example the insulator device comprises paper and a substantially water vapour impermeable material. This solution advantageously enables the insulator device to withstand a damp or wet environment without absorbing water. According to an example the substantially water vapour impermeable material of the insulator device comprises at least one layer of a polymer material.

According to another example the insulator device comprises at least one layer of a plastic material. This solution advantageously enables the insulator device to withstand a damp or wet environment without absorbing water. According to an example the insulator device comprises BubbleWrap®.

Figure 36 is an elevational view of an example of the expanded goods carrier bag 20 in an open expanded state 20B, placed next to an example of a collapsible grocery inner chill bag 400.

The collapsible grocery inner chill bag 400 is suitable for use inside of the carrier bag 20. In likeness to the goods carrier bag 20, the inner chill bag 400 may have:

a collapsed state 20A for enabling transportation of the inner chill bag in a substantially flat state, and

an expanded state such that the inner chill bag, in its expanded state, provides a second interior storage space 410 for transporting chilled and/or frozen grocery packages. The inner chill bag 400 may comprise:

inner walls and an inner bottom cooperating to form said second interior storage space; wherein a second rim portion of the inner walls facing away from the inner bottom provides an inner bag opening 420. The inner chill bag 400 may have an open expanded state for loading and/or unloading grocery packages to be transported, and

a closed expanded state such that the inner chill bag, in its closed expanded state, provides a substantially closed second interior storage space for transporting chilled and/or frozen grocery packages. The inner bag opening 420 may be closable opening which, in the closed expanded state of the inner chill bag cooperates with said inner walls and said inner bottom so as to minimize or prevent entry of air from the environment into the second interior storage space. According to an example the collapsible grocery inner chill bag 400, in its expanded state, is shaped and dimensioned to fit inside of the carrier bag 20.

Figure 37 is an elevational view of an example of a handle-carryable goods carrier chill bag package 450. The chill bag package 450 illustrated in figure 37 includes an expanded goods carrier bag 20 in the closed expanded state 20C, and the collapsible grocery **inner chill** bag 400, in its expanded state; the **inner chill** bag 400 being shaped and dimensioned to fit inside of the carrier bag 20.

An example of the handle-carryable goods carrier chill bag package 450 may thus comprise a collapsible handle-carryable goods carrier chill bag 20 and a collapsible grocery inner chill bag 400. Hence, **the handle-carryable goods carrier chill bag**

package, in use, may include include the collapsible grocery inner chill bag 400 in its closed expanded state; and the collapsible handle-carryable goods carrier chill bag 20 in its closed expanded state, wherein the collapsible grocery inner chill bag is placed in the interior storage space 100 of the collapsible handle-carryable goods carrier chill bag 20.

This solution advantageously enables the packing of frozen grocery packages in the second interior storage space 410. This solution therefore enjoys a high thermal resistance from a frozen grocery package in the second interior storage space to the environment outside of the outer handle-carryable goods carrier bag, since any air inside of the first interior storage space 100 functions as insulation between **the** second interior storage space and the environment outside of the outer handle-carryable goods carrier bag. Additionally, there are double barriers for minimizing or preventing entry of air **from the environment outside of the** outer handle-carryable goods carrier bag **into the** second interior storage space when both of the bags are in their closed expanded states, since **the** second interior storage space is sealed by the closed inner bag as well as by the closed outer bag.

As mentioned above, the interior of the bag 20, when in use, may be initially chilled by the low temperature of frozen or chilled grocery packages which are placed in the interior storage space 100. Although this is sufficient for maintaining the frozen or chilled state of frozen or chilled grocery packages for an extended period of time, the inventor realized that this time period may be further extended.

According to an example, there is provided a **means 460 for cooling the interior of the bag** 20 so as to enable a further extended period of time during which the frozen or chilled state of frozen or chilled grocery packages is maintained.

According to an example the handle-carryable goods carrier chill bag package 450 **may, in use,** further comprise a **means 460 for cooling the interior 100 of the bag 20 and/or for cooling the second** interior storage space 410**.**

According to an example of the **means 460 for cooling the interior of the bag,** there is provided a cooling agent. A piece of dry ice is an example of such a cooling agent.

Dry ice is the solid form of carbon dioxide. The chemical formula of carbon dioxide is CO2. Thus a carbon dioxide molecule comprises two oxygen atoms bonded to a single carbon atom. It is colourless, non-flammable, and slightly acidic. Carbon dioxide can change from a solid to a gas with no intervening liquid form, through a process called sublimation. The opposite process is called deposition, where CO2 changes from the gas to solid phase (dry ice). At earth atmospheric pressure, sublimation/deposition occurs at −78.5 °C. Its enthalpy of sublimation is 571 kJ/kg (25.2 kJ/mol).

The density of dry ice varies, but usually ranges between about 1.4 and 1.6 g/cm3. The low temperature and direct sublimation to a gas makes dry ice an effective coolant, since it is colder than water ice and leaves no residue as it changes state.

According to an example of the Dry Ice cooling agent, there is provided pellets of dry ice, the size of the pellets being suitable for placing in the interior storage space 100 of the bag 20, when the bag 20 is in use as a chill bag. Thus, as the dry ice pellets gradually change from a solid form to gaseous carbon dioxide with no intervening liquid form (sublimation) there is a corresponding energy consumption of 571 kJ/kg which causes a decrease of the temperature of any food packages surrounding the dry ice pellets. The dry ice may be provided in a piece of a suitable size, dependent on the amount of refrigeration desired. According to an example, a single piece of dry ice may comprise one kilogram of dry ice. According to another example, a single piece of dry ice may comprise e.g. 10 grams of dry ice. According to yet another example, a single piece of dry ice may comprise e.g. 100 grams of dry

ice. Such relatively small pieces of dry ice may be referred to as dry ice pellets. One or several dry ice pellets may be used simultaneously in the interior storage space 100 of the chill bag 20, dependent on duration of the period of time it is desired to keep the interior storage space 100 at freezing temperatures.

A Method of Grocery Delivery

According to an example, the carrier bag 20 may advantageously be used by on-line shops, for delivery of frozen or chilled groceries which have been ordered e.g. via the Internet. The advantageous ability of the bag 20 to preserve the frozen or cold state of groceries for an extended length of time may enable a reduction in the cost for delivery of frozen or chilled groceries.

Figure 38 shows a schematic block diagram of an example of a system for delivering goods, such as e.g. groceries, according to an example of the invention. Reference numeral **500** relates to a client location with a computer 510 having a user interface 520 for enabling a client, such as e.g. a person wanting to buy goods, to access the Internet. The computer 510 has a communications port 520 for bi-directional data exchange. The communication port 520 is connectable to a communications network 530, e.g. via a data interface19. The communications network 530 may be the world wide internet, also known as the Internet. The communications network 530 may also comprise a public switched telephone network.

A server computer 540 is also connected to the communications network 530. The server computer 540 may comprise a database 560, user input/output interfaces 570 and data processing hardware 580, and a communications port 590. The server computer 540 is located on a **server location 592**, which is geographically separate from the client location 500. The server location 592 may be in a first city, such as the Swedish capital Stockholm, and the client location may be in another city, such as Berlin, Germany. Alternatively, the server location 592 may be in a first part of a

town and the client location may be in another part of the same town. The server location 592 may also be referred to as supplier part 592, or supplier part location 592. The server computer may be part of an on-line business entity 595 for the sales and delivery of goods that needs to be kept chilled, cold or frozen.

The on-line business also includes a storage facility 600 for goods 40. A storage computer 610 is connected to the communications network 530. The storage computer 610 may comprise user input/output interfaces 620 and data processing hardware 630, and a communications port 640.

The storage facility 600 also comprises one or several storage rooms 650. According to an example of the invention, the storage room 650 has a controlled environment, in that the temperature and the relative humidity of the air in the storage room 650 is controlled so that it is kept within certain predetermined ranges.

The goods may comprise a plurality of different types of goods, and the goods may be sorted into different temperature ranges TI, TII, TIII, and TIV, each type of gods being stored in a corresponding storage room 650_{TI}, 650_{TII}, 650_{TIII}, and 650_{TIV} having a temperature in accordance with the corresponding goods temperature range TI, TII, TIII, or TIV (See Figure 39). According to an example the temperature in each storage room is set 650_{TI}, 650_{TII}, 650_{TIII}, and 650_{TIV} in accordance with a lowest acceptable goods temperature range for the corresponding goods. According to an example the temperature in each storage room 650_{TI}, 650_{TII}, 650_{TIII}, and 650_{TIV} is set in accordance with a lowest acceptable goods temperature range for the corresponding goods, and the relative humidity of the air is also set to a lowest acceptable value dependent on the type of goods in that storage room. According to an example, the relative humidity of the air is set to a value equal to or lower than lower than 40% RH in a room storing chilled or frozen goods so as to reduce or minimize the rate of condensation.

Figure 39 is a schematic block diagram of an example of a storage facility 600 comprising plural storage rooms 650_{TI}, 650_{TII}, 650_{TIII}, and 650_{TIV}. With reference to Figure 39, the facility 600 may also comprise a goods loading room 660. The goods loading room 660 may be arranged so that a storage room 650 is accessible directly from the goods loading room 660.

According to an example, the ambient air temperature in goods loading room 660 is kept lower than +18 degrees Centigrade. The air humidity is advantageously kept low in the environment where chilled or frozen goods is to be packed into bags 20 so as to eliminate or minimize the occurrence of condensation or frosting on chilled or frozen goods. According to an example the relative air humidity is kept lower than 40% RH. According to another example the relative air humidity is kept lower than 20% RH.

In this connection it may be noted that the occurrence of condensation can cause significant heating of chilled, non-frozen, goods. If air humidity causes condensation on the surface of a piece of chilled, non-frozen, goods the increase of the mean temperature of a piece of chilled, non-frozen, goods is:

$DT_{chg} = 2260 * m_{Cond} / (W_{chg} * m_{chg})$, where

DT_{chg} = the increase in mean temperature of the chilled goods [degrees Centigrade]

m_{Cond} = number of grams of water being deposited on chilled goods by condensation

W_{chg} = mean heat capacity of the chilled goods

m_{chg} = the mass of the chilled goods [kilograms]

For frozen goods the impact of frosting is even more severe. When air humidity causes water droplets to be formed on frozen goods the condensed water may also freeze. The formation of condensed water from air humidity, the condensed water subsequently also freezing to form ice, or frost, is herein also referred to as

"frosting". If air humidity causes frosting on the surface of a piece of frozen goods the increase of the mean temperature of a piece of frozen goods is:

$DT_{FRG} = 2594 * m_{Cond} / (W_{FRG} * m_{FRG})$, where

DT_{FRG} = the increase in mean temperature of the chilled goods [degrees Centigrade]

m_{frost} = number of grams of frost (frozen water) being deposited on frozen goods by condensation & freezing

W_{FRG} = mean heat capacity of the frozen goods

m_{FRG} = the mass of the frozen goods, measured in kilograms

Accordingly, an object and an advantageous feature of the invention is to eliminate or minimize warming of chilled or frozen goods during packing into a bag 20 by eliminating or minimizing the occurrence of frosting and/or condensation on chilled or frozen goods. According to an example, the ambient air temperature in goods loading room 660 is therefore kept lower than +10 degrees Centigrade, and the air humidity is also kept low in the environment where chilled or frozen goods is to be packed into bags 20 so as to eliminate or minimize the occurrence of condensation or frosting on chilled or frozen goods. According to an example the relative air humidity is kept lower than 30% RH. According to another example the relative air humidity is kept lower than 20% RH.

In fact, the energy released by 1 gram of water vapour being turned into a layer of ice on a package containing one kilogram of frozen water is actually sufficient to warm that whole kilogram of frozen water by 1,18 degrees. Thus, if e.g. 12 grams of water vapour is allowed to turn into a frost layer of ice on a package of frozen grocery, that energy (just over 31 kJ) may suffice to warm that grocery by several degrees. The exact temperature change depends on the specific heat capacity W_{FRG} of that particular piece of grocery, as illustrated by the equations listed above. Pure fresh water ice has a specific heat capacity of 2200 J/(kg *K), and thus 12 grams of

frost being formed would suffice to warm that one kilogram of fresh water ice by about 14 degrees Centigrade.

In this connection the maximum amount of water vapour at various air temperatures may be relevant. The right hand column in Table 1 below provides an overview of the water mass per unit volume of vapour saturated air. The left hand side column indicates corresponding temperature and the middle column indicates the pressure of saturated vapour.

Temperature °C	Pressure mbar	Density g * m^{-3}
-35	0,23	0,22
-30	0,37	0,35
-25	0,63	0,57
-20	1,03	0,91
-15	1,65	1,39
-10	2,60	2,15
-8	3,09	2,53
-6	3,68	2,99
-4	4,37	3,53
-2	5,17	4,14
±0	6,11	4,85
+2	7,05	5,57
+4	8,13	6,37
+6	9,34	7,27
+8	10,72	8,28
+10	12,26	9,41
+12	14,01	10,67
+14	15,97	12,08
+16	18,17	13,65
+18	20,62	15,39
+20	23,37	17,32
+22	26,42	19,44
+24	29,83	21,81
+26	33,60	24,40
+28	37,79	27,26
+30	42,42	30,39
+32	47,55	33,85
+34	53,19	37,61
+36	59,41	41,74
+38	66,25	46,25
+40	73,77	50,17
+42	82,01	56,52
+44	91,02	62,38
+46	100,87	68,57
+48	111,64	75,50
+50	123,4	83,0

Table 1

The storage facility 600 also comprises storage of bags 20 for the transport of chilled or frozen goods. The bags 20 may be bags 20 for the transport of chilled or frozen goods. The bags 20 may be provided in plural predetermined sizes, such as e.g. six different sizes. The interior storage space volume of the bags 20 sizes may comprise e.g. 4,5 litres, 10 litres, 20 litres, 30 litres, 40 litres and 50 litres.

With reference to Figure 39, the facility 600 may comprise plural storage rooms 650_{TI}, 650_{TII}, 650_{TIII}, and 650_{TIV}, as mentioned above. The Goods storage facility # may keep a stock of goods 40_I at a first cool temperature within the first temperature range T_I. The first temperature range may be 15-18 degrees Centigrade. Such goods 40_I may comprise grocery such as fresh produce, such as fruit or mushroom, which may be provided in separate portion sized packages or containers 40A. Thus, some goods may be provided at **a** first, cool, temperature range T_I of about 15-18 degrees Centigrade.

Some goods may be provided at a second, cold non-freezing, temperature range T_{II}. The second cold non-freezing temperature range may be a range of about +6 to +8 degrees Centigrade. Alternatively, the cold non-freezing temperature range may be a range of about +1 to +4 degrees Centigrade.

Some goods may be provided at a third temperature range T_{III}. The third temperature range TIII may be a freezing temperature range of e.g. between -18 degrees to – 22 Centigrade.

Moreover, some goods may be provided at a fourth freezing temperature range T_{IV} which is colder than the third range. The fourth range may be e.g. of between -25 to -40 degrees Centigrade. Providing frozen goods within such a low temperature range advantageously extends the time required for the frozen goods to warm towards a minimum freezing temperature T_{frMin}. The minimum freezing temperature T_{frMin} may be e.g. -10 or -4 degrees Centigrade. The value of the minimum freezing temperature T_{frMin} depends on the type of goods.

According to an example, the fourth freezing temperature range T_{IV} is a settable range, such that the fourth freezing temperature range T_{IV} can be set to a value $T_{IV} = T_{f4}$ +/- T_{ra}, wherein the value T_{IV} is a temperature between -25 to -40 degrees Centigrade, and T_{ra}= is inaccuracy range. The inaccuracy range T_{ra} may be a narrow span of a few degrees. The inaccuracy range T_{ra} may be a narrow span of e.g. less than two degrees.

When transporting chilled or frozen goods in an example of a chill conserving bag 20, the duration from the packing of the chilled or frozen product into the chill conserving bag 20 until the goods has reached a certain higher temperature T_{ch2} depends on the initial temperature T_{ch1} of the chilled or frozen goods. Thus, a lower initial goods temperature T_{ch2} will increase the duration T_{COOL} during which the goods is kept below a certain limit value $T_{chlimit}$. Thus a lower initial goods temperature T_{ch2} will enable a longer acceptable transport time of the chilled or frozen goods.

However, the inventors concluded that a lowering of the initial temperature T_{ch1} does not lead to a proportionally longer duration T_{COOL} during which the goods is kept below a certain limit value $T_{chlimit}$.

Figures 40A and **40B** and **40C** show a schematic block diagram of an example of a method of delivering chilled goods and/or frozen goods.

With reference to figure 40A, the left flow chart F10 illustrates actions performed by means of a **client location** computer 510. In a step S200 a client, such as e.g. a person wanting to buy goods, places an order for chilled and/or frozen goods by causing the **client location** computer 510 to communicate with the server computer 540 located at the server location 592. The client may thus place an order for a certain amount A of chilled and/or frozen goods to be delivered to a delivery destination DD.

The server computer 540 may thus be adapted to receive an order, as indicated by step S300 in the right hand side flow chart F20 in Fig 40A. The server computer 540 may also include functionality for debiting, and for confirming receipt of the order.

When the order includes a request for goods that should be kept within mutually different temperature ranges, the server computer 540 may be adapted to sort the order information according to the goods temperature ranges (step S310).
With reference to Figure 40A and Figure 38, the server computer 540 may, in a step **S320**, transfer a delivery instruction DI to the storage computer 610 at the storage facility 600. The delivery instruction DI may comprise information about the amount of each piece of goods ordered and information indicative of the delivery destination DD. The delivery instruction DI may also be indicative one or plural goods temperature ranges associated with the ordered goods.

In a step S330 the delivery instruction DI may be received by the storage computer 610 at the storage facility 600. In a step S340 the storage computer 610 may be adapted to create a packing instruction PI. The packing instruction may include information about the amount of each piece of goods ordered.
It is noted that the step S310 may be performed by the storage computer 610, as an alternative to being performed by the server computer.

When the order includes a request for goods that should be kept within mutually different temperature ranges, the storage computer 610 may be adapted include structured information in the packing instruction PI so that an approximate volume and/or an approximate mass of the goods within an individual temperature range TI, TII, TIII, or TIV is indicated by the packing instruction PI. In dependence on the information in the packing instruction PI the storage computer 610 may generate an indication of a suitable type and/or suitable size of transport container for the ordered goods. As mentioned above, the bags 20 may be provided in plural predetermined sizes, such as e.g. five different sizes. The interior storage space

volume of the bags 20 sizes may include plural bag volume sizes V1, V2, V3, V4, V5. The bag volumes may include V1, V2, V3, V4, V5, V6 being mutually different sizes such as e.g. 4 litres, 10 litres, 20 litres, 30 litres, 40 litres and 50 litres.

With reference to figure 38 in conjunction with figure 39, and step S340 in Fig. 40A, the storage computer 610 may deliver the packing instruction PI to a relevant user input/output interface 620_{I}, 620_{II}, 620_{III} , or 620_{IV} dependent on the volume and/or mass indicated for goods within an individual temperature range TI, TII, TIII, or TIV is indicated by the packing instruction PI. Thus, for example, when the packing instruction PI includes an indication that X kg of goods within the fourth temperature range TIV is to be packed, the instruction may be sent to the corresponding user input/output interface 620_{IV} (See Figure 39). A user input/output interface 620_{I}, 620_{II}, 620_{III} , and/or 620_{IV} may include a display. The display 620_{I}, 620_{II}, 620_{III} , and/or 620_{IV} may be adapted to be read by a person whose task it is to move the indicated amount of goods from the indicated storage room 650_{TI}, 650_{TII}, 650_{TIII}, and/or 650_{TIV} into a bag 20 having an indicated size V1, V2, V3, V4, or V5. It has been found that there is an optimum filling degree of a chill bag 20. Moreover, it has been found that if X kg of a certain chilled or frozen goods is to be transported, it is better to include the X kg in one chill bag 20 than to split the X kg into smaller plural smaller amounts in different containers. Thus, all goods within a certain temperature range should preferably be collectively packed in as few containers as possible, while not exceeding the optimum filling degree of a chill bag 20. The optimum filling degree allows for an air gap to form between the inner surface of the bag 20 and the outer surface of the cold or frozen goods. Preferably the bag is filled to a filling degree such that the chilled goods avoids physical contact with any side wall and with the inside of the closed upper surface, i.e. the sealed opening portion of the bag 20. Thus, packing instruction PI may include information indicative of a recommended number container(s) 20 and recommended container size V1, V2, V3, V4, or V5 for goods within each temperature range (see step S350

in Figure 40A) so as to allow for packing a minimum number of uniform goods temperature containers being filled to the optimum filling degree.

The filling degree is determined so as to balance between conflicting requirements. If the filling degree is too small, the bag has too little content of chilled or frozen goods, the amount of stored negative energy is small rendering an undesiredly fast warming of the goods due the small amount of "cold energy". The terms "negative energy" or"cold energy" are used since a piece of chilled goods having a certain temperature absorbs energy , i.e. absorbs positive energy, in the process of increasing its temperature. The absorbed energy is the energy that may seep in via the walls of the closed and sealed container, by way of heat conduction through the walls. Advantageously, according to examples of the disclosure, heating by condensation and/or frosting within the container 20 or bag 20 is eliminated or reduced, since entry of air is prevented or reduced as described elsewhere in this document, thereby basically rendering heat conduction through the walls the only remaining manner by which energy can seep into the interior of the container 20 or bag 20.

On the other hand, if the filling degree is too large, the goods may fill the interior storage space to such an extent that the chilled or frozen goods may rest close to the side walls, or even touch the side walls, thereby reducing or eliminating an insulating effect gained by a gap between the side walls and the chilled or frozen goods placed at a centre position of the bottom panel of the bag.

As mentioned above, it was found that a good filling degree of a bag 20 is between 25% and 75%, according to an example of the disclosure, so as to gain an insulating effect by a gap between the side walls and the chilled or frozen goods placed in the interior storage space. It has been found that it is preferable to have at least 2 kg of chilled or frozen goods in order to provide an amount of stored cold energy within the bag 20, when the bag 20 has a volume between 10 litres and 50 litres. More preferably, a bag 20 having a volume between 10 litres and 50 litres, should be filled

with at least 2,5 kg of chilled or frozen goods and the filling degree should preferably be less than 90%. It has been concluded that a bag 20 having a volume between four litres and 10 litres, should preferably be filled with at least 1,5 kg of chilled and/or frozen goods and the filling degree should preferably be less than 90%.

It has been found by experiments that a good filling degree appears to be between 30% and 70% of the bag volume.

An optimum filling degree appears to be between 40% and 60% of the bag volume. According to a preferred example the filling degree is between 45% and 55% of the bag volume.

With reference to Figure 40B, in a step S360 one or plural bags 20 are packed. According to a preferred example, a bag 20, having a bottom panel and side panels, is packed in a manner that allows an air gap to be formed between the side panels of the bag 20 and chilled or frozen goods placed at a centre position of the bottom panel. According to a preferred example, a certain bag 20 is filled with goods having mutually uniform temperature. This advantageously contributes to a substantially uniform temperature throughout the goods in that bag 20, and it minimizes any temperature re-distribution between mutually different pieces of goods. Thus, in step S360 one or plural bags 20 may be packed such that a minimum number of uniform goods temperature containers are filled to the optimum filling degree. With reference to figure 39, the actual packing of bags 20 may be performed manually by a person receiving instructions from the user interface 620 in goods loading room 660.

When the bag(s) 20 have been filled, as described above, each bag 20 may be closed and sealed, as indicated in step S370 (Fig 40B). This may also be done manually. As described elsewhere in this document, there are many alternative manner by which closing and/or sealing of the bag 20 may be performed. This may include heat

welding, gluing, sealing by use of a tape, or by clamping. Closing and/or sealing of the bag 20 may be also be performed by folding a rim portion of a bag 20.
According to yet an example, with reference to figure 41, the bag 20 may include a neck portion 662 of flexible material at the rim portion of the bag wall(s), the flexible material being shaped and sized to allow a string 664 being placed around the neck portion so as to strangle the neck portion such that the bag becomes substantially sealed.

According to an example, the storage computer 610 may deliver the packing instruction PI to a packing robot 670 (See figure 38 in conjunction with step S340 in Fig. 40A). Although Figure 38 only shows one storage room 650, it is to be understood that there may be plural storage rooms 650_{TI}, 650_{TII}, 650_{TIII}, 650_{TIV} and one, several or all the storage rooms 650_{TI}, 650_{TII}, 650_{TIII}, 650_{TIV} may be provided with a packing robot 670, thereby enabling complete packing to be to performed in a cold and dry environment.
When packing is performed by a robot the whole packing procedure may be performed within the respective storage room 650_{TI}, 650_{TII}, 650_{TIII}, 650_{TIV} having a controlled air temperature and a controlled air humidity. According to an example, the ambient air temperature in goods loading room 660 is kept lower than +25 degrees Centigrade, and the air humidity is advantageously kept lower than 70% in the environment where chilled or frozen goods is to be packed into bags 20 so as to eliminate or minimize the occurrence of condensation or frosting on chilled or frozen goods. According to an example the relative air humidity is kept lower than 40% RH. According to another example the relative air humidity is kept lower than 20% RH.
For optimum cold retention properties of the bag 20 during the-transport-to-come, the bag 20 should preferably be packed and sealed such that the air trapped within the bag 20 has a relative humidity of less than 70% at an air temperature equal to the surface temperature of the goods during packing. The purpose of this feature is to minimize or eliminate the risk of condensation occurring within the bag 20. Since

the relative air humidity decreases in response to increased temperature, such relatively dry air being initially trapped in the bag may not only avoid causing condensation, but it may also advantageously be able to absorb and dilute some humidity that may originate from the chilled goods or from a minor entry of ambient air during transport.

With reference to step 380 in Figure 40B, and Figure 38, the sealed container(s) 20 may be placed in or on a transport vehicle 680 for distribution to the delivery destination DD. The delivery destination may be the client location 500, or a geographically different place.

As illustrated by step S390 in Fig. 40C, the sealed container(s) is/are transported to the delivery destination DD in accordance with the information in the delivery instruction DI. The sealed container(s) 20 may have the ability to retain an initial low goods temperature for a long time due to the interaction of a number of cleverly combined features, as described elsewhere in this document, even when used in an air atmosphere environment having an ambient air temperature of more than +10 degrees Centigrade. The sealed container(s) 20 may have the ability to retain an initial low goods temperature for a long time also when the air atmosphere environment has an ambient air temperature of more than +20 degrees Centigrade or more.

With reference to step S400 in Figure 40B, and Figure 38, the sealed container(s) 20 may be delivered at the delivery destination DD in accordance with the information in the delivery instruction DI.

As mentioned above, an embodiment of the bag 20 comprises

a wall adapted to enclose an interior storage space (100) for transporting chilled and/or frozen goods 40, 40A, the wall being shaped and adapted to form an interior storage space 100 to a volume of five metric litres; the chill bag having

a collapsed state for enabling transportation of the paper chill bag in a substantially flat state, and

an expanded state such that the paper chill bag, in its expanded state, provides an interior storage space (100) for transporting chilled and/or frozen goods, the wall being shaped and folded so as to form

a front wall panel (110, S1A),

a back wall panel (120, S1B),

and

a bottom panel (140); wherein the wall panels and the bottom panel cooperate to form said interior storage space (100) to a volume of five litres in the expanded state of the kraft paper chill bag (20); said wall comprising:

an outer paper layer; and

an inner paper layer; and

a thermally insulating intermediate space beween the outer paper layer and the inner paper layer; the intermediate space comprising an intermediate material; and

a closable bag opening (160, 420) such that the chill bag (20) in its closed state seals, or substantially seals, the interior storage space (100) from the environment so as to minimize or prevent entry of air from the environment into the interior storage space (100); the bag opening being closed by folding a flap 26 be folded down and secured in position by the use of the adhesive layer 29, as illustrated in figure 13. The a bottom panel was made as disclosed in connection with Figure 18F.

A comparative test was done for the purpose of evaluating the relative ability to maintain a frozen state of goods. A bag 20 as described above (Here referred to as testbag TB), i.e. a bag as disclosed in Figure 13 in conjunction with Figure 18F, was filled with an amount of frozen goods, and the the bag 20 was placed in an environment of 20 degrees Centigrade and a relative humidity of 60%RH. In this test the test bag TB had fragmented stuffing material in the form of recycled paper as intermediate material H.

For the purpose of comparison, a kraft paper bag as disclosed in EP3140223B1 (here referred to as KPB), was packed with the same amount of frozen goods, at the same initial temperature, and the kraft paper bag KPB was also placed in the same environment. Thus, the measuring condition were the same. Whereas the frozen goods in the kraft paper bag KPB had increased its temperature by 4 degrees centigrade after 1 hour, the frozen goods in the inventive bag 20 had increased its temperature by 4 degrees centigrade after 2 hours.
Whereas the the goods in the kraft paper bag KPB had increased its temperature by 8 degrees centigrade after two and a half hours, the goods in the inventive bag 20 had increased its temperature by 8 degrees centigrade after 5 hours.
Hence, the test indicated that the inventive bag 20 can maintain a frozen state of goods for approximately twice as long time as the kraft paper bag KPB.

Figure 17A shows a table with measurement data from comparative test, comparing temperature retaining capacity for different bags and comparing temperature retaining capacity for bags with mutually different intermediate materials.
Thus, the table in Figure 17A provides measurement data from a comparative test. When the goods is not frozen, but chilled to an initial temperature in the range of about +2 degrees Centigrade to + 5 degrees Centigrade, the initial temperature is maintained for even longer, when the bag is placed in an air environment having a temperature in the range from +24 to +26 degrees Centigrade, as indicated by the table in Figure 17A. In the table of Figure 17A the bags to be compared were packed with mutually the same amount of chilled, non-frozen goods, the initial temperature of the goods being indicated in the column marked “start temp”.
In the table of Figure 17A, the two rows (rows 5 and 9) which in the leftmost column are marked “ifoodbag27L” indicate measurement data for a kraft paper bag as disclosed in EP3140223B1 (here referred to as KPB). The other remaining rows of the table of Figure 17A provide test data for bag 20 as described above (Here referred to as testbag TB) with mutually different example intermediate materials H. These alternative intermediate materials H are also discussed elsewhere in this document, e.g. the text relating to figure 14 and the text relating to figures 3, 4, 6, 8, 9, 10, and figure 11.

The 12:th row in the table in Figure 17A lists Versa-Pak™. Here, the term Versa-Pak™ refers to a multiple layer cushioning paper packaging from recycled and biodegradable cellulose tissue.

A temperature retaining container system

As mentioned above, **Figures 40A** and **40B** and **40C** show a schematic block diagram of an example of a method of delivering chilled or frozen goods according to an example of the invention. **Figure 40A** in combination with **figures 42A and 42B** illustrate an alternative example of a method of delivering chilled goods and/or frozen goods.

With reference to Figure 42A, in step S360 one or plural bags 20 are packed, as described above in connection with Fig 40B. When the bag(s) 20 have been filled, as described above, each bag 20 may be automatically closed and sealed by a packing robot 670 (See figure 38), as indicated in step S370 (Fig 40B and fig 42A). This may alternatively be done manually. As described elsewhere in this document, there are many alternative manners by which closing and/or sealing of the bag 20 may be performed. This may include heat welding, gluing, sealing by use of a tape, or by clamping. Closing and/or sealing of the bag 20 may be also be performed by folding a rim portion of a bag 20. According to yet an example, with reference to figure 41, the bag 20 may include a neck portion 662 of flexible material at the rim portion of the bag wall(s), the flexible material being shaped and sized to allow a string 664 being placed around the neck portion so as to strangle the neck portion such that the bag becomes substantially sealed.

According to an example, the storage computer 610 may deliver the packing instruction PI to a packing robot 670 (See figure 38 in conjunction with step S340 in Fig. 40A). Although Figure 38 only shows one storage room 650, it is to be understood that there may be plural storage rooms 650_{TI}, 650_{TII}, 650_{TIII}, 650_{TIV} and

one, several or all the storage rooms 650_{TI}, 650_{TII}, 650_{TIII}, 650_{TIV} may be provided with a packing robot 670, thereby enabling complete packing to be to performed in a cold and dry environment.

When packing is performed by a robot the whole packing procedure may be performed within the respective storage room 650_{TI}, 650_{TII}, 650_{TIII}, 650_{TIV} having a controlled air temperature and a controlled air humidity.

Figure 42A and 42B in **conjunction with Figure 40A** is a schematic block diagram of an example of a method for delivering chilled or frozen goods. According to an example, chilled and/or frozen goods to be delivered is packed into a bag 20, such as a carrier bag 20, and thereafter the bag 20, which may be a carrier bag 20, is closed. The bag 20 may be packed to a filling degree. One or several bags 20 may thereafter be placed in a rigid container 6420 (see step S6380 in Fig. 42A).

The packing procedure may be performed in the goods loading room 660, and during the packing procedure the ambient air temperature in goods loading room 660 is preferably kept lower than +15 degrees Centigrade, and the air humidity is advantageously kept lower than 50% in the environment where chilled or frozen goods is to be packed into bags 20 so as to eliminate or minimize the occurrence of condensation or frosting on chilled or frozen goods. According to an example the relative air humidity is kept lower than 40% RH. According to another example the relative air humidity is kept lower than 20% RH.

For optimum cold retention properties, in the packed bag 20 during transport, the climate of the respective storage room 650TI, 650TII, 650TIII, 650TIV is controlled to a temperature approximately equal to the temperature of the chilled goods and/or frozen goods. For good cold retention properties of the bag 20 during the-transport-to-come, the bag 20 should preferably be packed and sealed in an air environment such that the air trapped within the bag 20 has a relative humidity of less than 70% at an air temperature equal to the surface temperature of the goods during packing.

For optimum cold retention properties of the bag 20 during the-transport-to-come,

the bag 20 should preferably be packed and sealed such that the air trapped within the bag 20 has a relative humidity of less than 50% at an air temperature equal to the surface temperature of the chilled or frozen goods 40, 40A, 40B during packing. The purpose of this feature is to minimize or eliminate the risk of condensation occurring within the bag 20. Since the relative air humidity decreases in response to increased temperature, such relatively dry air being initially trapped in the bag may not only avoid causing condensation, but it may also advantageously be able to absorb and dilute some humidity that may originate from the chilled goods or from a minor entry of ambient air during transport.

Likewise, for optimum cold retention properties of the rigid container 6420 during the-transport-to-come, the rigid container 6420 should be packed and sealed such that the air trapped within the rigid container 6420 has a relative humidity of less than 70% at an air temperature equal to the surface temperature of the chilled or frozen goods 40, 40A, 40B during packing.
The chilled or frozen goods 40, 40A, 40B may comprise grocery packages 40, as discussed elsewhere in this document.

Table 1 provides approximate information about the absolute water content for saturated air, i.e. at 100% relative humidity at various temperatures. Thus, when the air trapped within the bag 20 has a relative humidity of less than 70% at an air temperature equal to the temperature of the goods during packing, the absolute water content will be very low.
The purpose of this feature is to minimize or eliminate the risk of condensation occurring within the bag 20. Since the relative air humidity decreases in response to increased temperature, such relatively dry air being initially trapped in the bag may not only avoid causing condensation, but it may also advantageously be able to absorb and dilute some humidity that may originate from the chilled goods or from a minor entry of ambient air during transport.

With reference to figure 42A, a rigid container 6420 (see Fig 43) may be provided (Step S6375), or a container system (See Fig 47) including a second rigid container 6420B may be provided.

After the step (S370) of sealing the bag(s) 20, the bag(s) 20 may be placed (step S6380) in a rigid container 6420 (See Fig 43), or in a second rigid container 6420B of the container system. One or plural container(s) 20 may be placed in a single rigid container 6420 or 6420B, which may be filled to a rigid container filling degree. The rigid container filling degree depends on the type of rigid container used.

Figure 43 is an illustration of an example of a rigid container 6420, and **Figure 44A and 44B** are illustrations of a closure device or lid 6460 that may be used to cover an opening 6450 of the rigid container 6420 so as to provide a closed state of the rigid container 6420. The lid co-operates with the opening such that the rigid container in its closed state seals, or substantially seals, an interior storage space 6465 from the environment so as to minimize or prevent entry of air from the environment into the interior storage space. Said rigid container 6420 further comprises a bottom wall 6430 and a plurality of side walls 6440. The opening 6450 can be provided by a rim 6445 of the rigid container 6420. The rigid container 6420 may be a box. According to an example the rigid container walls comprise a plastic material. A plastic material may typically have a thermal conductivity in the range from 0,23 W/(m*K) to about 0,4 W/(m*K).

In one example, the bottom wall 6430, the plurality of side walls 6440 and the lid are adapted to be substantially water vapour impermeable. In one example, the bottom wall 6430, the plurality of side walls 6440 and the lid comprise an insulating layer and a layer of a material being adapted to be substantially water vapour impermeable. This is in one example achieved by layers according to what has been described before in this disclosure.

In one example, at least one of the walls of the rigid container, and/or the lid, includes a layer of an energy absorbent. In one example, all of the walls of the rigid container include a layer of an energy absorbent material.

The energy absorbent material is in one example a material having a specific heat capacity of more than 1000 J/(kg *K). The energy absorbent material can be chilled to a predetermined temperature before use of the rigid container.

The rigid container can comprise a water vapour impermeable layer so as prevent entry of air from the environment into the interior storage space 6465. The rigid container can comprise an insulating layer, which comprises a material having a thermal conductivity of less than 0,2 W/(K*m). The rigid container can comprise a layer of an energy absorbent material having a specific heat capacity of more than 1000 J/(kg *K). The energy absorbent material can be adapted to be chilled to a predetermined temperature before use of the rigid container.

The energy absorbent material is in one example a phase change material having a specific heat capacity and a latent heat value. The energy absorbent material can be arranged to be chilled to a predetermined temperature before use of the rigid container. The predetermined temperature can be selected such that said phase change material is in a solid state. According to an example the phase change material comprises water. Thus, when said phase change material is in a solid state the phase change material comprises frozen water, i.e. water ice. According to an example the phase change material comprises fresh water having a phase change temperature of approximately zero degrees Centigrade.

With reference to figure 42, the method includes the step of closing (Step S6390) the rigid container 6420 such that the rigid container in its closed state seals, or substantially seals, an interior storage space 6465 from the environment so as to

minimize or prevent entry of air from the environment into the interior storage space.

In a subsequent step S6394, the rigid container may be marked with data indicative of a delivery destination DD for bags 20 packed inside that particular rigid container 6420. The marking of the rigid container 6420 is done based on the information in the delivery instruction DI (See above). Alternatively the rigid container 6420 is individually marked so as to indicate a queue position, indicating when that individual rigid container 6420 is to be unloaded in relation to other rigid containers 6420 to be delivered by the same transport vehicle 680. Thus, a rigid container 6420 may include a delivery destination tag DDT for holding the data indicative of a delivery destination DD for bags 20, and/or for holding data indicative of a queue position, indicating when that individual rigid container 6420 is to be unloaded in relation to other rigid containers. The data in/on the delivery destination tag DDT is based on the information in the delivery instruction DI. Morevoer, the data in/on the delivery destination tag DDT may be based on information in the delivery instruction DI, such as adress of the delivery destination DD in conjunction with map data and data of the route to be followed by the delivery vehicle during delivery of bags 20 to a large number of delivery destinations DD.

The rigid containers 6420 are sorted in a step S6396, based on the information in the delivery instruction DI, such as adress of the delivery destination DD in conjunction with map data and data of the route to be followed by the delivery vehicle during delivery of bags 20 to the various delivery destinations DD of the goods in the bags 20 which are inside the individual rigid containers 6420. Thus, the rigid containers 6420 are sorted so as to be loaded into the loading space of transport vehicle in a First-In-Last-Out order based on date indicative of delivery destinations and delivery route information. Thus, the rigid containers 6420 are sorted (step S6396) in a a First-In-Last-Out order.

One or several rigid containers 6420 may thereafter be packed (step S6400) onto or into the transport vehicle 680. It is desirable to use the loading space of the transport vehicle 680 as efficiently as possible, and it is also desirable to enable the delivery personell to work as efficiently as possible during delivery of the bags 20. Therefore, the rigid containers 6420 are preferably loaded (step S6400) onto or into the transport vehicle loading space in a First-In-Last-Out order.

The transport vehicle 680 may be a motorised vehicle 680. The shape, size and dimensions of the loading space of a transport vehicle 680 is preferably larger than 260 metric liters, such that at least four rigid containers 6420 can be placed inside of the transport vehicle loading space, when each rigid container 6420 occupies a volume of more than 60 metric liters. The loading space of the transport vehicle 680 may e.g. have a width in excess of 2 meters, a height in excess of 1,9 meters, and a depth in excess of 4 meters. An example transport vehicle loading space has a width of 2,09 meters, a height of 2,00 meters, and a depth of 4,14 meters. Thus the volume of the transport vehicle loading space may be in excess of 17 000 metric litres.

In this connection it is noted that, according to an example, the rigid container 6420 has an internal storage space volume in excess of 100 metric liters.
An example rigid container 6420 has the following outer dimensions: a width of 5,00 dm at the widest, a height of 6,10 dm including the lid (i.e. when the lid is placed over the rigid container opening), and a length of 7,80 dm. Thus, the loaded rigid containers, when placed next to each other and on top of each other, as they may be placed in the loading space of the transport vehicle 680, each occupy a space of about 237,9 metric liters (cubic decimeters).

As illustrated by step S6410 in Fig. 42B, the sealed rigid container 6420 may then be transported to the delivery destination DD (See Fig. 38) in accordance with the information in the delivery instruction DI, e.g. by means of the transport vehicle 680. The sealed container(s) 20 inside of the sealed rigid container 6420 may have

the ability to retain an initial low goods temperature for a very long time due to the interaction of a number of cleverly combined features, as described elsewhere in this document, even when used in an air atmosphere environment having an ambient air temperature of more than +10 degrees Centigrade and a relative air humidity of more than 80%. The sealed container(s) 20 may have the ability to retain an initial low goods temperature for a very long time also when the air atmosphere environment has an ambient air temperature of more than +20 degrees Centigrade or more and a relative air humidity of more than 80% or more, since condensation heating and heating by frosting is prevented by efficient sealing in at least two steps, i.e. the sealing provided by sealed rigid container 6420, and the additional sealing provided by sealed bag 20 of chill bag 20, and because of improved insulating properties of sealed rigid container 6420 and the improved insulating properties of the sealed bag 20.

With reference to step S6420 in Figure 42B, and Figure 38, the sealed bag(s) 20 in a rigid container can advantageously be delivered at the correct delivery destination DD in accordance with data in/on the delivery destination tag DDT on the relevant rigid container. This is since the data in/on the delivery destination tag DDT reflects the information in the delivery instruction DI, as described above.

Because of the efficient temperature conserving properties of examples of the goods transport system according to this disclosure, the duration of the transport may be allowed to be advantageously long while still retaining desired goods temperature. Thus, one or several sealed container(s) 20, or bag(s) 20, may be delivered and left at the delivery destination DD, where a recipient, such as e.g. a customer or a client may take the container(s) 20, or bag(s) 20 and carry it e.g. to a fridge or a freezer, where the chilled and/or frozen goods may be unloaded from the container(s) 20, or bag(s) 20 into the fridge and/or freezer, respectively.

Because of the efficient temperature retention properties of the goods transport system, the cost for delivery of chilled and/or frozen goods may be significantly

decreased. This advantageous effect is attained since the efficient temperature retention properties of the goods transport system including the combination of sealed container(s) 20 or carrier bags 20 and the sealed rigid container 6420 enables the transport to be performed using a vehicle without any actively refrigerated storage enclosure for the transportation of the loaded container 6420. According to an example the transport vehicle 680 may be a motorised vehicle 680 having a vehicle storage area without any fridge or freezer. Thus, whereas conventional motorised transport vehicles for transporting chilled and/or frozen goods use energy in the form of electricity or gas or petrol etc, for maintining a certain temperature in the air surrounding the goods during transport, the above described combination of sealed container(s) 20 or carrier bags 20 and the sealed rigid container 6420 may enable the transport to be performed using a vehicle without consuming energy in the form of electricity or gas or petrol to actively chill the vehicle storage area during transport. This advantageously enables use of less costly vehicles, while the combination of sealed container(s) 20 or carrier bags 20 and the sealed rigid container 6420 advantageously maintains a low temperature of the chilled and/or frozen goods for an extended amount of time.

According to a preferred example the container 20, or bag 20, comprises biodegradable materials, as disclosed above in this document, therefore allowing for it to be disposed of in an environmentally friendly manner. According to some examples every material in the container 20, or bag 20, is a biodegradable material.

As mentioned above, with reference to step S6420 in Figure 42B, and Figure 38, the sealed bag(s) 20 in a rigid container can advantageously be delivered at the correct delivery destination(s) DD in accordance with data in/on the delivery destination tag DDT on the relevant rigid container. Thus, during the delivery tour, the rigid containers 6420 are unloaded and/or emptied in a Last-in-First-Out-Order (Step S6414).

According to an example, the rigid containers may be shaped and dimensioned so that they can be stacked and nested to save space when empty (Step S6424). Thus, when a rigid container 6420 has been emptied and the lid of the rigid container 6420 is not covering the rigid container opening, another rigid container 6420 can advantageusly be sunk into the the empty rigid container 6420. In this manner several rigid containers 6420 are stackable in a nested fashion so as to save space in the delivery vehicle. This feature of nesting the rigid containers 6420 is further discussed elsewhere in this document.

Thus, whereas the bags 20 are delivered at the delivery destinations, the rigid container 6420 may remain in the vehicle 680 so as to be returned to the storage facility 600 (Step S6430, see Figure 42B), thereby allowing it to be used again, in that step S6380 may be repeated using the returned rigid container 6420 (See Figure 42A).

According to an example, the returned rigid container 6420 passes an inspection step (S6432). The inspection step may comprise an evaluation of the status of the rigid container 6420, such as e.g. the physical condition, and/or the hygenic condition of the rigid container 6420. According to an example, the inspection step S6432 may include taking microbiological samples and performing a corresponding analysis.

A rigid container 6420 may optionally be passed to a washing and cleaning step (S6440). Thus, the rigid container 6420 may be cleaned so as to remove any dirt or foreign objects, dependent on the outcome of the inspection step (S6432).

Moreover, following the washing and cleaning step (S6440), the rigid container 6420 may optionally be passed to a disinfecting step and/or a sterilizing step (S6450). Thus, the rigid container 6420 may be disinfected/sterilized such that the rigid container 6420 fulfils established criteria, such as e.g. criteria for distribution of groceries. In this connection it is noted that in an example of the rigid container

6420, the rigid container 6420 walls and lid is comprises Expanded Polypropylene (EPP). According to an example, the disinfecting step and/or a sterilizing step (S6450) includes washing the rigid container 6420 in alcohol, at least when the rigid container 6420 is made of Expanded Polypropylene (EPP). In this connection, it is noted that Expanded Polypropylene (EPP) has an excellent chemical resistance to alcohol. Accordingly, cleaning and disinfection may be performed on the rigid container 6420 made of EPP by the use of alcohol. Moreover, the EPP rigid container 6420 advantageously can withstand a very high temperature of 110 degrees Centigrade, allowing it to be efficiently cleaned and disinfected by a hot liquid, even up to such a temperature as +110 degrees centigrades.
Thus hot water, e.g. at a high temperature of about 100 degrees Centigrade may be used. This is an environmentally friendly solution since water is, of course, non toxic.

According to an example, the cleaning (S6440) and the disinfecting (S6450) of the rigid container 6420 is performed so as to conform with regulation (EC) no 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs. Moreover, According to an example, the cleaning (S6440) and the disinfecting (S6450) of the rigid container 6420 is performed so as to conform with Regulation (EC) No 853/2004 of the European Parliament and of the Council of 29 April 2004 laying down specific hygiene rules for on the hygiene of foodstuffs.

In this connection it is noted that in an example of the rigid container 6420, the rigid container 6420 walls and lid is comprises Expanded Polypropylene (EPP). The rigid container 6420 being made out of the EPP material provides a number of features which are very advantageous. Expanded Polypropylene (EPP) is a highly versatile closed-cell bead foam that provides a unique range of properties, including outstanding energy absorption, multiple impact resistance, thermal insulation, buoyancy, water and chemical resistance, exceptionally high strength to weight ratio

and 100% recyclability. EPP in general can be made in a wide range of densities. The quality of the EPP selected for making the walls and the lid of the rigid container 6420 is preferably a moulded density of less than 60 kg/cubic metre, this quality of EPP advantageously having a thermal conductivity (at 10 degrees Centigrade) of 0,040 W/(m*K) or less than 0,040 W/(m*K). An example rigid container 6420 is made of Expanded Polypropylene (EPP) having a moulded desity of 40 kg/cubic metre and a thermal conductivity (at 10 degrees Centigrade) of 0,038 W/(m*K). Other EPP qualities may be used for making the walls and the lid of the rigid container 6420 so that the moulded density is higher and the thermal conductivity (at 10 degrees Centigrade) is also higher. However, the EPP quality is selected so that the thermal conductivity (at 10 degrees Centigrade) is less than 0,15 W/(m*K). The EPP quality is preferably selected so that the thermal conductivity (at 10 degrees Centigrade) is less than 0,07 W/(m*K).

Before providing the rigid container 6420, it might be chilled (Step S6370). Said chilling can be performed to a predetermined temperature. Before providing the second rigid container 6420B, it might be chilled (Step S6370). Said chilling can be performed to a predetermined temperature.

What has been described in relation to Fig. 40A, Fig. 42A, and Fig. 42B can be part of a method of delivering chilled goods in a first sealable container.

Said method of delivering chilled goods in a first sealable bag 20 comprises the step of receiving an order for an amount of chilled goods. This is in one example performed according to what has been stated in relation to step s300. The first sealable container can be the kraft paper chill bag according to the present disclosure. The first sealable container can be a bag 20 or a container according to any of the examples according to the present disclosure.
The method further comprises packing said amount of chilled goods in said first sealable bag 20 adapted to be used in an air atmosphere environment. This is in one

example performed according to what is described in relation to step s360. The first sealable bag 20 has a wall adapted to enclose an interior storage space for transporting chilled and/or frozen goods. The wall is shaped and adapted to form said interior storage space to a volume of at least four metric litres. The wall may comprise an outer material layer; and an inner material layer; and a thermally insulating intermediate space beween the outer material layer and the inner material layer, the intermediate space comprising an intermediate material. Moreover, one or several of the outer material layer; the inner material layer; and the intermediate material layer mat be a material having a thermal conductivity of less than 0,15 W/(K*m). The first sealable bag 20 has a closable opening such that the bag 20 in its closed state seals, or substantially seals, the interior storage space from the environment so as to minimize or prevent entry of air from the environment into the interior storage space.

The method further comprises the step of closing said closable opening of the bag 20 so as to seal said amount of chilled or frozen goods from said air atmosphere environment. This is in one example performed as described in relation to step s370.

The method even further comprises the step of providing a rigid container 6420, or providing a goods transport system. Said rigid container or said goods transport system can be formed according to any of the examples of the present disclosure.

The method comprises the step of placing the closed first sealable bag 20 inside the rigid container 6420, or inside the second rigid container of the goods transport system. This can be according to what has been described in relation to step s6380.

The method further comprises the step of transporting the closed first sealable bag 20 to a delivery destination DD while keeping the closed first sealable bag 20 inside of the rigid container 6420, or inside the second rigid container 6420B of the goods transport system. This is in one example performed according to what is described in relation to step s6410.

The step of transporting the closed first sealable bag 20 comprises in one example maintaining a closed state of the closed first sealable bag 20 during the complete

transport from a goods loading room 660, where said first sealable bag 20 was loaded and closed, to the delivery destination DD. This advantageously prevents warming by condensation heat or frosting. When the closed first sealable bag 20 is placed inside of the insulated rigid container 6420, having a wall thickness of at least 15 mm and a thermal conductivity of less than 0,15 W/(K*m) the initially chilled and/or frozen goods retains its chilled and/or frozen status for an advantageously extended period of time.

Figure 44A is a perspective view from above of a closure device or lid 6460. Figure 44B is a perspective view from below the closure device or lid 6460 of Figure 44A. The lid may be provided with sealing means 6470 so as to cooperate with a rim 6445 of the rigid container opening so as to minimize or prevent entry of air from the environment into the interior storage space of the rigid container.

Figure 45 is an illustration of the rigid container 6420 in a closed state with the lid 6460 placed to cover the opening.

Figure 46 is an illustration of the rigid container 6420 in a closed state with the lid 6460 placed to cover the opening, and loaded with two bags 20. Although fig 46 illustrates the bags 20 in an open state, it is to be understood that when used for transporting chilled or frozen goods, the bags 20 will normally be provided in a closed and sealed state when placed in the rigid container. By providing the chill bag 20, in a closed and sealed state when placed in the rigid container, ambient air close to the outer surface of chill bag 20 will be the air of the loading area, which advantageously may be of a low temperature and a low relative humidity. According to examples of the disclosure the air of the loading area may be controlled to a sufficiently low air humidity so as to avoid any liquid water forming, or any frosting forming, on the chilled or frozen goods or on the outer surface of the bags 20.
In this context it is noted that if a bag 20 has been loaded so that some chilled or frozen goods touches a wall panel of bag 20, there may be formed a locally cold

spot, and if the bag 20 were placed in an environment having a relative air humidity, the dew point may be reached. If the dew point were reached so that liquid water or frost is formed there would also be a large amount of heat produced at that cold spot. As discussed above in this document, the energy released by 1 gram of water vapour being turned into ice would actually be sufficient to warm one whole kilogram of frozen water by more than one degree Kelvin. Most of that energy is produced by the vapour changing phase to the liquid state. Thus, the provision of a air sealing container 6420 may advantageously prevent energy transport into the bag 20 by the provision of an interior storage space 6465 having a low air humidity. Moreover, the provision of an interior storage space 6465 having a low air humidity also provides insulation since air has a low thermal conductivity of about 0,024 W/(m*K).

Table 6, below, indicates approximate thermal conductivity values for some materials.

Material	λ = thermal conductivity (W/(m*K))
Carbon dioxide	0,014
Air	0,024
Nitrogene	0,024
Water	0,6
Water ice (at -4°C)	2,1
Fiberplatta	0,06
Polyethene	0,23-0,29
Wood (pine)	0,14
Aluminium	237

Table 6

Figure 47 is a diagrammatic illustration of a goods transport system comprising a first rigid container 6420A, said first rigid container having an insulating wall, said first rigid container being of a first size. The first rigid container has a rim 6445

providing said opening 6450, the rim being provided opposite said bottom wall; and the plurality of side walls 6440 are arranged in a tapered manner so that the rigid container is wider at said rim than at said bottom wall.

The goods transport system also comprises a second rigid container 6420B wherein said rim 6445 provides said opening 6450 opposite said bottom wall. The plurality of side walls 6440 are arranged in a tapered manner so that the rigid container is wider at said rim than at said bottom wall.

The second rigid container 6420B is of a second size smaller than the first size so that the second rigid container 6420B, in its closed state, fits inside the first rigid container 6420A in its closed state. Moreover, at least one of the walls of the second rigid container 6420B, and/or the lid of the second rigid container 6420B, may include a layer of an energy absorbent.

As mentioned above, the rigid container walls and/or the lid of a rigid container 6420 6420A, 6420B may comprise a plastic material. According to an example, one or several of the walls and/or the lid of a rigid container 6420 6420A, 6420B may be hollow. According to an example, the hollow walls and/or the lid of a rigid container 6420 6420A, 6420B may be filled with air so as to provide thermal insulation. According to another example, the hollow walls and/or the lid of a rigid container 6420 6420A, 6420B may be filled with an energy absorbent material. According to an example the energy absorbent material comprises water.

Referring to Figure 47, the first rigid container 6420A may have insulating walls 6430A, 6440A and an insulating lid 6460A, and the second rigid container 6420B may have walls 6430B, 6440B and/or a lid 6460B which is filled with an energy absorbent material. The energy absorbent material may be a phase change material. According to an example the phase change material comprises water. Thus, when said phase change material is in a solid state the phase change material comprises frozen water, i.e. water ice. According to an example the phase change material comprises fresh water having a phase change temperature of approximately zero degrees Centigrade.

As illustrated in Figure 47, one or several closed and sealed bags 20 may be placed inside the rigid container 6420, 6420A, 6420B. The combination of the first rigid container 6420A and the second rigid container 6420B may also be referred to as a container assembly 6920.

The provision of a a container assembly 6920 comprising one or several closed and sealed bags 20 which may be packed with chilled and/or frozen goods, the closed and sealed bag 20 being placed inside a closed and sealed second rigid container 6420B wherein the second rigid container has walls 6430B, 6440B and/or a lid 6460B filled with an energy absorbent material, stabilizes temperature inside the second rigid container when the the second rigid container is closed. When the the second rigid container 6420B is placed inside of a first rigid container 6420A having insulating walls 6430A, 6440A and an insulating lid 6460A, the temperature inside the second rigid container is even further stabilized.

Here, and in the whole of this document, when referring to an energy absorbent, this refers in one example to a heat energy absorbent.

This disclosure presents a number of solutions advantageously enabling the transport of frozen or chilled goods while maintaining the frozen or chilled state of the goods for a dramatically extended duration of time, while preserving the integrity of the carrier bag during transport, even when the bag is transported in tropical environments, e.g. at temperatures of 25 degrees Centigrade or more.

In this context it is to be noted that the air in the atmosphere of the earth inherently has a certain humidity. In other words, the air contains a certain amount of water in vapour form. In this context, it deserves mentioning that the *absolute humidity* is the mass of water vapour per unit volume of total air and water vapour mixture. Absolute humidity in the atmosphere reaches roughly 30 grams per cubic meter when the air is saturated at 30 °C. The absolute humidity in southern Sweden in the

month of Juli (average value for the years 1996 to 2012) ranged from 9 grams/cubic metre to 12 grams/cubic metre, according to the Swedish Meteorological and Hydrological Institute (SMHI).

A *relative air humidity* of around 50% is common, and during summertime or in subtropical or tropical climate zones the outdoor air humidity may be higher than that. Thus a *relative air humidity* of around 80% is not unusual. The *relative humidity* of an air-water mixture is defined as the ratio of the partial pressure of water vapour (H2O) in the mixture to the saturated vapour pressure of water at a given temperature. Thus the relative humidity of air is a function of both water content and temperature. As a rule of thumb, the relative air humidity may be estimated to increase by about 5% when the temperature drops by 1 degree. Accordingly, when the air of the environment has a temperature of + 18 degrees C and a relative air humidity of e.g. 60% and that air meets a cold surface, vapour may condense into liquid water on the surface when the air temperature reaches the dew point, i.e. a *relative air humidity* of about 100% .

In this context, it also to be noted that heat is released when vapour condenses into liquid water. In fact, one (1) gram of liquid water being formed from vapour releases 2260 J (joule) of energy. When that one gram of liquid water freezes to ice form it releases another 334 J. Thus, the energy released by 1 gram of water vapour being turned into a layer of ice is 2594 J. By comparison, it is to be noted that only 2,2 J is required in order to increase the temperature of 1 gram of ice (frozen water) by one degree. In other words, the energy released by 1 gram of water vapour being turned into a layer of ice on a package containing one kilogram of frozen water is actually sufficient to warm that whole kilogram of frozen water by 1,18 degrees. Thus, if 12 grams of water vapour is allowed to turn into a frost layer of ice on a package of frozen grocery, that energy (just over 31 kJ) suffices to warm that grocery by several degrees. The exact temperature change depends on the specific heat capacity of that particular piece of grocery. Ice has a specific heat capacity of 2200 J/(kg *K), and

thus 12 grams of frost being formed would suffices to warm that one kilogram of fresh water ice by about 14 degrees Centigrade.

Thus, whereas a collapsible handle-carryable goods carrier bag according the state of the art, as disclosed by the German Utility Model Application DE 89 04 678 provides handles for conveniently carrying the groceries, any frozen grocery packages would appear to inherently cause vapour to condense into liquid water when the open carrier bag is transported in a warm air atmosphere environment having air humidity allowing such air to reach the dew point on a frozen grocery package surface. Such a condensation process may actually cause a rapid warming of the frozen grocery. Moreover, if the state of the art carrier bag according to DE 89 04 678 is carried by a walking person in a warm air environment, the movement would appear to inherently cause an exchange of air between the bag interior, which is chilled by the frozen groceries, and the warmer air surrounding the carrier bag, and this air exchange process will further drive the process of condensing vapour into liquid water by supplying new warm air to surfaces of the frozen groceries. Not only does this process cause thawing of initially frozen groceries and warming of initially chilled groceries, but it may also produce liquid water by condensation inside the carrier bag, which may jeopardize the integrity of the bag bottom or side wall, since it is made solely of paper, according to DE 89 04 678. Thus, the strength of carrier bag made solely of paper may decrease, and the risk of breaking increases when the paper-only-carrier bag becomes wet.

By contrast, the collapsible handle-carryable goods carrier chill bag according to the above defined solution comprises a mechanical interlock which is closable such that, in the closed expanded state of the carrier bag, the mechanical interlock cooperates with said wall panels and said bottom panel so as to close and substantially seal the interior storage space from the environment so as to minimize or prevent entry of air from the environment into the interior storage space such that *when a piece of goods*

comprising a frozen item is transported in said interior storage space the collapsible bag is adapted to minimize or prevent the occurrence of condensation within the interior storage space.

Thus, for example, if a carrier bag, having a volume of 50 litres in the expanded state of the carrier bag, is filled by 75% with frozen groceries, there will remain about 25% of the total volume which can be filled by air in connection with the loading of the bag. Thus, as an example, about 12,5 liters of air having an initial temperature of about 18 degrees Centigrade and, about 10 grams of water per cubic metre (example relating to approximate average absolute outdoor humidity in southern Sweden in the month of Juli) may be enclosed in the bag when it is sealed after packing. In this connection it is noted that the term "litre" means "metric litre" i.e. one litre equals one cubic decimetre. Accordingly, the 12,5 liters of contained air may include about 0,125 grams of water in vapour form. Air contained within the bag together with frozen groceries may be caused to cool, and during this decreasing of the air temperature the water vapour in that air may first condense into water, releasing 0,2825 kJ of energy, and then it may freeze releasing 0,04175 kJ of energy. Thus, the two phase changes during the transformation of 0,125 grams of water from vapour form into ice may deliver 0,324 kJ. The energy released may suffice to increase the temperature of 10 kg of frozen water by less than half a degree Centigrade. According to an estimate it would be about 0,008 degrees Centigrade. The energy released by cooling the 0,125 grams of water by 19 degrees Centigrade is comparatively small and may actually be regarded as negligible is comparison. In effect, the collapsible bag being adapted to minimize or prevent entry of air from the environment into the interior storage space advantageously contributes to maintaining the frozen or chilled state of the groceries for a significantally extended duration of time, while also preserving the integrity of the carrier bag by minimizing or preventing the formation of liquid water within the interior storage space, and by the kraft paper layer having a substantially water vapour impermeable membrane

bonded to at least one side of the kraft paper layer, thereby reducing or preventing paper disintegration due to paper wetness.

Figure 48 is an exploded perspective view of another example of an insulated rigid container box 6425. The insulated rigid container box 6425 may have a rectangular, or square shape, as seen from above. Thus the insulated rigid container box 6425 may have four corner edges connecting side walls at an angle of 90 degrees, or about 90 degrees.

The insulated rigid container box 6425 comprises an insulated rigid container 6420C having an insulated lid 6460C that may be used to cover an opening 6450 of the insulated rigid container 6420C so as to provide a closed state of the insulated rigid container 6420C. The insulated lid 6460C co-operates with the opening such that the insulated rigid container in its closed state seals, or substantially seals, an interior storage space 6465 from the environment so as to minimize or prevent entry of air from the environment into the interior storage space. Said insulated rigid container 6420C further comprises an insulated bottom wall 6430C and a plurality of insulated side walls 6440C. The opening 6450 can be provided by a rim 6445C of the insulated rigid container 6420C. The bottom wall 6430C, the plurality of side walls 6440C and the lid are adapted to be substantially water vapour impermeable, and/or substantially water impermeable.

According to an example the rigid container walls comprise Expanded polypropylene (EPP). In one example, the bottom wall 6430, the plurality of side walls 6440 and the lid comprise Expanded polypropylene (EPP) having a density in the range from 40 kg/cubic metre to 90 kg/cubic metre, and a thermal conductivity in the range from 0,035 W/(m*K) to 0,045 W/(m*K).

According to a preferred version of the insulated rigid container box 6425, the insulated rigid container 6420C and the insulated lid 6460C comprises

a carefully selected type of Expanded polypropylene (EPP) having a density in the range from 40 kg/cubic metre to 50 kg/cubic metre, and
a thermal conductivity in the range from 0,035 W/(m*K) to 0,040 W/(m*K).
The carefully selected type of EPP has a water absorption at saturation of less than 1 (less than one) volume percent (Vol. %) after one day, in accordance with test method DIN 53428. The carefully selected type of EPP has a water absorption at saturation in the range from 1 (one) to 2,5 volume percent (Vol. %) after 7 (seven) days, in accordance with test method DIN 53428. Hence, the carefully selected type of EPP is substantially water vapour impermeable, and/or substantially water impermeable. Thus, it does not readily absorb water.

Moreover, the carefully selected type of EPP is very temperature resistant and heat resistant, in that it withstands a very wide range of temperatures, from -40 degrees Centigrade to + 110 degrees Centigrade. This advantageous heat resistance of the carefully selected type of EPP enables efficient cleaning of the preferred version of the insulated rigid container box 6425. Moreover, this advantageous heat resistance of the carefully selected type of EPP enables efficient disinfection and sterilization of the preferred version of the insulated rigid container box 6425. In this connection it is noted that water at a boiling temperature can be used as a method of killing microbes that may be present. The sensitivity of different micro-organisms to heat varies, but if water is held at 70 °C (158 °F) for ten minutes, many organisms are killed. However, some micro-organisms are more resistant to heat and thus, it may be necessary to expose some micro-organisms to one minute at the boiling point of water, i.e. at 100 degrees Centigrade or more at the atmospheric pressure at sea level. Hence, the carefully selected type of EPP enables efficient disinfection and sterilization of the preferred version of the insulated rigid container box 6425 using hot water, e.g. at 100 degrees Centigrade, since the selected type of EPP withstands up to + 110 degrees Centigrade.
With reference to steps S6440 and/or S6450 in Figure 42A, the preferred version of the insulated rigid container box 6425, including the insulated rigid container 6420C

and the insulated lid 6460C comprising the carefully selected type of Expanded polypropylene, may thus be washed and/or disinfected and sterilized using hot water, e.g. at a temperature exceeding 70 degrees C, and preferably at a temperature between 100 degrees C and 110 degrees C. Hence, the steps S6440 and/or S6450 may be performed in an environmentally friendly manner using a non-toxic liquid including, or consisting of, hot water at a temperature exceeding 70 degrees C, and preferably at a temperature between 100 degrees C and 110 degrees C.

Moreover, the carefully selected type of EPP has an excellent chemical resistance to alcohol, such as ethanol, denatured ethanol, 1-propanol, and isopropyl alcohol. The chemical resistance of the carefully selected type of EPP was tested for EPP having a density of 50 kg/cubic metre at 22 degrees Centigrade for 14 days.
In this connection, it is noted that alcohols, in various forms, may be used as a disinfectant. Types of alcohol that may be used include ethanol, denatured ethanol, 1-propanol, and isopropyl alcohol, preferrably at Concentrations of 60 to 90%, being the concentrations that work best for purposes of being disinfectant. Alcohol is effective against a range of microorganisms. Hence, the steps S6440 and/or S6450 may be performed in an environmentally friendly manner using alcohol, such as ethanol, denatured ethanol, 1-propanol, and isopropyl alcohol. In this connection it is noted that alcohols may be used to disinfect devices and tools, as well as to disinfect the skin of a patient before a needle stick and before surgery.
Moreover, the carefully selected type of EPP also has an excellent chemical resistance to ketone as well as to sodium hydroxide solution (10%), ammonium, chloride(5%), nitric acid (10%), and hydrichloric acid (10%). Again, the chemical resistance of the carefully selected type of EPP was tested for EPP having a density of 50 kg/cubic metre at 22 degrees Centigrade for 14 days.

Moreover, the carefully selected type of EPP is very durable, thereby enabling the loading of heavy articles in the preferred version of the insulated rigid container box 6425, 6420C, 6460C comprising the carefully selected type of Expanded

polypropylene (EPP) having a density in the range from 40 kg/cubic metre to 50 kg/cubic metre. In fact, the insulated rigid container box 6425, 6420C, 6460C comprising the carefully selected type of Expanded polypropylene has the advantageous properties of high energy absorption on low weight, a very good resilience after static and dynamic stress, and it has an almost unaffected energy absorption after multiple-impacts. This is, at least in part, due to the advantageous mechanicals properties of the carefully selected type of EPP, such as:

- Compressive stress at 25% deformation of 150 to 380 kPA (test method according to DIN 53421)
- elasticity such that the elongation at break is 15% with a tensile strength in the range from 480 to 880 kPa (test method according to DIN 53571)
- Specific energy absorption in the range from 320 to 700 KJ/cubic metre (test method according to ISO 4651).
- Bump elasticity in the range from 30 to 31 % (test method according to DIN 53512).
- Static load per surface 5% / 100d in the range from 23 to 92 kPa (test method according to DIN 53421).
- Squash hardness in the range from 200 to 400 kPa (test method according to DIN 53577).

Additionally, the EPP material is recyclable, in that it can be reconverted into its source material polypropylene through a melting process. Thus, when an insulated rigid container box 6425, 6420C, 6460C comprising Expanded polypropylene (EPP) has been worn or mechanically damaged, it can be recycled into a new insulated rigid container box 6425, 6420C, 6460C. Else a worn or mechanically damaged insulated rigid container box 6425, 6420C, 6460C, may be recycled into other products including polypropylene or Expanded polypropylene (EPP).

Moreover, the EPP material is advantageously non-toxic, which makes it very suitable for transporting food products.

Thus, in summary, expanded polypropylene (EPP) has a low density and it has a high elasticity; it has low compressibility and a high deformation recovery rate; EPP

is resistant to alcohol, oils, acid and alkali chemicals, and solvents, it has a low thermal conductivity and it does not readily absorb water. In addition to being non-toxic and tasteless, it can be recycled with very high efficiency with minimal performance degradation. These properties make the box 6425 comprising EPP very suitable for packaging of products sensitive to shock during handling, such as electronics and medical devices, and these properties also make the box 6425 comprising EPP very suitable for transporting food products.

Figure 49 is same as Figure 48, but with less reference numerals in order to simplify illustration of the following description. Referring to Figure 49, the thickness of the walls of the insulated rigid container box 6425, 6420C is denoted T_W. The bottom wall 6430, and the plurality of side walls 6440 may be made to have a wall thickness T_W. The lid may be made to have a lid thickness T_L. According to an example, the lid thickness T_L is selected to be the same, or substantially the same, as the wall thickness T_W.

As mentioned above, the bottom wall 6430, the plurality of side walls 6440 and the lid may be made to comprise Expanded polypropylene (EPP) having a density in the range from 40 kg/cubic metre to 90 kg/cubic metre, and a thermal conductivity in the range from 0,035 W/(m*K) to 0,045 W/(m*K).

Figure 50 is an example illustration of how thermal conductance and weight of the insulated rigid container box 6425, 6420C, 6460C depends on wall thickness.

In this connection it is noted that, when designing the shape of the rigid container box 6425, 6420C, 6460C, the inventors needed to balance conflicting requirements regarding the thickness of walls of the rigid container box 6425, 6420C, 6460C and the thickness of the lid. More specifically

- the thermal conductance of the walls, would advantageously decrease with an increase in wall thickness T_{wall}, rendering a desire to make the walls as thick as possible, while

- the total weight of the insulated rigid container box 6425, 6420C, 6460C, would unfortunately increase with an increase in wall thickness T_w, renering a desire to make the walls as thin as possible. In effect, a balance between these conflicting requirements has to be found. The inventors found that the wall thickness T_W should be between a minimum wall thickness T_{Wmin} and a maximum wall thickness T_{Wmax}. The inventors found that, when the material of the insulated rigid container box 6425, 6420C, 6460C, is mainly expanded polypropylene (EPP), the the wall thickness T_W should be between a minimum wall thickness T_{Wmin} of 15 mm and a maximum wall thickness T_{Wmax} of 60 mm in order to render good thermal properties while also achieving good mechanical properties, such as weigh and sturdyness. According to a preferred example, the wall thickness T_W is in the range from 25 mm to 40 mm. In an example, the wall thickness T_W is preferably 30 mm.

According to the preferred example, referring to figure 49, the insulated rigid container box 6425, 6420C has an outer upper wall length L_{OUW} = 762 mm, an outer upper wall width W_{OUW} = 500 mm, and a wall height H_W = 519 mm. The lid may have a total height H_{TL} = 100 mm. The thickness of the lid, however, may have a thinnest thickness $T_L = T_W$. Hence, when the material of the insulated rigid container box lid 6460C, is mainly expanded polypropylene (EPP), the the lid thickness T_L should be between a minimum lid thickness T_{Lmin} of 15 mm and a maximum lid thickness T_{Lmax} of 60 mm in order to render good thermal properties while also achieving good mechanical properties, such as weight and sturdyness. According to a preferred example, the lid thickness T_L is in the range from 25 mm to 40 mm. In an example, the lid thickness T_L is preferably 30 mm.
Accordingly, the insulated rigid container box 6425, 6420C, 6460C, according to the preferred example weighs about 3 kg, and it provides an internal volume of about 130 metric litres (i.e. about 130 cubic decimeters).

Figure 51 is a perspective view of the insulated rigid container box 6425 of figure 48, wherein the lid 6460C is placed over the opening 6450.

Figure 52 is a sectional view upon the line A-A of Figure 48 of the insulated rigid container 6420C. As illustrated, the insulated rigid container 6420C has an inner upper length L_{IU} and an outer lower length L_{OL}, the outer lower length L_{OL} being smaller than the inner upper length L_{IU} so as to allow stacking and nesting of the insulated rigid container 6420C. Additionally the insulated rigid container 6420C has an inner upper width W_{IU} and an outer lower width W_{OL}, the outer lower width W_{OL} being smaller than the inner upper width W_{IU} so as to allow stacking and nesting of the insulated rigid container 6420C.

Moreover, the insulated rigid container 6420C has an inner upper height H_{IU} and an outer lower height H_{OL} so as to allow the lower part of the insulated rigid container 6420C to be lowered into the upper part of an identical insulated rigid container 6420C.

Figures 53A, 53B, and 53C illustrate the stacking of two identical insulated rigid containers 6420C of the type shown in figure 52. According to an example, as shown in figure 53, the inner upper height H_{IU} may be substantially the same as the outer lower height H_{OL} so as to allow the lower part of the insulated rigid container 6420C2 to be fully received by the upper part of the receiving insulated rigid container 6420C1. As shown in Figure 53C, the outer edges 6480 of the bottom wall of the inserted container 6420C2 will thus rest on an inner shelf portion 6490 formed on the inner surface of the wall of the receiving insulated rigid container 6420C1.

Figures 54A, 54B, and 54C also illustrate the stacking of two identical insulated rigid containers 6420C of the type shown in figure 52. According to the Figure 54 example, the inner upper height H_{IU} may be higher than the outer lower height H_{OL} so as to allow the lower part of the insulated rigid container 6420C2 to be fully received by the upper part of the receiving insulated rigid container 6420C1. As shown in Figure 54C, however, a protruding portion 6500 on the outer wall of the

inserted container 6420C2 will thus rest on the rim surface 6445C of the receiving insulated rigid container 6420C1.

Figure 55 illustrates that a large number of insulated rigid containers 6420C can be stacked in a manner that allows a very compact storing, and/or transport, of a large number of insulated rigid containers 6420C in a very small spatial volume, since the lower parts fit inside the upper parts when at least the upper part of a receiving container 6420C is empty and the lid is removed.

Figure 56 illustrates that a large number of insulated rigid containers 6425, when fully loaded with goods and having the lid covering the opening, can be stacked one above the other in a manner achieves mechanically stable storing, and/or transport, of a large number of insulated rigid containers 6425 when placed one above the other, since the outer surface of the bottom wall 6430C includes a stabilizing protrusion 6510 that fits in a corresponding recess 6520 on the top surface of the lid 6460C. Hence, the top surface of the lid of the first, lowest, insulated rigid container 6425-I (See fig. 56) has a recess configured to receive a corresponding protrusion provided on the outer surface of the bottom wall 6430C of the second insulated rigid container 6425-II. The second insulated rigid container 6425-II is thus placed on top of the first insulated rigid container 6425-I, as illustrated in fig. 56. Likewise, a third insulated rigid container 6425-III may be placed on top of the second insulated rigid container 6425-II. In this manner a number of insulated rigid container boxes 6425 can be stacked one above the other in a stable manner.

Figure 57 is a schematic general view of insulated rigid container boxes 6425 having protrusions 6510 and corresponding recesses 6520.

Figure 58 a schematic general view of an outer bottom surface 6525 of an insulated rigid container box 6425, the outer bottom surface being provided with four protrusions 6510. The example protrusions 6510 shown in figure 58 are circular

protrusions 6510 configured to fit inside corresponding circular recesses 6520. The circular protrusion 6510 may be a rounded circular protrusion. Thus, for example, the protrusion may be shaped as a part of a spherical surface protruding from the outer bottom surface of an insulated rigid container box 6425.

Figure 59 a schematic general view of an outer top surface of the lid 6460C of an insulated rigid container box 6425, the outer top surface of the lid 6460C having circular recesses 6520 that may be configured to receive circular protrusions 6510 as discussed in connection with Figure 58 above.

Figure 60 a schematic general view of another example of an outer top surface of the lid 6460C of an insulated rigid container box 6425, the outer top surface of the lid 6460C having elongated recesses 6520E that may be configured to receive elongated protrusions 6510E as discussed in connection with Figure 61 below.

Figure 61 a schematic general view of an example of an elongated protrusion 6510E for attachment to a external bottom surface of an insulated rigid container box 6425. The elongated protrusion 6510E has a first elongated surface 6530 configured to be received in the elongated recess 6520E as discussed in connection with Figure 60 above. According to an example, the first elongated surface 6530 is paralell with a second elongated surface 6540 configured to be attached to the external bottom surface 6525 (See Figure 58 and/or 62) of the insulated rigid container box 6425. The elongated protrusion 6510E has two long side surfaces 6550, and two end surfaces 6560.

According to a preferred embodiment, the two long side surfaces 6550, or at least one of the long side surfaces 6550, is at a sharp angle with the first elongated surface 6530. In other words, the angle at the edge where a long side surface 6550 meets the first elongated surface 6530 is 90 degrees or sharper. This feature increases friction for movements perpendicular to the direction of elongation of the elongated protrusion 6510E when the elongated protrusion 6510E has been received in a corresponding elongated recess 6520E.

According to a preferred embodiment the end surfaces 6560, or at least one of the end surfaces 6560, is sloped (See Fig. 61) so as to simplify sliding the insulated rigid container box 6425 over a floor surface in the direction of elongation of the elongated protrusion 6510E. With reference to figure 61, there is shown a cartesian co-ordinate system having three mutually perpendicular axes X, Y and Z.

Figure 62 is a sectional side view of a part of an insulated rigid container box 6425 having a bottom wall 6430C having an external bottom surface 6525 and an internal bottom surface 6570. A protrusion 6510, or an elongated protrusion 6510E, may be attached on the external bottom surface 6525. The protrusion 6510, or elongated protrusion 6510E, may be attached by a fastener device 6580. According to an example the fastener device 6580 comprises a screw that stretches through the bottom wall 6430C. The fastener device 6580 may comprise a screw having a wider head portion and an elongated screw body, and the fastener device 6580 may also include a nut. Thus, the protrusion 6510, or elongated protrusion 6510E, may be attached to the external bottom surface 6525 by a screw and a nut, such that e.g. the nut is provided on the inside of the box and the head of the screw is sunk in a recess in the protrusion 6510, or elongated protrusion 6510E. According to an example the the protrusion 6510, or elongated protrusion 6510E comprises a hard and/or wear resistant material having a low surface friction. One example of such a material, for the protrusion 6510, or elongated protrusion 6510E, is a metal. The metal protrusion 6510, or elongated metal protrusion 6510E, may comprise a light metal, such as e.g. aluminium.

The fastener device may comprise a hard plastic material, or alternatively a metal material. The size of the fastener device 6580 is very small in relation to the bottom surface of the box, and thus its effect on thermal conduction is very small, or even negligable.

As discussed in connection with Figure 54A, 54B, 54C, one, or several, or all of the side walls may be provided with a protruding portion 6500. The protruding portion 6500 projects from the external surface of the lower side wall portion 6440CL, thereby connecting the external surface of the lower side wall portion 6440CL with the external surface of the upper side wall portion 6440CU (See Figure 48 and Figure 63).

Figure 63 is a sectional side view of another example of an insulated rigid container box 6425; figure 63 illustrating the insulated rigid container box 6425 without the lid. The insulated rigid container box 6425 of figure 63 includes a protruding portion 6500 between the narrower lower part of the insulated rigid container box 6425 and the wider upper part of the insulated rigid container box 6425.

The protruding portion 6500 of figure 63 includes a lip portion 6590. The lip portion 6590 provides for a grippable surface 6595. Thus, fingers of a human hand may be intruduced into a groove formed between the lip 6590 and the upper part of the external surface of the lower side wall portion 6440CL.

Alternatively, an operator may use a hook or a bent stick 6600 (See fig. 63) for entering into the groove, behind the lip 6590, so as to enable pulling the insulated rigid container box 6425 in the direction indicated by arrow B in Figure 63.

According to a preferred embodiment, the direction of elongation of elongated protrusion 6510E is paralell, or substantially paralell to the direction of arrow B. Thus, the plane of the surface 6595 may be orthogonal to, or substantially orthogonal to, the direction of elongation of elongated protrusion 6510E (See Figure 63). This advantageously means that when an operator pulls the insulated rigid container box 6425 over a floor in the direction indicated by arrow B in Figure 63, then the sloped portion 6560 of the elongated protrusion 6510E will face any uneven parts of the floor thereby simplifying the movement of the box 6425.

As an alternative to EPP as the main material comprised in the box 6425, the insulated rigid container box 6425 may comprise wood, such as e.g plywood. The insulated rigid container box 6425 comprising wood as a wall material may be made in the shapes described and discussed in connection with any of the figures 43 to 63. wood has a thermal conductivity of 0,14 W/(m*K), or less. Thus wood has a

significantly lower thermal conductivity than common plastic mayterials, since common plastic materials often have a thermal conductivity higher than 0,23 W/(m*K). Moreover, wood is biodegradable, rendering a very environmentally friendly insulated rigid container box 6425.

According to yet another example, the insulated rigid container box 6425 may comprise corrugated fiberboard. Corrugated fiberboard is a material consisting of a fluted corrugated sheet and one or two flat linerboards. The corrugated medium sheet and the linerboard(s) are made of kraft containerboard, a paperboard material usually over 0.01 inches (0.25 mm) thick. Corrugated fiberboard may also be referred to as corrugated cardboard. Thus, the insulated rigid container box 6425 may comprise paper-pulp based material. The insulated rigid container box 6425 comprising paper-pulp based material, such as e.g. corrugated fiberboard, as a wall material may be made in the shapes described and discussed in connection with any of the figures 43 to 63. The insulated rigid container box 6425 comprising paper-pulp based material, such as e.g. corrugated fiberboard, may be provided with an outer layer of a substantially water vapuor impermeable material. The substantially water vapuor impermeable material may be substantially water vapour impermeable membrane 190, as described elsewhere in this document. The substantially water vapour impermeable membrane 190 may be a polymer coating as described in EP 1,094,944, and as described e.g. in connection with figures 41C, 41D, 41E, and 41F in this document.

Further examples are described below:

Example 1. A bag for transporting goods comprising

at least one wall panel being shaped and adapted to form an interior storage space (100) for transporting said goods; the at least one wall panel including

an outer yield-able material layer;

an inner yield-able material layer; and

a cushioning layer disposed between the outer layer and the inner layer; wherein the bag is a protective bag having

a collapsed state (20A) for enabling transportation of the protective bag in a substantially flat state, and

an expanded state (20B) such that the protective bag (20), in its expanded state, provides said interior storage space for transporting goods, the protective bag further comprising:

a bag opening; wherein

the protective bag has

an open expanded state (20C) for loading and/or unloading said goods via the bag opening, and

a closed expanded state (20D) such that the protective bag (20), in its closed expanded state (20D), provides a closed interior storage space for transporting goods.

2. The protective bag according to example 1, wherein

the bag opening is a closable opening which, in the closed expanded state (20D) of the protective bag cooperates with said at least one wall panel so as to protect said goods, when placed in the interior storage space, against impact damage.

3. The protective bag according to example 1 or 2, wherein

the outer layer includes paper.

4. The protective bag according to any preceding example, wherein

the inner layer includes paper.

5. The protective bag according to any preceding example, wherein

the cushioning layer comprises a soft material, forming a lining.

6. The protective bag according to any preceding example, wherein

the cushioning layer comprises paper.

7. The protective bag according to any preceding example, wherein

the cushioning layer comprises fragmented stuffing material.

8. The protective bag according to any preceding example, wherein

said stuffing material is adhesively attached to at least one of the said yieldable material layers.

9. The protective bag according to any preceding example, wherein

said stuffing material is adhesively attached to at least one of the said yield-able material layers, said stuffing material being lightly compressed and applied across an area of at least one of said yield-able material layers.

10. The protective bag according to any preceding example, wherein the cushioning layer comprises a biodegradable material.

11. The protective bag according to any preceding example, wherein the outer layer includes a biodegradable material.

12. The protective bag according to any preceding example, wherein the inner layer includes a biodegradable material.

13. The protective bag according to any preceding example, wherein the fragmented stuffing material comprises paper.

14. The protective bag according to any preceding example, wherein the fragmented stuffing material comprises recycled paper.

15. The protective bag according to any preceding example, wherein the fragmented stuffing material comprises recycled paper, said recycled paper including a mix of at least two types of recycled paper.

16. The protective bag according to any preceding example, wherein the fragmented stuffing material comprises recycled paper, said recycled paper including a mix of at least two types of recycled paper, one of said recycled paper types including recycled newspaper.

17. The protective bag according to any preceding example, wherein the outer layer includes Kraft paper.

18. The protective bag according to any preceding example, wherein

the inner layer includes Kraft paper.

19. The protective bag according to any preceding example, wherein
said wall panel being shaped and adapted to form said interior storage space to a volume of between 4 metric litres and 50 metric litres, or between 10 metric litres and 50 metric litres, in the expanded state of the bag.

20. The protective bag according to any preceding example, wherein
the outer yield-able material layer comprises paper of a water resistant paper quality.

21. The protective bag according to any preceding example, wherein
the inner yield-able material layer comprises paper of a water resistant paper quality.

22. The protective bag according to any preceding example, wherein
the outer yield-able material layer, and or the inner yield-able material layer, comprises paper having a basis weight of at least 60 grams per m^2.

23. The protective bag according to any preceding example, wherein
the outer yield-able material layer, and or the inner yield-able material layer, comprises paper having a basis weight of at least 90 grams per m^2.

24. The protective bag according to any preceding example, wherein
the bag (20) is based on a tubular protector strip (5T).

25. The protective bag according to any preceding example, wherein
the bag (20) has a rim portion by the bag opening, and wherein
the rim portion is provided with at least one handle.

26. The protective bag according to any preceding example, wherein

the handle comprises an opening (37) through the outer yield-able material layer and through the inner yield-able material layer.

27. The protective bag according to any preceding example, wherein

the handle comprises a paper strip formed in a U-shape and having two paper strip end portions (200A, 210A); the paper strip end portions (200A, 210A) of the first handle (170A) being attached to the rim portion (150, 25b) of a bag wall (110, 120, S1A, S1B).

28. The protective bag according to any preceding example, wherein

a bag portion (25c) is folded so as to form a flat bottom panel, or substantially flat bottom panel (140).

29. The protective bag according to any preceding example, wherein

a bag edge portion (25c) facing away from the bag opening (160) is folded so as to form a flat bottom panel, or substantially flat bottom panel (140).

30. A bag (20) for transporting goods in an air environment having an air humidity; the bag being a collapsible bag having

a collapsed state (20A) for enabling transportation of the collapsible bag in a substantially flat state, and

an expanded state (20B) such that the collapsible bag (20), in its expanded state, provides an interior storage space for transporting goods, the collapsible bag comprising:

a bottom panel; and

a wall panel; wherein the wall panel and the bottom panel cooperate to form said interior storage space to a volume of between 4 metric litres and 50 metric litres, or between 10 metric litres and 50 metric litres in the expanded state of the bag;

wherein a rim portion of the wall panel facing away from the bottom panel provides a bag opening; and wherein

the collapsible bag has

an open expanded state (20C) for loading and/or unloading goods via the bag opening, and

a closed expanded state (20D) such that the collapsible bag (20), in its closed expanded state, provides a substantially closed interior storage space for transporting goods; wherein

the bag opening is a closable opening which, in the closed expanded state (20D) of the collapsible bag, cooperates with said wall panel and said bottom panel so as to minimize or prevent entry of air from the environment into the interior storage space.

31. A collapsible bag (20) for transporting goods in an air environment having an air humidity; the bag being a collapsible bag having

a collapsed state (20A) for enabling transportation of the collapsible bag in a substantially flat state, and

an expanded state (20B) such that the collapsible bag (20), in its expanded state, provides an interior storage space for transporting goods, the collapsible bag comprising:

at least one wall panel; and

a bottom panel; wherein the at least one wall panel and the bottom panel cooperate to form said interior storage space to a volume of between 4 metric litres and 50 metric litres, or between 10 metric litres and 50 metric litres in the expanded state of the bag; and

a bag opening; and wherein

the collapsible bag has

an open expanded state (20C) for loading and/or unloading goods via the bag opening, and

a closed expanded state (20D) such that the collapsible bag (20), in its closed expanded state (20D), provides a substantially closed interior storage space for transporting goods; wherein

the bag opening is a closable opening which, in the closed expanded state (20D) of the collapsible bag, cooperates with said at least one wall panel and said bottom panel so as to minimize or prevent entry of air from the environment into the interior storage space.

32. The bag (20) according to any preceding example, wherein

the at least one wall panel comprises at least two wall panels.

33. The collapsible bag (20) according to any preceding example, in particular example 31, wherein

the collapsible bag (20), in its closed expanded state, comprises:

three wall panels; and

said bottom panel; wherein the wall panels and the bottom panel cooperate to form said interior storage space.

34. The collapsible bag (20) according to any preceding example, in particular example 31, wherein

the collapsible bag (20), in its closed expanded state, comprises:

four wall panels that cooperate to form a tetrahedron shape.

35. The collapsible bag (20) according to any preceding example, in particular example 34, wherein

one of the wall panels is said bottom panel.

36. The collapsible bag (20) according to any preceding example, wherein

the wall panel, or at least one of the wall panels, comprises

an outer material layer; and

an inner material layer; and

an intermediate space beween the outer material layer and the inner material layer.

37. The collapsible bag (20) according to any preceding example, wherein the outer material layer comprises a biodegradable material.

38. The collapsible bag (20) according to any preceding example, wherein the outer material layer consists of biodegradable material.

39. The collapsible bag (20) according to any preceding example, wherein the inner material layer comprises a biodegradable material.

40. The collapsible bag (20) according to any preceding example, wherein the inner material layer consists of biodegradable material.

41. The collapsible bag (20) according to any preceding example, in particular example 36, wherein

the outer material layer is shaped as a sheet having

an outer material first surface, and

an outer material second surface, wherein the outer material second surface faces the intermediate space.

42. The collapsible bag (20) according to any preceding example, wherein

the inner material layer is shaped as a sheet having

an inner material first surface, and

an inner material second surface, wherein the inner material second surface faces the intermediate space.

43. The collapsible bag (20) according to any preceding example, in particular when dependent on example 35, wherein

air is trapped in the intermediate space.

44. The collapsible bag (20) according to any preceding example, in particular when dependent on example 40 and/or 41, wherein

air is trapped in the intermediate space so that at least 70% of the inner material second surface is separated from the outer material second surface.

45. The collapsible bag (20) according to any preceding example, in particular when dependent on example 40 and/or 41, wherein

the outer material layer is arranged and positioned in relation to the inner material layer such that air is trapped in the intermediate space so that at least 70% of the inner material second surface is separated from the outer material second surface.

46. The collapsible bag (20) according to any preceding example, wherein

an intermediate material is placed in the intermediate space.

47. The collapsible bag (20) according to any preceding example, wherein

the intermediate material comprises a biodegradable material.

48. The collapsible bag (20) according to any preceding example, wherein

the intermediate material is a biodegradable material.

49. The collapsible bag (20) according to any preceding example, wherein

the biodegradable material comprises paper.

50. The collapsible bag (20) according to any preceding example, wherein

the outer material layer comprises kraft paper.

51. The collapsible bag (20) according to any preceding example, wherein

the inner material layer comprises kraft paper.

52. The collapsible bag (20) according to any preceding example, wherein

the intermediate material comprises a biodegradable pulp based material.

53. The collapsible bag (20) according to any preceding example, wherein the outer material layer is a biodegradable material.

54. The collapsible bag (20) according to any preceding example, wherein the outer material layer includes greaseproof paper.

55. The collapsible bag (20) according to any preceding example, wherein the outer material layer includes paper that is water resistant.

This solution advantageously prevents any water that, if air in the environment is humid, may be generated by condensation on the outside surface of the bag, from seeping into the wall. Thereby, this solution reduces or eliminates an increased thermal conduction in the wall which may otherwise occur due to water having a high thermal conductivity of about 0,6 W/(m*K).

56. The collapsible bag (20) according to any preceding example, wherein the outer material layer includes paper that was manufactured by supercalendering so as to render the paper water resistant.

57. A bag (20) for transporting goods in an air environment having an air humidity; the bag being a collapsible bag having

a collapsed state (20A) for enabling transportation of the collapsible bag in a substantially flat state, and

an expanded state (20B) such that the collapsible bag (20), in its expanded state, provides an interior storage space for transporting goods, the collapsible bag comprising:

at least one wall panel; and

a bag opening; and wherein

the collapsible bag has

an open expanded state (20C) for loading and/or unloading said goods via the bag opening, and

a closed expanded state (20D) such that the collapsible bag (20), in its closed expanded state (20D), provides a closed interior storage space for transporting goods; wherein

the bag opening is a closable opening which, in the closed expanded state (20D) of the collapsible bag, cooperates with said at least one wall panel so as to minimize or prevent exchange of air between the environment and the interior storage space.

58. The bag (20) according to any preceding example, wherein

said at least one wall panel is folded so as to provide

a front wall panel (S1A), and

a back wall panel (S1B), wherein the front wall panel (S1A) and a back wall panel (S1B) cooperate to form said interior storage space.

59. The bag (20) according to any preceding example, wherein

said at least one wall panel is folded so as to provide

a front wall panel (S1A),

a back wall panel (S1B), and

a bottom panel (140); wherein the wall panels and the bottom panel cooperate to form said interior storage space.

60. The bag (20) according to any preceding example, wherein

the wall panel, or at least one of the wall panels, comprises

an outer material layer; and

an inner material layer; and

a thermally insulating intermediate space beween the outer material layer and the inner material layer.

This solution advantageously provides, in the closed expanded state (20D) of the protective bag, a three step thermal protection for goods placed in the interior storage space of the bag.

Firstly, the thermally insulating intermediate space provides for a minimized thermal conductance between the air of the bag environment and the goods placed in the interior storage space of the bag.

Secondly, the outer material layer and the inner material layer, each having a low air permeability, cooperate with the closable opening, in the closed expanded state (20D) of the collapsible bag, to minimize or prevent exchange of air between the environment and the interior storage space.

Hence, for example, the formation of condensation is minimized or prevented on chilled and/or frozen goods placed in the interior storage space of the bag, since the entry of any humid air from the evironment is minimized or prevented by the outer material layer and the inner material layer in cooperation with the closed opening. Thus, condensation heating of chilled and/or frozen goods is is minimized or prevented by the outer material layer and the inner material layer in cooperation with the closed opening.

Similarly, when the goods placed in the interior storage space of the bag has a temperature higher than the temperature of the air environment, then the inner material layer acts as an air barrrier to to minimize or prevent any steam that may arise from hot goods, such as hot food items, from entering into the intermediate space. Since steam holds water, and water has a relatively high thermal conductivity, the inner material layer acting as a air barrier thereby minimizes or eliminates the detrimental effect that such steam and/or water would otherwise have on the thermally insulating function of the intermediate space.

Thus, the outer material layer and the inner material layer provide a two step air exchange barrier.

Additionally, the intermediate space provided beween the outer material layer and the inner material layer will protect said goods, when placed in the interior storage

space, against impact damage, which could otherwise occur if the bag, when filled with goods, e.g. falls or is hit by another object.

61. The bag (20) according to any preceding example, wherein
the outer material layer comprises a biodegradable material.

62. The bag (20) according to any preceding example, wherein
the outer material layer consists of biodegradable material.

63. The bag (20) according to any preceding example, wherein
the inner material layer comprises a biodegradable material.

64. The bag (20) according to any preceding example, wherein
the inner material layer consists of biodegradable material.

65. The bag according to any preceding example, wherein
an intermediate material is placed in the intermediate space.

66. The bag according to any preceding example, wherein
the intermediate material comprises paper.

67. The bag according to any preceding example, wherein
the intermediate material comprises fragmented stuffing material.

68. The bag according to any preceding example, wherein
said intermediate material is adhesively attached to at least one of the said yield-able material layers.

69. The bag according to any preceding example, wherein
said intermediate material is adhesively attached to at least one of the said yield-able material layers, said intermediate material being lightly compressed and applied across an area of at least one of said yield-able material layers.

70. The bag according to any preceding example, wherein the intermediate material comprises a biodegradable material.

71. The bag according to any preceding example, wherein the outer layer includes paper.

72. The bag according to any preceding example, wherein the inner layer includes paper.

73. The bag according to any preceding example, wherein the intermediate material is a fragmented stuffing material.

74. The bag according to any preceding example, wherein the fragmented stuffing material comprises recycled paper.

75. The bag according to any preceding example, wherein the fragmented stuffing material comprises recycled paper, said recycled paper including a mix of at least two types of recycled paper.

76. The bag according to any preceding example, wherein the fragmented stuffing material comprises recycled paper, said recycled paper including a mix of at least two types of recycled paper, one of said recycled paper types including recycled newspaper.

77. The bag according to any preceding example, wherein the outer layer includes Kraft paper.

78. The bag according to any preceding example, wherein the inner layer includes Kraft paper.

79. The bag according to any preceding example, wherein

said wall panel being shaped and adapted to form said interior storage space to a volume of between 4 metric litres and 50 metric litres, or between 10 metric litres and 50 metric litres in the expanded state of the bag.

80. The bag according to any preceding example, wherein

the outer yield-able material layer comprises paper of a water resistant paper quality.

This solution, i.e. providing a water resistant paper quality for forming an outer material layer of a bag, advantageously prevents any water that, if air in the environment is humid, may be generated by condensation on the outside surface of the bag, from seeping into the wall. Thereby, this solution reduces or eliminates an increased thermal conduction in the wall which may otherwise occur due to water having a high thermal conductivity of about 0,6 W/(m*K). In this connection it is noted that paper typically has a thermal conductivity of less than 0,15 W/(m*K) when established at 23°C and 50% RH (Relative Humidity).

81. The bag according to any preceding example, wherein

the inner material layer comprises paper of a water resistant paper quality.

82. The bag according to any preceding example, wherein

the outer material layer, and or the inner material layer, comprises paper having a basis weight of at least 60 grams per m^2.

83. The bag according to any preceding example, wherein

the outer material layer, and or the inner material layer, comprises paper having a basis weight of at least 90 grams per m^2.

84. The bag according to any preceding example, wherein

the bag (20) is based on a tubular protector strip (5T).

85. The bag according to any preceding example, wherein

the bag (20) has a rim portion by the bag opening, and wherein a rim portion is provided with at least one handle.

86. The bag according to any preceding example, wherein the handle comprises an opening (37) through the outer material layer and through the inner material layer.

87. The bag according to any preceding example, wherein the handle comprises a paper strip formed in a U-shape and having two paper strip end portions (200A, 210A); the paper strip end portions (200A, 210A) of the first handle (170A) being attached to a rim portion (150, 25b) of a bag wall (110, 120, S1A, S1B).

88. The bag according to any preceding example, wherein a bag portion (25c) is folded so as to form a flat bottom panel, or substantially flat bottom panel (140).

89. The bag according to any preceding example, wherein a bag edge portion (25c) facing away from the bag opening (160) is folded so as to form a flat bottom panel, or substantially flat bottom panel (140).

90. The bag according to any preceding example, wherein the outer layer includes a paper layer having an air permeability of 0,5 µm/(Pa·s), or less.

91. The bag according to any preceding example, wherein the inner layer includes a paper layer having an air permeability of 0,5 µm/(Pa·s), or less.

92. The bag according to any preceding example, wherein

said at least one wall panel comprises a paper layer, said paper layer having a biodegradable polymer coating.

This bag may be a paper bag as disclosed in WO2015171036 (ifoodbag).

93. The bag according to any of examples 71 or 72 or 80 or 81, wherein

the outer material layer and/or the inner material layer comprises a paper layer, said paper layer having a biodegradable polymer coating.

This biodegradable polymer coating advantageously provides a very good barrier having a low air permeability while also being biodegradable.

94. The bag according to example 92 or 93, wherein

the biodegradable polymer coating (1003) comprises an outer layer (1006) containing polylactide, and

an adhesive inner layer (1007) of biodegradable polymer material coextruded with the polylactide, said inner layer binding the outer layer to the paper layer (1008).

95. The bag according to example 93, wherein

the biodegradable polymer coating (1003) comprises an outer coating layer (1006) containing polylactide, the weight of said outer layer being at the most about 20 g/m2, and

an adhesive inner coating layer (1007) of biodegradable polymer material coextruded with the polylactide, said inner coating layer binding the outer coating layer to the paper layer (1008) with an adhesive strength sufficient to prevent peeling off of the coating, and wherein

the combined total weight of the outer coating layer (1006) and the adhesive inner coating layer (1007) lying on top of each other is in the range of 12-30 g/m2.

96. The bag according to any of examples 94 or 95, wherein

the adhesive layer (1007) contains biodegradable polyester amide, cellulose ester or aliphatic or aliphatic-aromatic copolyester.

97. The bag according to any of examples 94 to 97, wherein

the biodegradable coating (1003) contains mixed in the polymer a finely divided mineral component.

98. The bag according to any of examples 94 to 97, wherein

the biodegradable coating (1003) is only on one side of the paper layer.

99. The bag according to any of examples 94 to 98, wherein

the biodegradable coating (1003) is provided on each side of the paper layer.

100. The bag according to any of examples 94 to 99, wherein

the biodegradable coating is a compostable coating.

101. The bag according to any of examples 71 or 72 or 80 or 81, wherein

the outer material layer has a biodegradable polymer coating, said polymer coated outer material layer having an air permeability less than 0.35 µm/(Pa·s).

102. The bag according to any of examples 71 or 72 or 80 or 81, wherein

the inner material layer has a biodegradable polymer coating, said polymer coated inner material layer having an air permeability less than 0.35 µm/(Pa·s).

103. The bag according to any of examples 100 or 101, wherein

the biodegradable coating is as defined in any of examples 94-100.

104. The bag according to any preceding example, wherein

the outer layer includes a Non-woven material.

105. The bag according to any preceding example, wherein

the inner layer includes a Non-woven material.

106. The bag according to any preceding example, wherein

the intermediate material comprises a biodegradable pulp based material.

This solution advantageously provides a biodegradable intermediate material.

107. The bag according to any preceding example, wherein

intermediate material comprises fluff pulp.

Fluff pulp, which may also be referred to as comminution pulp or fluffy pulp, is a type of pulp, which may be made from long fibre softwoods.

This solution advantageously provides a biodegradable intermediate material.

108. The bag according to any preceding example, wherein

the intermediate material comprises flax fibers.

Flax fiber can be extracted from the bast beneath the surface of the stem of the flax plant. The flax fibres form soft, lustrous, and flexible bundles of fiber, and hence this solution advantageously provides a good biodegradable intermediate material.

109. The bag according to any preceding example, wherein

the intermediate material comprises hemp refined into a thermally insulating material.

It is noted in this connection, that hemp, or industrial hemp, is a strain of the Cannabis sativa plant species that is grown specifically for industrial uses of its derived products. The plant is spun into usable fibres, and the fibres are then refined into a thermally insulating material. Hence, this solution advantageously provides a biodegradable thermally insulating material.

110. The bag according to any preceding example, wherein

the intermediate material comprises shredded paper.

This solution advantageously allows for a low cost insulating material that is also very high in air content, and since air has a very low thermal conductivity, the shredded paper also provides very good insulation properties.

111. The bag according to example 110, wherein
the shredded paper is shredded recycled paper.
This solution advantageously adds to the environmental friendlieness of the bag in that the carbon dioxide print of the bag production is reduced by using a recycled paper as source material instead of making the intermediate material from a freshly produced source material.

112. The bag according to any preceding example, wherein
the intermediate material (H) comprises fibres made from pine tree wood.
This solution advantageously provides a biodegradable intermediate material.

113. The bag according to any preceding example, wherein
the intermediate material (H) comprises cellulose wadding.
This solution advantageously provides a biodegradable intermediate material.

114. The bag according to any preceding example, wherein
the intermediate material (H) comprises cotton wool.
This solution advantageously provides a biodegradable intermediate material.

115. The bag according to any preceding example, wherein
the intermediate material (H) comprises a plurality of interconnected superposed sheets (SY) of a yieldable material wherein such a superposed sheet is provided with a multiplicity of adjacent lengthwise and widthwise offset discrete areas of embossed, three dimensional patterns defined by mounds and recesses, the patterns of mounds and recesses in adjacent discrete areas being different, the superposed sheets being so

disposed relative to each other that areas having identical patterns are at least partly offset from the identical patterned areas in the adjacent sheets so that air filled spaces are formed between adjacent interconnected superposed sheets.

This solution advantageously provides a large number of three-dimensional spaces that are filled with air and separated by the interconnected superposed sheets of a yieldable material. The large number of air filled spaces, formed by the interconnected superposed sheets, in combination with the fact that air has a very low thermal conductivity, as mentioned elesewhere in this document, advantageously renders an intermediate material that has excellent thermally insulating properties. Thus, the bag, provided with this type of intermediate material has excellent thermally insulating properties. Additionally, this type of intermediate material enables the bag to provide excellent protection for fragile objects in the goods placed in the interior storage space of the bag.

The intermediate material H has a series of embossed offset sheets SY. The embossed offset sheets SY are enclosed in between the outer material layer, F,G and the inner material layer, G, F.

The sheets SY from one side may each have a series of mounds MU and recesses RV which are next to each other and arranged in rows extending longitudinally or diagonally. Instead of diagonally, they may also extend at varying angles of 30 to 60° or even other intermediate angular displacements. The intermediate material comprising a plurality of interconnected superposed sheets of a yieldable material may be as described in GB1373428, the content of which is hereby incorporated by reference.

116. The bag according to example 115, wherein

the areas of patterns are rectangular and the identical areas of each sheet are lengthwisely offset from the comparable areas- of each adjacent sheet.

117. The bag according to example 115 or 116, wherein the mounds and recesses are frusto-conical when viewed in section perpendicular to the plane of the sheet.

118. The bag according to any of examples 115, 116 and 117, wherein

the mounds and recesses of adjacent sheets are in partially nested interengagement.

119. The bag according to any of examples 115 to 118, wherein there is a glued connection at the engaging portions of the mounds and recesses of adjacent sheets (SY) to prevent them from moving lengthwise relative to each other.

120. The bag according to any of examples 115 to 119, wherein

the interconnected superposed sheets comprise paper.

This solution advantageously provides a biodegradable intermediate material.

121. The bag according to any preceding example, wherein

the intermediate material comprises dried plant material which is shaped and arranged to provide multiple air pockets while keeping at least a portion of the outer material layer separated from the inner material layer so as to thermally insulate the interior storage space from the air environment.

122. The bag according to example 121, wherein

the dried plant material comprises mosses.

This solution advantageously provides a renewable and biodegradable intermediate material. In this connection it is noted that mosses are small flowerless plants that typically form dense green clumps or mats, often in damp or shady locations. The individual plants are usually composed of simple leaves that are generally only one cell thick, attached to a stem that may be branched or unbranched. The irregular shape of mosses renders, also in a dried stat of the mosses, to the formation of multiple air air pockets.

123. The bag according to any preceding example, wherein

the outer layer and/or the inner layer includes a textile material.

124. A bag (20) for use in an air atmosphere environment, said air atmosphere having a humidity, the bag (20) having

a wall adapted to enclose an interior storage space (100) for transporting goods (40), the wall being shaped and adapted to form said interior storage space (100) to a volume of at least four metric litres, or at least ten metric litres,; said wall comprising:

a layer of a material having a thermal conductivity of less than 0,2 W/(K*m); and

a closable opening (160) such that the bag (20) in its closed state (20C) substantially seals the interior storage space (100) from the environment so as to minimize or prevent entry of air from the environment into the interior storage space (100).

125. The bag according to any preceding example, wherein
the bag is adapted to be collapsible so as to have

a collapsed state (20A) for enabling transportation of the bag in a substantially flat state, and

an expanded state (20B, 20C) such that the bag, in its expanded state, provides said interior storage space (100) for transporting goods (40).

126. The bag according to any preceding example, wherein
the bag (20) is shaped in such a manner that plural bags (20) can be stacked so as to enable transporting a plurality of stacked containers (20, 20A) within a certain volume in three dimensional space; said certain volume being smaller than the sum of the individual container volumes (100).

127. The bag according to any preceding example, wherein
said material layer is a biodegradable material.

128. The bag according to any preceding example, wherein
said material layer comprises paper.

129. The bag according to any preceding example, wherein
said substantially water vapour impermeable membrane is a biodegradable material.

130. The bag according to any preceding example, wherein
said goods comprises chilled and/or frozen goods (40).

131. The bag according to any of examples 124 to 130, wherein
said wall further comprises
a substantially water vapour impermeable membrane bonded to at least one side of said material layer.

132. The bag according to example 131, wherein
said substantially water vapour impermeable membrane is a biodegradable polymer coating as defined in any of examples 92 to 100.

133. A bag (20) for use in an air atmosphere environment, the bag having
a collapsed state (20A) for enabling transportation of the bag in a substantially flat state, and
an expanded state such that the bag, in its expanded state, provides an interior storage space for transporting goods, such as e.g. chilled and/or frozen goods, the bag comprising:
a paper layer being shaped and folded so as to form
a front wall panel (S1A),
a back wall panel (S1B),
two side wall panels (S2A, S2B); and

a bottom panel; wherein the wall panels and the bottom panel cooperate to form said interior storage space to a volume larger than 10 litres, or larger than four litres, in the expanded state of the bag; and

wherein a rim portion of the wall panels facing away from the bag bottom panel provides a bag opening; the bag further comprising

a first handle being associated with said rim portion of said front wall panel (S1A) so as to allow gripping by a human hand such as to enable carrying of the bag; and wherein

said paper layer is a kraft paper layer; and wherein

the bag has

an open expanded state for loading and/or unloading goods to be transported, and

a closed expanded state such that the carrier bag, in its closed expanded state, provides a substantially closed interior storage space for transporting goods; wherein

the bag opening is a closable opening which, in the closed expanded state of the carrier bag cooperates with said wall panels and said bottom panel so as to minimize or prevent entry of air from the environment into the interior storage space.

134. The bag according to any preceding example, wherein
the bag is a collapsible handle-carryable carrier chill bag.

135. The bag according to any preceding example, in particular example 133, wherein

said kraft paper layer has a substantially water vapour impermeable membrane bonded to at least one side of the kraft paper layer.

136. The bag according to any preceding example, wherein

the substantially water vapour impermeable membrane is bonded to the side of the kraft paper layer facing the outside of the bag.

137. The bag according to example 135 or 136, wherein

said substantially water vapour impermeable membrane is a biodegradable polymer coating as defined in any of examples 92 to 100.

138. The bag according to any preceding example, wherein

the bag (20) has a rim portion by the bag opening, and wherein

the rim portion is provided with a separate kraft paper sheet (4610, 4620); and wherein

a first part (4620) of the separate kraft paper sheet (4610, 4620) forms a handle support sheet (4620) which is attached to the rim portion (150, 25b) e.g. by an adhesive; and wherein

a second part of the separate kraft paper sheet (4610, 4620) forms at least one handle (4610); the handle (4610) being connected to the handle support sheet (4620) by at least one folding edge (4630).

139. The bag according to example 138, wherein

the handle support sheet (4620) and the handle (4610) are parts of the same kraft paper sheet (4610, 4620);

the handle (4610) being separable from the handle support sheet (4620) by breaking a perforation (4625);

said perforation forming at least two perforated lines (4625) in the separate kraft paper sheet (4610, 4620); wherein

a first perforated line (4625A) runs from a first end of said at least one folding edge (4630), said first perforated line (4625A) forming the shape of an edge of the handle part (4610), and said first perforated line (4625) running to a first end of another folding edge (4630); and

a second perforated line (4625B) runs from a second end of said at least one folding edge (4630).

140. The bag according to example 138, wherein

the handle support sheet (4620) and the handle (4610) are parts of the same support and handle kraft paper sheet (4610, 4620);

the handle part (4610) being separable from the handle support sheet (4620) by breaking a perforation (4625);

said perforation forming at least one perforated line (4625) in the support and handle kraft paper sheet (4610, 4620), said perforated line (4625) starting from said at least one folding edge (4630), said perforated line (4625) forming the shape of an edge of the handle part (4610), and said perforated line (4625) running to another folding edge (4630).

141. The bag according to any preceding example, wherein

the closable opening comprises a closure means.

142. The bag according to any preceding example, wherein

the closable opening comprises a closure device.

143. The bag according to any preceding example, wherein

closing and/or sealing of closable opening is achieved by heat welding, and or heat sealing (39HS).

144. The bag according to any preceding example, wherein

closing and/or sealing of the bag (20) is achieved by gluing.

145. The bag according to any preceding example, wherein

closing and/or sealing of closable opening is achieved by use of a tape.

146. The bag according to any preceding example, wherein

closing and/or sealing of closable opening is achieved by folding a rim portion of the bag (20).

147. The bag according to any preceding example, wherein

the bag (20) includes a neck portion (662) of flexible material at the rim portion of the bag wall, the flexible material being shaped and sized to allow a string (664) being placed around the neck portion so as to strangle the neck portion such that the bag (20) becomes sealed, or substantially sealed.

148. The bag according to any preceding example, wherein

closing and/or sealing of closable opening is achieved by clamping.

149. The bag according to any preceding example, wherein

the bag has a rim portion by the bag opening, the bag further comprises:

- at least two wall panels,
- a closure device (240) including a first elongated closure element (240A) attached to an interior surface of the rim portion of one of the wall panels, and a second elongated closure element (240B) attached to an interior surface of the rim portion of the other wall panel, the elongated closure elements are positioned and adapted for mating with each other so as to achieve closing of the bag opening.

150. The bag according to example 149, wherein the first elongated closure element (240A) comprises an elongated cavity with lips forming a slit along its length so as to enable a mating protrusion provided by the second elongated element (240B) to enter the slit between the lips.

151. The bag according to example 149 or 150, wherein the closure device (240) further comprises a movable pressure device (280) adapted to force the mating protrusion of the second elongated closure element (240B) to enter the elongated cavity of the first elongated closure element (240A).

152. The bag according to any of examples 1148-151, wherein the bag comprises a substantially planar reinforcement sheet attached to the interior surface of the rim portion (150) of one of the at least one wall so as to withstand gravity of the goods when loaded in the bag.

153. The bag according to any preceding example, wherein
the bag has a rim portion by the bag opening, the bag further comprises:
- at least two wall panels,
- a closure device including a first elongated closure element attached to an interior surface of the rim portion of one of the wall panels, and a second elongated closure element attached to an interior surface of the rim portion of the other wall panel, the elongated closure elements are positioned and adapted for mating with each other so as to achieve closing of the bag opening.

154. The bag according to example 153, wherein the elongated closure elements comprise permanent magnets of different polarities adapted to attract each other so as to achieve closing of the bag opening.

155. The bag according to any preceding example, wherein

closing and/or sealing of closable opening is achieved by repeated folding of a top part of the rim portion (25b).

156. The bag according to example 155, wherein

the bag opening is brought to a closed state by placing the rim portion (25b) of the back wall panel (S1B) in contact with the rim portion (25b) of the front wall panel (S1A); and

repeatedly folding the rim portions (25b) of the front wall and the back wall are so as to obtain a closed and sealed state.

157. The bag according to example 156, wherein

the closed state of the bag is secured by placing glue in one or several of the folds.

158. The bag according to example 156, wherein

the closed state of the bag is secured by clamping (5170b).

159. The bag according to any preceding example, wherein the bag has a rim portion by the bag opening, the bag comprising:

- at least two wall panels,
- a rim portion forming part of one of the wall panels, said rim portion having a visual indication of a suggested folding edge.

160. The bag according to any preceding example, wherein the bag comprises:

- at least two wall panels, and
- a rim portion by the bag opening being part of a wall panel, said rim portion of a wall panel comprises at least one die cut opening (37) so as to form a handle (35) configured to allow gripping by a human hand.

161. The bag according to example 160, wherein

the bag (20) comprises

a closure device (39; 160) on the rim portion of a wall panel, wherein said die cut opening (37) is formed above the closure device (39; 160).

162. The bag according to example 161, wherein

the bag is formed by a protector strip (5, 5T) having a protector strip first edge portion (25b; 25c) and a protector strip second edge portion (25c; 25b);

said wall panel rim portion (150) being formed by said protector strip first edge portion (25b); and wherein

said die cut opening (37) is formed in said protector strip first edge portion (25b; 25c); and

said closure device (39; 160) is positioned between said die cut opening (37) and said protector strip second edge portion (25c; 25b).

163. The bag according to any preceding example, wherein the bag comprises:

at least two wall panels, and

the bag is formed by a protector strip (5, 5T) having a protector strip first edge portion (25b; 25c) and a protector strip second edge portion (25c; 25b);

said wall panel rim portion (150) being formed by said protector strip first edge portion (25b; 25c); and wherein

the protector strip first edge portion (25b; 25c) comprises at least one die cut opening (37) so as to form a handle (35) configured to allow gripping by a human hand.

164. The bag according to example 163, wherein
said at least one die cut opening (37) is an opening in said outer material layer (F; G) and/or in said inner material layer (G; F).

165. The bag according to any preceding example, wherein
the protector strip (5; 5T) forms a bag having a wall, and wherein
there are fold lines (27, 28) indicating borders between a front wall and a back wall.

166. The bag according to any preceding example, wherein the bag further comprises at least one cord configured to form a cord handle attached to a rim portion of the bag for carrying the bag in the expanded state.

167. The bag according to example 166, wherein
the at least one cord is attached to a rim portion of the front wall panel, said at least one cord being arranged to extend from the rim portion of the front wall panel, under the bottom wall panel, and bach to a rim portion of the back wall panel.

168. The bag according to example 166 or 167, wherein
the at least one cord is slidably attached to an external surface of the wall panel.

169. The bag according to any of examples 166 - 168, wherein the cord handle is slidably attached to the rim portion of a wall panel, e.g. by extending through an opening in the rim portion; said opening being positioned above a closure means (39; 39HS).

170. The bag according to any preceding example, wherein
a bag wall edge portion (25c) facing away from the bag opening (160) is folded so as to form a substantially flat bottom panel (140).

171. The bag according to example 170, wherein said bottom panel (140) has a width of at least 8 cm.

172. The bag according to example 170 when dependent on example 59, wherein said front wall panel (S1A), is joined to said back wall panel (S1B) along a first fold line (FL1) that runs from said bag opening to said bottom panel (140); and wherein

said bag wall edge portion (25c) is provided with a second fold line (FL2); said second fold line (FL2) being substantially perpendicular to said first fold line (FL1).

173. The bag according to example 172, wherein

an external layer of the bottom portion is folded down so that opposing triangles (TR1, TR2) are formed on each side of the bottom portion.

174. The bag according to any of examples 170 to 173 when dependent on example 59, wherein

said front wall panel (S1A), is joined to said bottom panel (140) along a third fold line (FL3).

175. The bag according to example 174 when dependent on example 172 and 60, wherein

the second fold line (FL2) is parallel with the third fold line (FL3); and

the second fold line (FL2) is a fold line on said front wall.

176. The bag according to example 174 when dependent on example 172 and 60, wherein

the second fold line (FL2) is parallel with the third fold line (FL3); and

the second fold line (FL2) is a fold line on said back wall.

177. The bag according to example 175 or 176, wherein

the bag is collapsible into said collapsed state (20A) by folding said front wall and/or said back wall along the second fold line (FL2) so that a first angle between a plane of said bottom panel (140) and a plane of said front wall and/or said back wall is between zero and 45 degrees when the bag is in the collapsed state (20A).

178. The bag according to example 177, wherein

a second angle between the plane of said bottom panel (140) and the plane of said front wall and/or said back wall is between 45 degrees and 90 degrees (i.e. perpendicular) when the bag is in the closed expanded state (20D).

179. The bag according to any preceding example, wherein

said bottom panel (140) comprises a laminated rectangular protector strip (5); the laminated rectangular protector strip (5) being attached to at least a part of an edge portion (25c) of the bag.

180. A rigid container (6420) to be used in an air environment, the rigid container comprising

a bottom wall (6430); and

a plurality of side walls (6440); wherein

said rigid container has a rim (6445) providing an opening (6450); and

a lid (6460) configured to cover said opening when the lid is placed over the rim so as to provide a closed state of the rigid container (6420); and wherein

the lid co-operates with the rim (6445) such that the rigid container in its closed state seals, or substantially seals, an interior storage space (6465) from the environment so as to minimize or prevent entry of air from the environment into the interior storage space.

181. The rigid container according to example 180, wherein

said bottom wall (6430) and said plurality of side walls (6440) and said lid are adapted to be substantially water vapour impermeable.

182. The rigid container according to example 180 or 181, wherein

said bottom wall (6430) and said plurality of side walls (6440) and said lid comprise an insulating layer and a layer of a material being adapted to be substantially water vapour impermeable.

183. The rigid container according to any of examples 180 - 182, wherein

At least one of the walls of the rigid container, and/or the lid, includes a layer of an energy absorbent.

184. The rigid container according to any of examples 180- 183, wherein

All of the walls of the rigid container includes a layer of an energy absorbent material.

185. The rigid container according to any of examples 180- 184, wherein

The energy absorbent material is a material having a specific heat capacity of more than 1000 J/(kg *K); the energy absorbent material being chilled to a predetermined temperature before use of the rigid container.

186. The rigid container according to any of examples 180- 185, comprising:

a water vapour impermeable layer so as prevent entry of air from the environment into the interior storage space (6465); and

an insulating layer comprising a material having a thermal conductivity of less than 0,2 W/(K*m); and

and a layer of an energy absorbant material having a specific heat capacity of more than 1000 J/(kg *K); the energy absorbent material being adapted to be chilled to a predetermined temperature before use of the rigid container.

187. The rigid container according to any of examples 180- 186, wherein

The energy absorbent material is a phase change material having a specific heat capacity and a latent heat value; the energy absorbent material being chilled to a predetermined temperature before use of the rigid container, the predetermined temperature being selected such that said phase change material is in a solid state.

188. The rigid container according to any of examples 180- 187, wherein

said rim (6445) providing said opening (6450) is provided opposite said bottom wall; and wherein

the plurality of side walls (6440) are arranged in a tapered manner so that the rigid container is wider at said rim than at said bottom wall.

189. A rigid container (6420) for use in an air environment, the rigid container comprising

a bottom wall (6430); and

a side wall (6440);

said side wall (6440) cooperating with said bottom wall (6430) to form a rigid container interior storage space (6465); and wherein

a rim portion (6445) of said side wall (6430) facing away from the bottom wall (6430) provides a container opening (6450) for enabling packing of articles into said rigid container interior storage space (6465) and for enabling removal of articles from said rigid container interior storage space (6465).

190. The rigid container according to any preceeding example, wherein

said container opening (6450) is closeable by placing a lid (6460) over the rim portion (6445) so as to provide a closed state of the rigid container (6420).

191. The rigid container according to any preceeding example, wherein

the rim (6445), in the closed state of the rigid container, co-operates with the lid such that the rigid container seals, or substantially seals, said interior storage space (6465) from the environment so as to minimize or prevent entry of air from the environment into the rigid container interior storage space (6465).

192. The rigid container according to any preceeding example, wherein

said side wall is shaped such that the rigid container is stackable.

This solution advantageously allows for one rigid container to be placed partially inside of another rigid container e.g. when the another rigid container is empty or less than fully packed with articles. In this connection it noted that when goods is delivered by a transport vehicle 680 it is important to be able to use the packing area of the transport vehicle 680 as efficiently as possible. Thus, for example, the packing area of the vehicle may be full when the vehicle leaves the storage facility 600 for deliveries to plural delivery destinations DD, and thus there is a shortage of space in

the packing area of the transport vehicle 680, and there is a desire to gain more space in the packing area of the transport vehicle 680. This is beacause it will be necessary to reach rigid containers placed far into the packing area of the transport vehicle 680, i.e. rigid containers that are initially hidden behind rigid containers that are closer to the packing area door of the transport vehicle 680.

Using the above defined rigid container advantageously enables a gradual gaining of empty space when rigid containers are emptied during a delivery tour since the rigid container is stackable.

193. The rigid container according to any preceeding example, wherein

said side wall (6440) is shaped and dimensioned such that the rigid container is stackable.

194. The rigid container according to any preceeding example, wherein

said side wall (6440) is shaped and dimensioned such that the rigid container is stackable, at least in an open state of the rigid container.

195. The rigid container according to any preceeding example, wherein

said side wall (6440) has a first wall portion, adjacent to said bottom wall (6430), said first wall portion having a first wall portion height, as measured from said bottom wall (6430) towards said rim portion; and

said side wall (6440) has a second wall portion, adjacent to said container opening (6450), said second wall portion including said rim portion (6445); said second wall portion having a second wall portion height, as measured from said rim portion (6445) towards said bottom wall; wherein

said side wall (6440) is shaped and dimensioned such that, in an open state of the rigid container, at least a part of said first wall portion of one rigid container fits inside of the second wall portion of another rigid container, the another rigid container being identically shaped and dimensioned, or substantially identically shaped and dimensioned, as said one rigid container.

This solution advantageously allows for one rigid container to be placed partially inside of another rigid container e.g. when the another rigid container is empty or less than fully packed with articles. In this connection it noted that when goods is delivered by a transport vehicle 680 it is important to be able to use the packing area of the transport vehicle 680 as efficiently as possible. Thus, for example, the packing area of the vehicle may be full when the vehicle leaves the storage facility 600 for deliveries to plural delivery destinations DD, and thus there is a shortage of space in the packing area of the transport vehicle 680, and there is a desire to gain more space in the packing area of the transport vehicle 680. This is beacause it will be necessary to reach rigid containers placed far into the packing area of the transport vehicle 680, i.e. rigid containers that are initially hidden behind rigid containers that are closer to the packing area door of the transport vehicle 680.

Using the above defined rigid container enables a gradual gaining of empty space when rigid containers are emptied during a delivery tour since the one rigid container fits so as to be placed inside of the second wall portion of another rigid container, when the another rigid container is sufficiently emptied to receive the first wall portion of the one rigid container. In this manner, the rigid container are advantageously adapted to be capable of being stacked.

196. The rigid container according to any preceeding example, wherein

said side wall includes a plurality of side walls.

197. The rigid container according to any preceeding example, wherein

said side wall (6440) has a first wall portion, adjacent to said bottom wall (6430); and

said side wall (6440) has a second wall portion, adjacent to said container opening (6450);

said side wall comprises a shoulder portion, the shoulder portion being positioned between said first wall portion and said second wall portion.

198. The rigid container according to example 197, wherein

the rigid container exhibits a first outer width between the shoulder portion and the bottom wall (6430); and

the said rigid container interior storage space (6465) exhibits an inner width between the shoulder portion and said container opening (6450); said first outer width being smaller than said inner width.

199. The rigid container according to any preceeding example, wherein

the rigid container exhibits a first outer width between the shoulder portion and the bottom wall (6430); and

the rigid container exhibits an inner width between the shoulder portion and said container opening (6450); said first outer width being smaller than said inner width so that said rigid container is stackable.

200. The rigid container according to any preceeding example, wherein

said rigid container side wall includes an insulation layer; said insulation layer having a minimum insulation layer thickness, and a maximum thermal conductivity; said maximum thermal conductivity being less than 0,15 W/(m*K);

said rigid container side wall having a minimum side wall thickness of at least 15 millimetres.

201. The rigid container according to example 200, wherein

said minimum insulation layer thickness is at least 15 millimetres.

202. The rigid container according to any preceeding example, wherein

said rigid container side wall is made of a material whose thermal conductivity is less than 0,15 W/(m*K).

203. The rigid container according to any preceeding example, wherein

said rigid container side wall includes an insulation layer having a thermal conductivity of less than 0,08 W/(m*K); said insulation layer comprising Expanded PolyPropylene.

204. The rigid container according to any preceeding example, wherein said side wall, and/or said bottom wall, comprises expanded polypropylene (EPP) having a density in the range from 40 kg/cubic metre to 90 kg/cubic metre, and a thermal conductivity in the range from 0,035 W/(m*K) to 0,045 W/(m*K).

205. The rigid container according to any preceeding example, wherein said side wall, and/or said bottom wall, comprises expanded polypropylene (EPP) being substantially water vapour impermeable, and/or substantially water impermeable.

206. The rigid container according to any preceeding example, wherein said side wall, and/or said bottom wall, comprises a material that withstands temperatures of 70 degrees Centigrade, or more.

207. The rigid container according to any preceeding example, wherein said side wall, and/or said bottom wall, comprises a material that withstands temperatures of 100 degrees Centigrade, or more.

208. The rigid container according to any preceeding example, wherein said side wall, and/or said bottom wall, has at least an outer surface layer of a material that has a chemical resistance to alcohol.
This solution advantageously enables cleaning and disinfection and/or sterilizing of the rigid container by use of alcohol.

209. The rigid container according to any preceeding example, wherein

said side wall, and/or said bottom wall, has an external surface facing said air environment, and an internal surface facing said rigid container interior storage space (6465);

the material of the wall stretching from the external surface to the internal surface.

210. The rigid container according to example 209, wherein

the material of the wall stretching from the external surface to the internal surface is expanded polypropylene (EPP).

211. The rigid container according to any preceeding example, wherein

an outer surface of the bottom wall (6430C) includes at least two protrusions (6510) at predetermined positions.

212. The rigid container according to example 211, wherein

said lid (6460C) has an external top surface; the external top surface being provided with at least two recesses (6520) at predetermined positions.

213. The rigid container according to example 212, wherein

said at least two bottom wall protrusions (6510) are configured to fit into said at least two lid surface recesses (6520) when placing said lid so that the external top surface of the lid faces the outer surface of the bottom wall (6430C).

This solution advantageously alllows for mechanically stable storing, and/or transport, of a large number of insulated rigid containers 6425 when placed one above the other, since the outer surface of the bottom wall 6430C includes a stabilizing protrusion 6510 that fits in a corresponding recess 6520 on the top surface of the lid 6460C.

214. The rigid container according to any of examples 211 to 213, wherein

at least one of said at least two protrusions (6510) has a sloped surface (6560).

This solution advantageously simplifies sliding the insulated rigid container box 6425 over a floor surface.

215. The rigid container according to any preceeding example, wherein

said protrusions (6510) are elongated protrusions (6510E) having two long side surfaces (6550), and two end surfaces (6560), wherein

at least one of said two end surfaces (6560) is a sloped surface (6560).

This solution advantageously simplifies sliding the rigid container in the direction of elongation of the elongated protrusions (6510E).

216. The rigid container according to example 215, wherein

said elongated protrusions (6510E) are shaped and configured to increase friction for movements perpendicular to the direction of elongation of the elongated protrusion (6510E).

217. The rigid container according to example 215, wherein

at least one of the long side surfaces (6550), is at a sharp angle with the first elongated surface (6530).

218. A method of delivering chilled goods in a sealable container, comprising the steps of

receiving an order for an amount of chilled goods; and

packing said amount of chilled goods in a closable container adapted to be used in an air atmosphere environment, the container being a bag according to any of examples 1-179,

and wherein the method further comprises the steps of

closing said closable opening so as to seal said amount of chilled or frozen goods from said air atmosphere environment; and

transporting the loaded container to a delivery destination (DD).

219. The method according to example 218 wherein said transporting step includes using a vehicle without any actively refrigerated storage enclosure for the transportation of the loaded container.

220. A goods transport system comprising:

a first rigid container (6420A) according to any of examples 180-217, said first rigid container having an insulating wall, said first rigid container being of a first size; and

a second rigid container (6420B) according to any of examples 180-217, wherein at least one of the walls of the second rigid container (6420B), and/or the lid of the second rigid container (6420B), includes a layer of an energy absorbent; said second rigid container (6420B) being of a second size smaller than the first size so that the second rigid container (6420B), in its closed state, fits inside the first rigid container (6420A) in its closed state.

221. A method of delivering chilled goods in a first sealable container (20), comprising the steps of:

receiving an order for an amount of chilled goods; and

packing said amount of chilled goods in said first sealable container (20) adapted to be used in an air atmosphere environment, the first sealable container (20) being a bag according to any of examples 1-179 having:

a wall adapted to enclose an interior storage space for transporting chilled and/or frozen goods, the wall being shaped and adapted to form said interior storage space to a volume of at least four metric litres, or at least ten metric litres,; and

a closable opening such that the container (20) in its closed state seals, or substantially seals, the interior storage space from the environment so as to minimize or prevent entry of air from the environment into the interior storage space;

and wherein the method further comprises the steps of

closing said closable opening of the container (20) so as to seal said amount of chilled or frozen goods from said air atmosphere environment; and

providing a rigid container (6420) according to any of examples 180-217, or providing a goods transport system according to example 220;

placing the closed first sealable container (20) inside the rigid container (6420) according to any of examples 180-217, or inside the second rigid container (6420B) of the goods transport system according to example 220;

transporting the closed first sealable container (20) to a delivery destination (DD) while keeping the closed first sealable container (20) inside of the rigid container (6420), or inside the second rigid container (6420B) of the goods transport system according to example 220 during the transport.

222. The method according to example 221; wherein

the step of transporting the closed first sealable container (20) includes maintaining a closed state of the closed first sealable container (20) during the complete transport from a goods loading room (660), where said first sealable container (20) was loaded and closed, to delivery destination (DD).

223. The method according to example 221 or 222, comprising the step of Chilling (S6370) the rigid container (6420) to a predetermined temperature before the step of providing said rigid container, or

Chilling (S6370) the second rigid container (6420B) to a predetermined temperature before the step of providing said second rigid container (6420B).

224. The method according to any of examples 221-223, wherein said first sealable container is a bag according to any of examples 1-179.

225. A goods transport system comprising

a storage facility (600) for goods; the storage facility comprising one or several storage rooms having a controlled environment in that the temperature and the relative humidity of the air in the storage room is controlled so that it is kept within certain predetermined ranges; wherein

the goods comprises a plurality of different types of goods sorted into different temperature ranges (TI, TII, TIII, TIV), each type of goods being stored in a corresponding storage room (650_{TI}, 650_{TII}, 650_{TIII}, 650_{TIV}) having a temperature in accordance with the corresponding goods temperature range (TI, TII, TIII, TIV);

a loading facility for enabling chilled or frozen goods is to be packed into closable and sealable containers (20); said loading facility comprising a plurality of said closable and sealable containers (20) for use in the distribution of said chilled or frozen goods in an air atmosphere environment;

a delivery vehicle for transporting said closable and sealable containers (20), when loaded with a predetermined amount of chilled or frozen goods, to a delivery destination, wherein such a container (20) is a bag according to any of examples 1-179.

226. The goods transport system according to example 225 comprising :

a server computer (540) having a communications port for communication via the Internet.

227. The goods transport system according to any of examples 225-226, further comprising the rigid container according to any of examples 180-217.

228. The goods transport system according to any of the preceding examples, wherein the goods comprises grocery.

229. The goods transport system according to any of any of the preceding examples, wherein the goods transport system is a grocery transport system.

230. A kit of parts, comprising:
a piece of chilled or frozen goods; and
a bag according to any of examples 1- 179.

231. The kit of parts according to example 230, further comprising:
a first rigid container (6420A) according to any of examples 180-217.

232. The kit of parts according to example 231, further comprising:
a first rigid container (6420A) according to any of examples 180-217, said first rigid container having an insulating wall, said first rigid container being of a first size; and
a second rigid container (6420B) according to any of examples 180-217, wherein at least one of the walls of the second rigid container (6420B), and/or the lid of the second rigid container (6420B), includes a layer of an energy absorbent; said second rigid container (6420B) being of a second size smaller than the first size so that the second rigid container (6420B), in its closed state, fits inside the first rigid container (6420A) in its closed state.

233. **A** method of delivering chilled and/or frozen goods, comprising the steps of
receiving (S300) an order for chilled and/or frozen goods (40, 40A); and
packing (S360) an amount of chilled and/or frozen goods (40, 40A) in a chill bag (20) adapted to be used in an air atmosphere environment having an air humidity,
the chill bag (20) having
a wall (110, S1A, 120, S1B, 130A, S2A, 130B, S2B, 140) adapted to enclose an interior storage space (100) for transporting chilled and/or frozen goods (40, 40A), the wall being shaped and adapted to form said interior

storage space (100) to a volume of at least four metric litres; said wall (110, S1A, 120, S1B, 130A, S2A, 130B, S2B, 140) comprising:

an outer paper layer; and

an inner paper layer; and

a thermally insulating intermediate space beween the outer paper layer and the inner paper layer; and

a closable bag opening (160, 420) such that the chill bag (20) in its closed state seals, or substantially seals, the interior storage space (100) from the environment so as to minimize or prevent entry of air from the environment into the interior storage space (100);

and wherein the method further comprises the steps of

closing (S370) said closable opening of the chill bag (20) so as to seal said packed amount of chilled or frozen goods from said air atmosphere environment; and

providing (S6375) a rigid container (6420) to be used in an air environment having an air humidity, the rigid container comprising

a rigid container bottom wall (6430); and

a plurality of rigid container side walls (6440); wherein said rigid container has a rigid container rim (6445) providing an opening (6450); and

a lid (6460) configured to cover said opening when the lid is placed over the rim so as to provide a closed state of the rigid container (6420); and wherein

the lid co-operates with the rigid container rim (6445) such that the rigid container in its closed state seals, or substantially seals, a rigid container interior storage space (6465) from the environment so as to minimize or prevent entry of air from the environment into the rigid container interior storage space (6465);

and wherein the method further comprises the steps of

placing (S6380) the packed and closed chill bag (20) inside the rigid container (6420);

closing and sealing the rigid container (6420);

transporting the closed chill bag (20) to a delivery destination (DD) while keeping the closed chill bag (20) inside of the rigid container (6420) during the transport; the chill bag having

a collapsed state for enabling transportation of the kraft paper chill bag in a substantially flat state, and

an expanded state such that the kraft paper chill bag, in its expanded state, provides an interior storage space (100) for transporting chilled and/or frozen goods, the chill bag (20) comprising:

a paper layer being shaped and folded so as to form

a front wall panel (110, S1A),

a back wall panel (120, S1B),

and

a bottom panel (140); wherein the wall panels and the bottom panel cooperate to form said interior storage space (100) to a volume of between four litres and fifty litres in the expanded state of the kraft paper chill bag (20); and

said paper layer (180, 180B, 180C, 180D) having a surface weight of at least 60 grams per square meter;

said paper layer (180, 180B, 180C, 180D) comprising a certain amount of air being trapped within the paper layer; said paper layer having a thermal conductivity of less than 0,15 W/(K*m) and an air permeability less than 0.5 µm/(Pa·s); the chill bag further comprising:

and wherein

the chill bag (20) has a closure device at said rim portion; said closure device being arranged and positioned to provide

an open expanded state of the chill bag (20) for loading and/or unloading chilled and/or frozen goods to be transported, and

a closed expanded state of the chill bag such that the chill bag, in its closed expanded state, provides a substantially closed interior storage space (100) for transporting chilled and/or frozen goods; wherein

the closure device is closable such that, in the closed expanded state of the chill bag, the closure device cooperates with said wall panels and said bottom panel, so as to close and substantially seal the interior storage space (100) from the environment so as to minimize or prevent entry of air from the environment into the interior storage space (100) such that the kraft paper chill bag is adapted to minimize or prevent the occurrence of condensation on the chilled and/or frozen goods within the interior storage space (100) during transport of the chilled and/or frozen goods; and wherein

the rigid container (6420) comprising

a bottom wall (6430); and

a side wall (6440);

said side wall (6440) cooperating with said bottom wall (6430) to form a rigid container interior storage space (6465) of at least 60 metric litres; and wherein

a rim portion (6445) of said side wall (6430) facing away from the bottom wall (6430) provides a container opening (6450) for enabling packing of articles into said rigid container interior storage space (6465) and for enabling removal of articles from said rigid container interior storage space (6465), wherein

said container opening (6450) is closeable by placing a lid (6460) over the rigid container rim portion (6445) so as to provide a closed state of the rigid container (6420), wherein

the rim (6445), in the closed state of the rigid container, co-operates with the lid such that the rigid container seals, or substantially seals, said interior storage space (6465) from the environment so as to minimize or prevent exchange of air between the environment and the rigid container interior storage space (6465), and wherein the method further comprises the steps of

opening the rigid container (6420) and

removing the packed and closed chill bag (20) from the inside of the rigid container (6420), e.g when the delivery destination (DD) has been reached.

Claims

1. A method of delivering chilled goods in a first sealable container (20), comprising the steps of:

receiving an order for an amount of chilled goods; and

packing said amount of chilled goods in said first sealable container (20) adapted to be used in an air atmosphere environment, the first sealable container (20) being a bag (20) for transporting goods in an air environment having an air humidity; the bag being a collapsible bag having

a collapsed state (20A) for enabling transportation of the collapsible bag in a substantially flat state, and

an expanded state (20B) such that the collapsible bag (20), in its expanded state, provides an interior storage space for transporting goods, the collapsible bag comprising:

at least one wall panel; and

a bag opening; and wherein

the collapsible bag has

an open expanded state (20C) for loading and/or unloading said goods via the bag opening, and

a closed expanded state (20D) such that the collapsible bag (20), in its closed expanded state (20D), provides a closed interior storage space for transporting chilled and/or frozen goods; wherein

the bag opening is a closable opening which, in the closed expanded state (20D) of the collapsible bag, cooperates with said at least one wall panel so as to minimize or prevent exchange of air between the environment and the interior storage space, wherein

the wall panel comprises

an outer material layer; and

an inner material layer; and

a thermally insulating intermediate space beween the outer material layer and the inner material layer; said wall being adapted to enclose the

interior storage space, the wall being shaped and adapted to form said interior storage space to a volume of at least four metric litres; and wherein the method further comprises the steps of

closing said closable opening of the bag (20) so as to seal said chilled and/or frozen goods from said air atmosphere environment; and

providing a rigid container (6420) for use in an air environment, the rigid container comprising

a bottom wall (6430); and

a side wall (6440);

said side wall (6440) cooperating with said bottom wall (6430) to form a rigid container interior storage space (6465); and wherein

a rim portion (6445) of said side wall (6430) facing away from the bottom wall (6430) provides a container opening (6450) for enabling packing of articles into said rigid container interior storage space (6465) and for enabling removal of articles from said rigid container interior storage space (6465);

placing the closed first sealable container (20) inside the rigid container (6420);

transporting the closed first sealable container (20) to a delivery destination (DD) while keeping the closed first sealable container (20) inside of the rigid container (6420).-

2. The method according to claim 1, wherein

said rigid container side wall (6440) has a first wall portion, adjacent to said bottom wall (6430), forming a lower part of the rigid container; and

said side wall (6440) has a second wall portion, adjacent to said container opening (6450), forming an upper part of the rigid container;

said side wall comprises a shoulder portion, the shoulder portion being positioned between said first wall portion and said second wall portion, wherein

the rigid container exhibits a first outer width between the shoulder portion and the bottom wall (6430); and

the rigid container exhibits an inner width between the shoulder portion and said container opening (6450); said first outer width being smaller than said inner width so that said rigid container is stackable when at least the upper part of a receiving container (6420C) is empty and the lid of the receiving container is removed.

3. The method according to claim 1 or 2, wherein

said side wall, and/or said bottom wall, has an external surface facing said air environment, and an internal surface facing said rigid container interior storage space (6465);

the material of the wall stretching from the external surface to the internal surface, wherein

the material of the wall stretching from the external surface to the internal surface is expanded polypropylene (EPP).

4. The method according to any preceeding claim, wherein

an outer surface of the bottom wall (6430C) includes at least two protrusions (6510) at predetermined positions; wherein

said lid (6460C) has an external top surface; the external top surface being provided with at least two recesses (6520) at predetermined positions.

5. The method according to any preceeding claim, wherein

an intermediate material is placed in the intermediate space of the bag wall panel; wherein

the intermediate material comprises fragmented stuffing material, the fragmented stuffing material comprising recycled paper.

6. The method according to any preceeding claim, wherein

the outer material layer of the bag wall includes paper.

7. The method according to any preceeding claim, wherein

the inner material layer of the bag wall includes paper.

8. The method according to any preceeding claim, wherein

the outer material layer of the bag wall includes a paper layer having an air permeability of 0,5 μm/(Pa·s), or less.

9. The method according to any preceeding claim, wherein

the bag is formed by a protector strip (5, 5T).

10. The method according to any preceeding claim, wherein

an outer bottom surface (6525) of the insulated rigid container box (6425) is provided with protrusions (6510); and

an outer top surface of the lid (6460C) is provided with circular recesses (6520) configured and positioned to receive outer bottom surface protrusions (6510) of another insulated rigid container box (6425).

11. The method according to any preceeding claim, wherein

the outer top surface of the lid (6460C) has elongated recesses (6520E) configured to receive external elongated bottom surface protrusions (6510E) of another insulated rigid container box 6425.

12. The method according to any preceeding claim, wherein

the insulated rigid container box 6425 includes a grippable surface (6595) between the narrower lower part of the insulated rigid container box (6425) and the wider upper part of the insulated rigid container box 6425.

13. The method according to any preceeding claim when dependent on claim 2, wherein

an external surface of said second wall portion extends past said shoulder portion so as to form a protruding portion (6500); the protruding portion

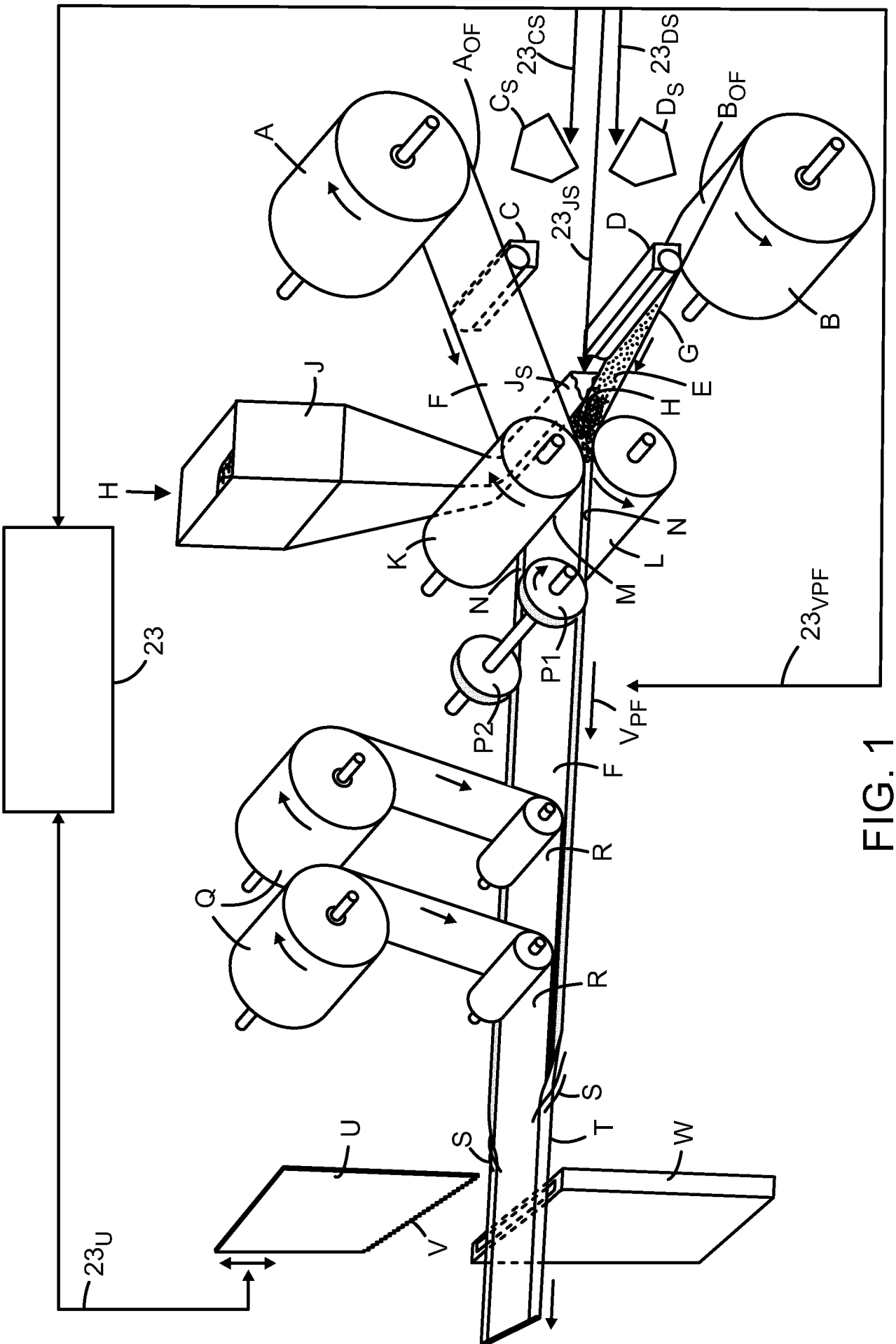
(6500) including a lip portion (6590); the lip portion (6590) providing a grippable surface (6595).

14. The method according to claim 13, wherein

the lip portion (6590) is configured to enable pulling the insulated rigid container box (6425) in a first direction, said first direction including a direction perpendicular to the plane of the grippable surface (6595).

15. The method according to claim 9, wherein

the bag is formed by a tubular protector strip (5T).


A
A_{OF}
C_S
23_{CS}
23_{DS}
D_S
B_{OF}
C
23_{JS}
D
B
F
J_S
H
E
G
J
H
K
N
L
M
N
23_{VPF}
23
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F
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R
S
T
W
U
S
V
23_U

FIG. 1

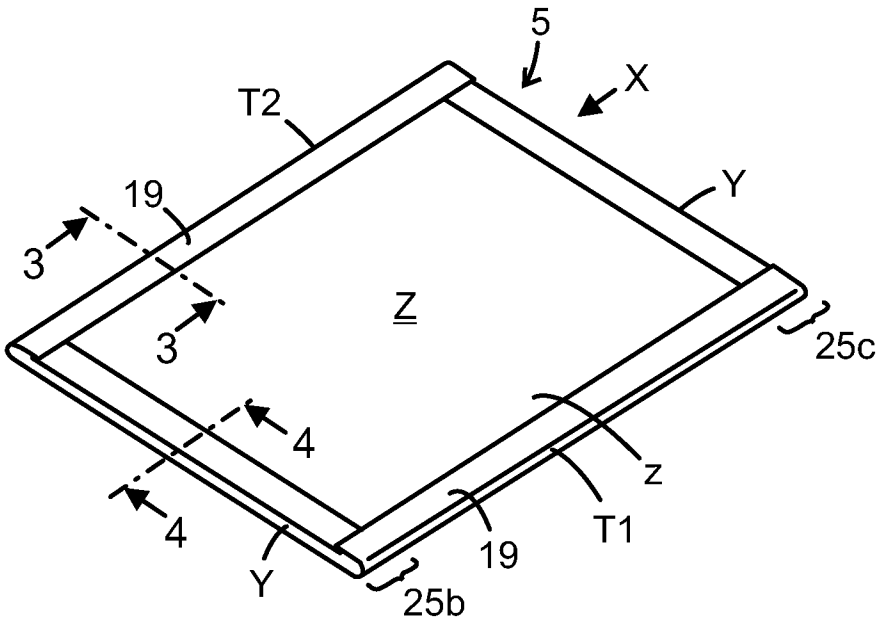


FIG. 2

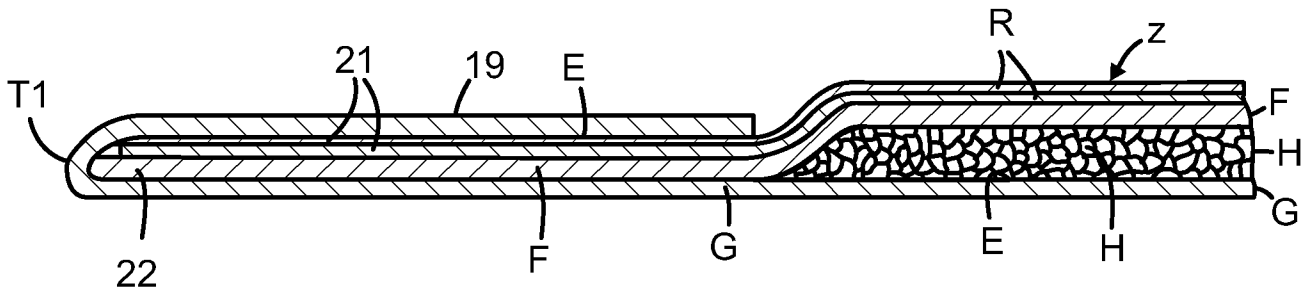


FIG. 3

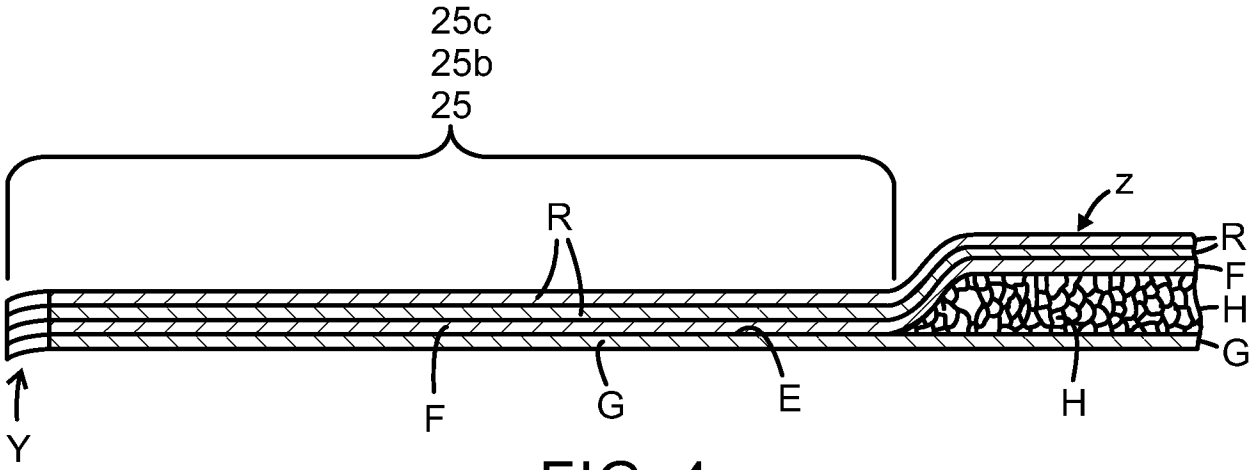


FIG. 4

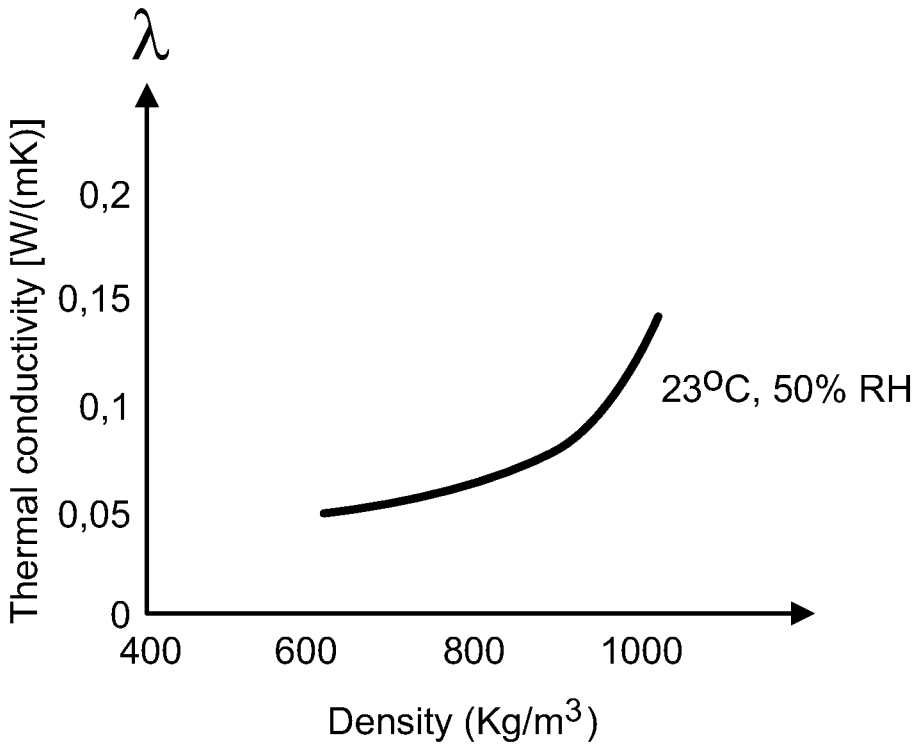

λ
Thermal conductivity [W/(mK)]
0,2
0,15
0,1
0,05
0
400
600
800
1000
Density (Kg/m3)
23OC, 50% RH

FIG. 4A

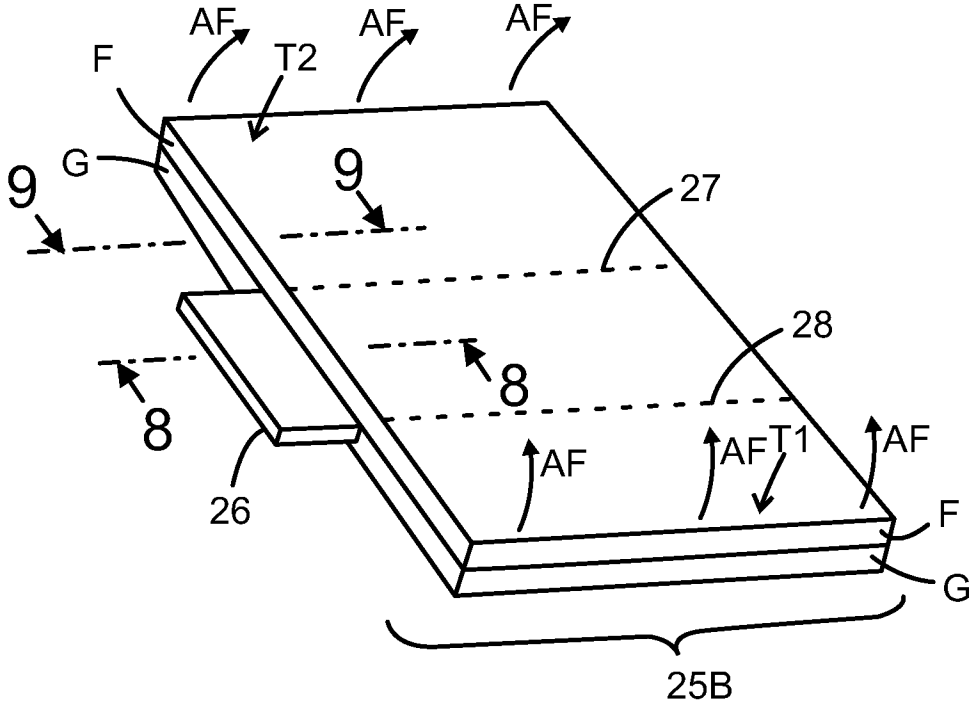

AF
AF
AF
F
T2
G
9
9
27
28
8
8
AF
AF
T1
AF
26
F
G
25B

FIG. 5

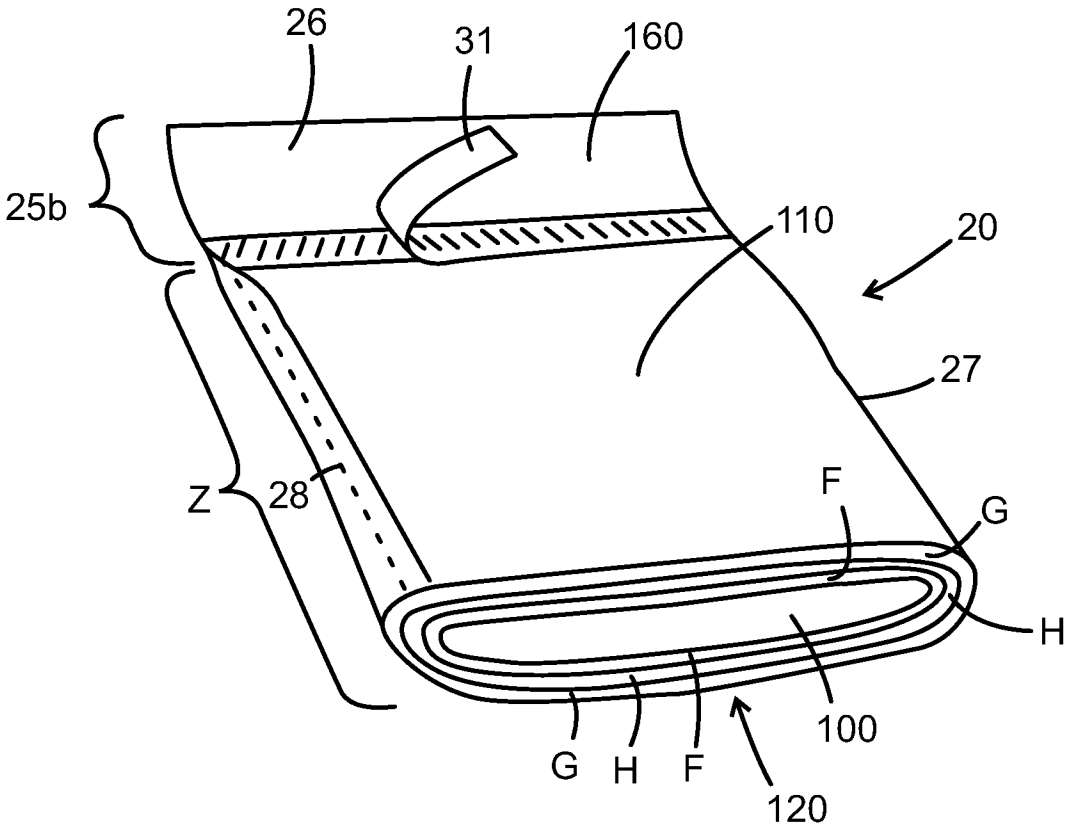

26
31
160
25b
110
20
27
Z
28
F
G
H
G
H
F
100
120

FIG. 6

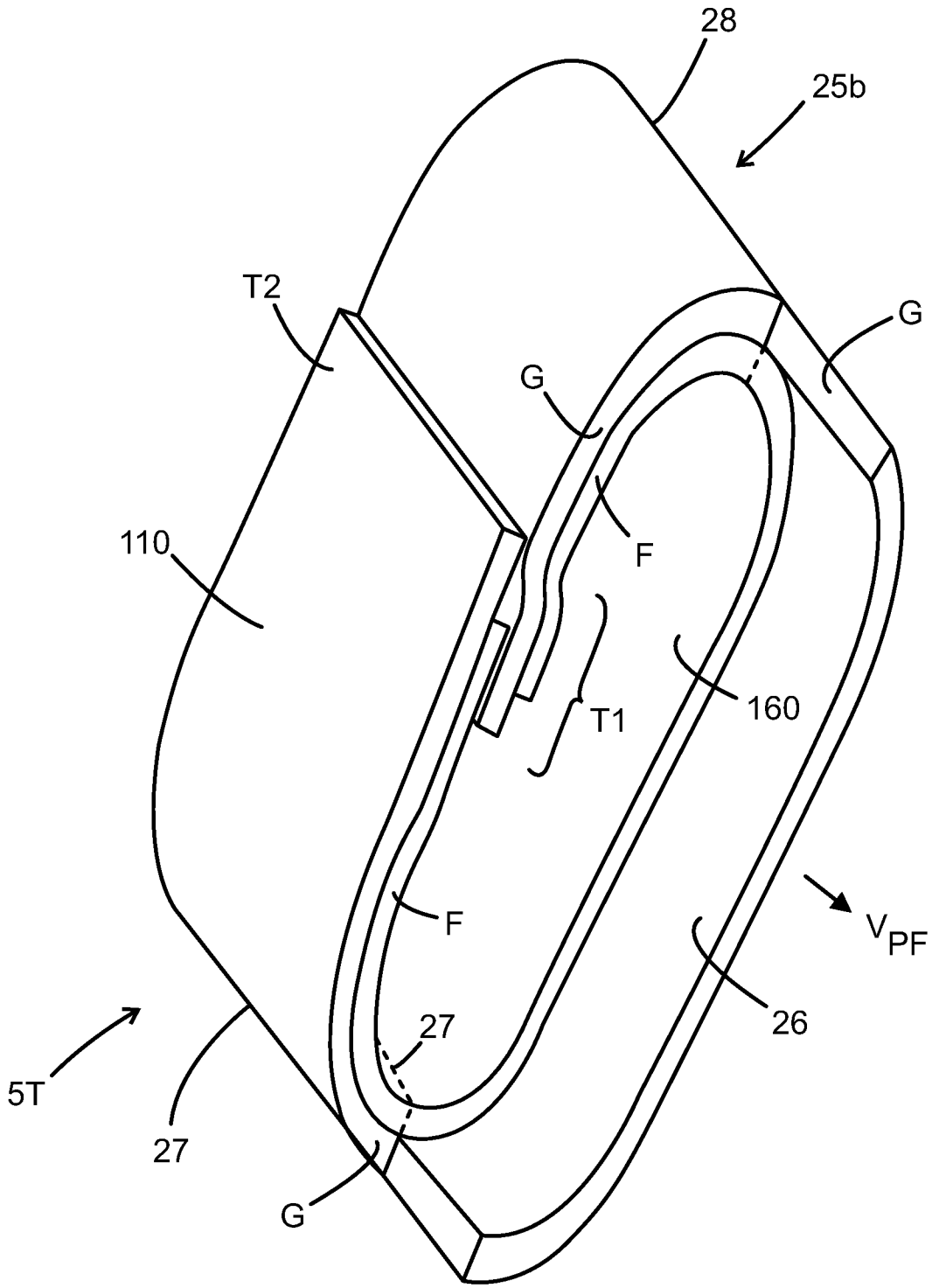


FIG. 7

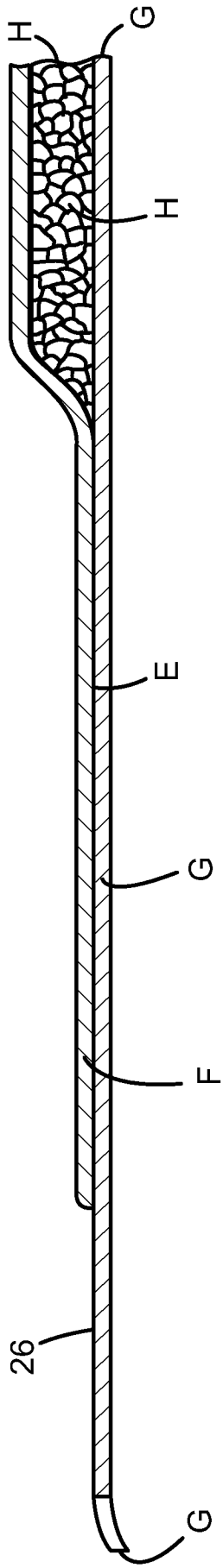


FIG. 8

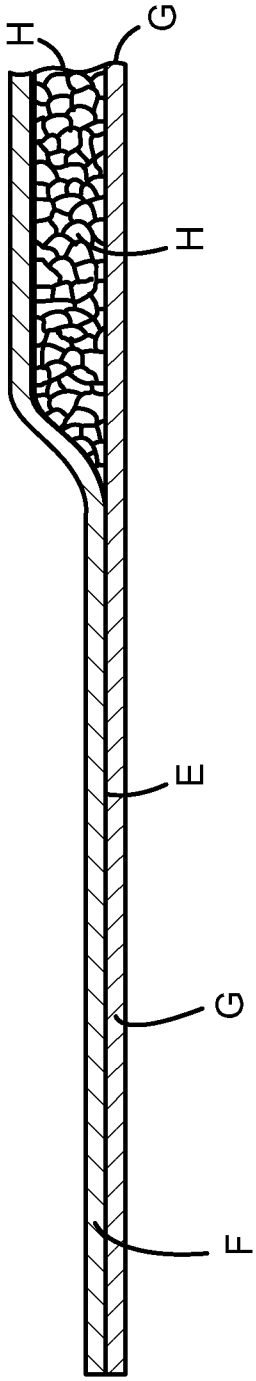


FIG. 9

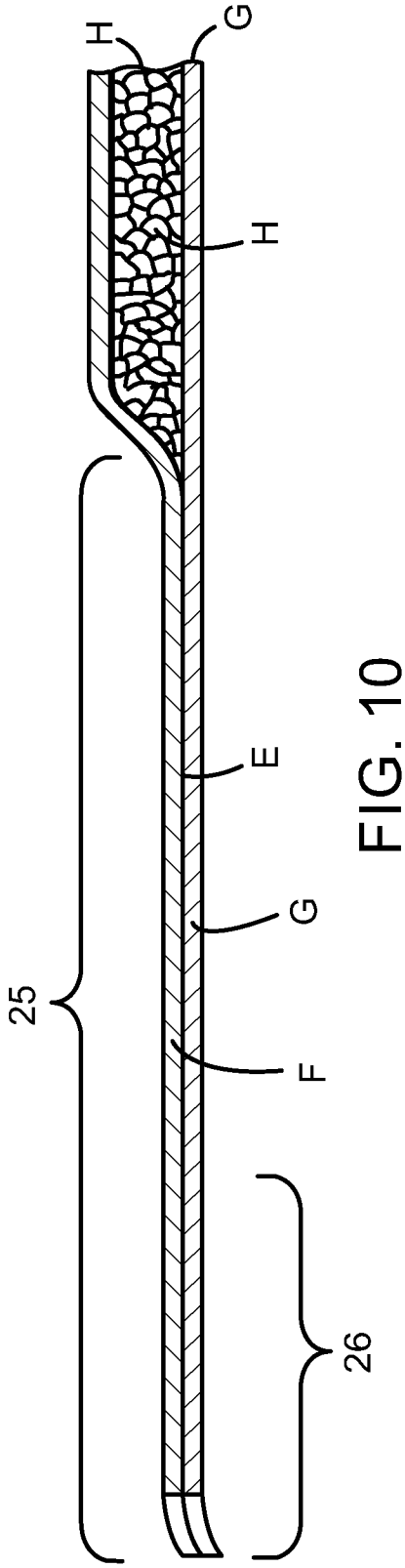


FIG. 10

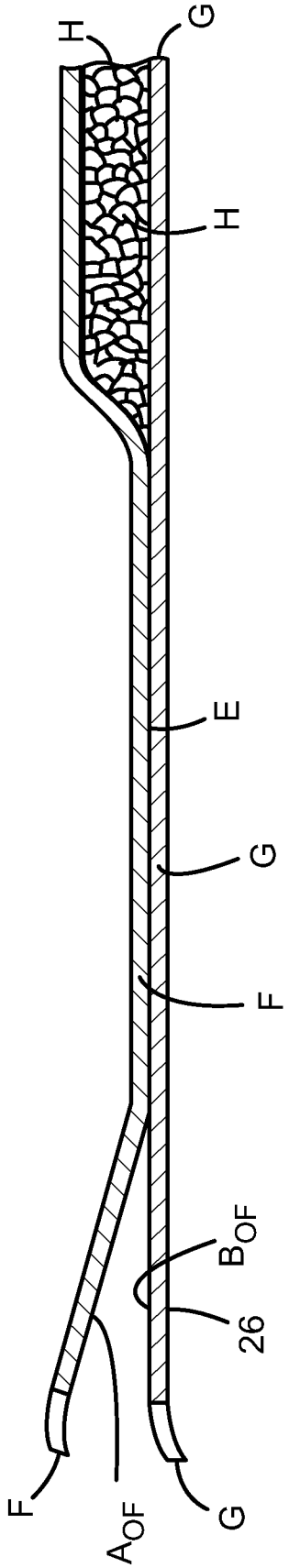
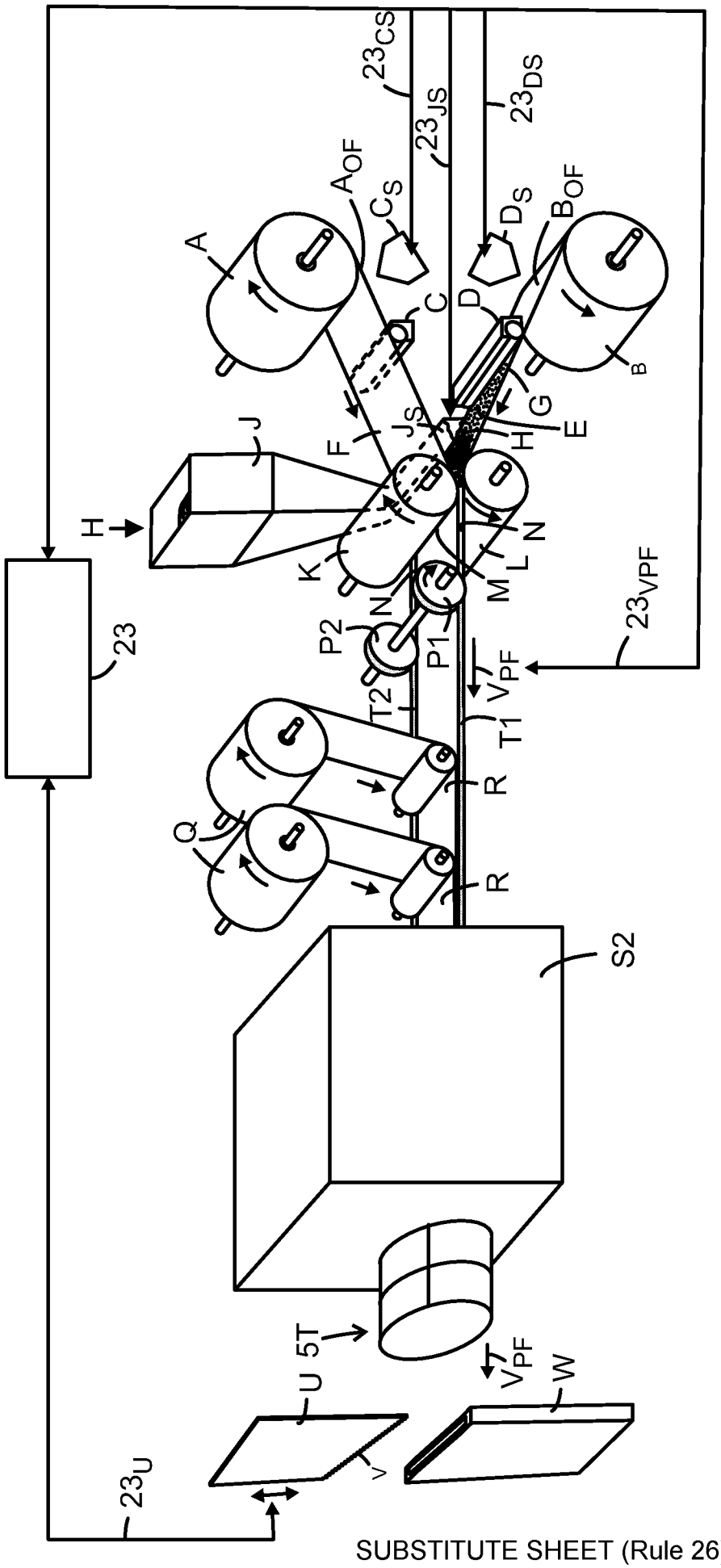


FIG. 11


23CS
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23DS
AOF
CS
DS
BOF
A
C
D
B
G
E
H
F
JS
J
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K
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L
M
23VPF
23
P2
N
P1
VPF
T2
T1
R
Q
R
S2
5T
U
VPF
W
V
23U

FIG. 12

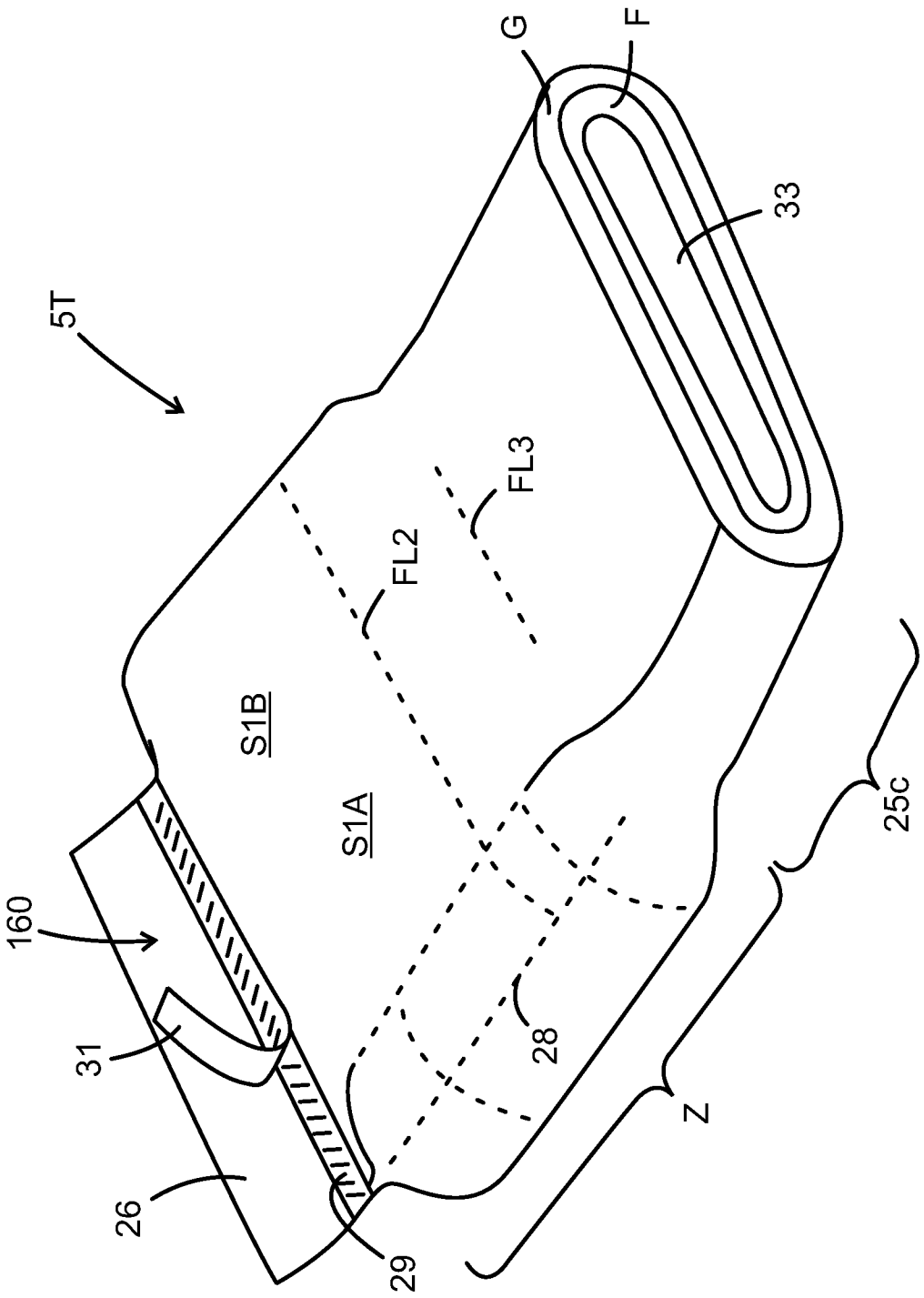

FIG. 13

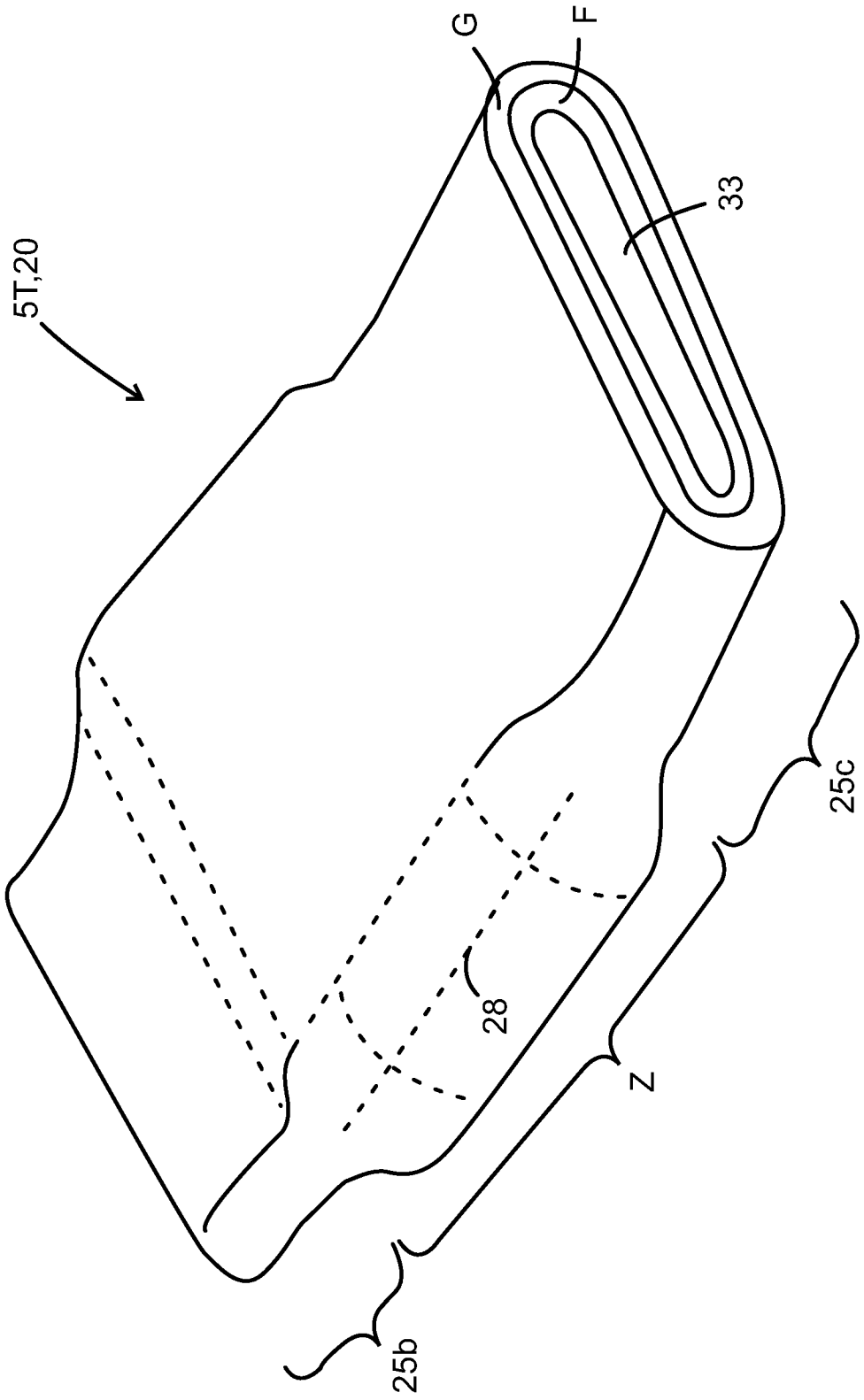

FIG. 14

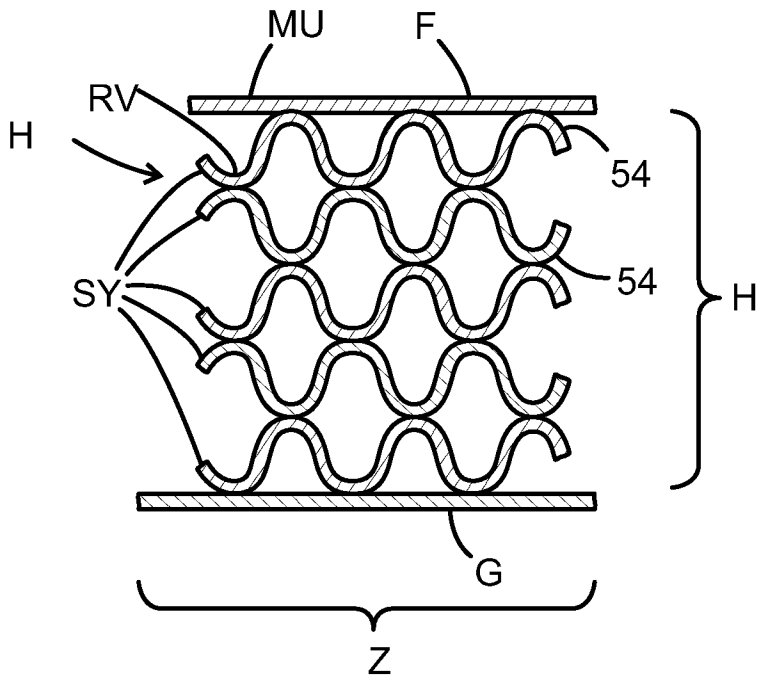

FIG. 14A

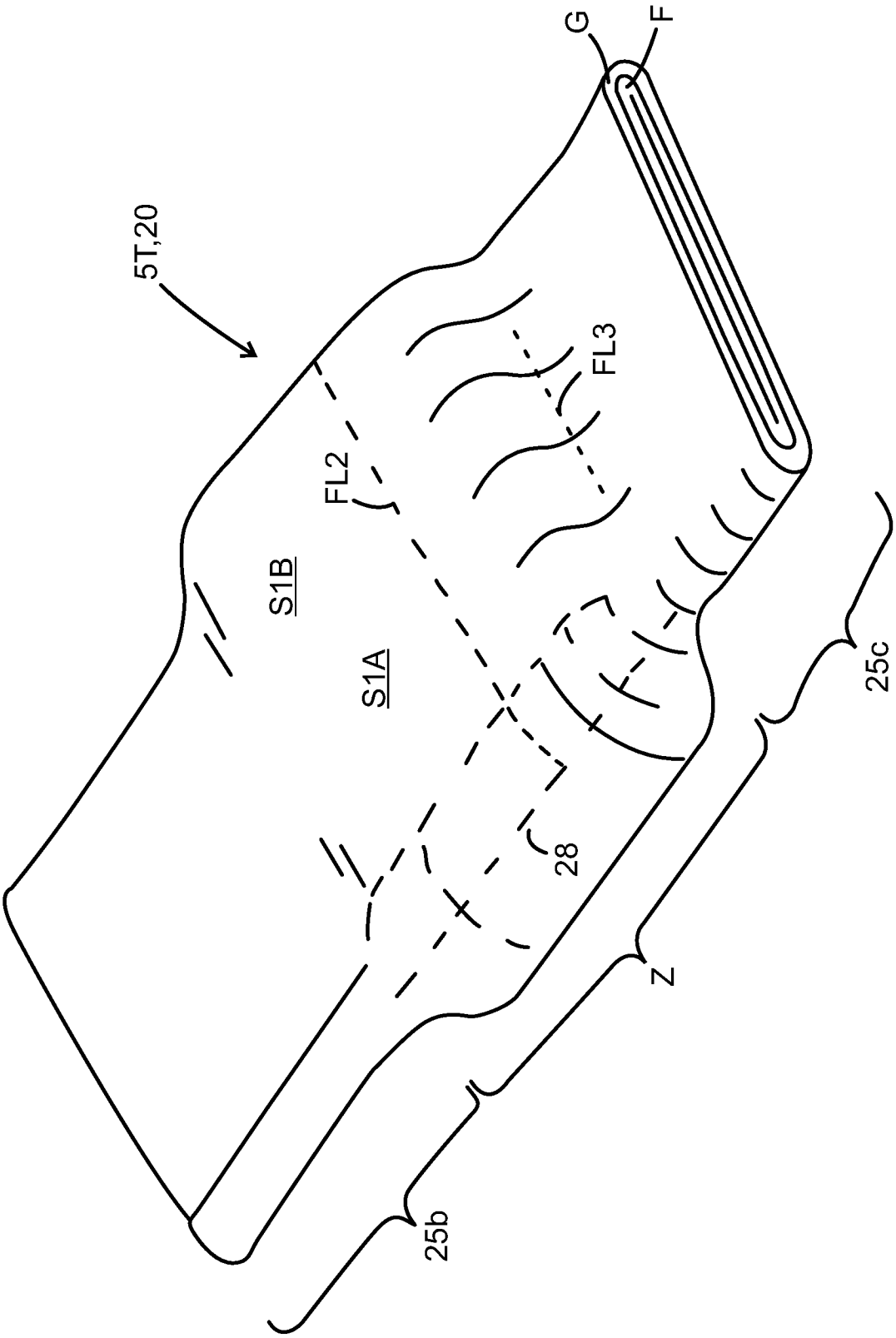

FIG. 15

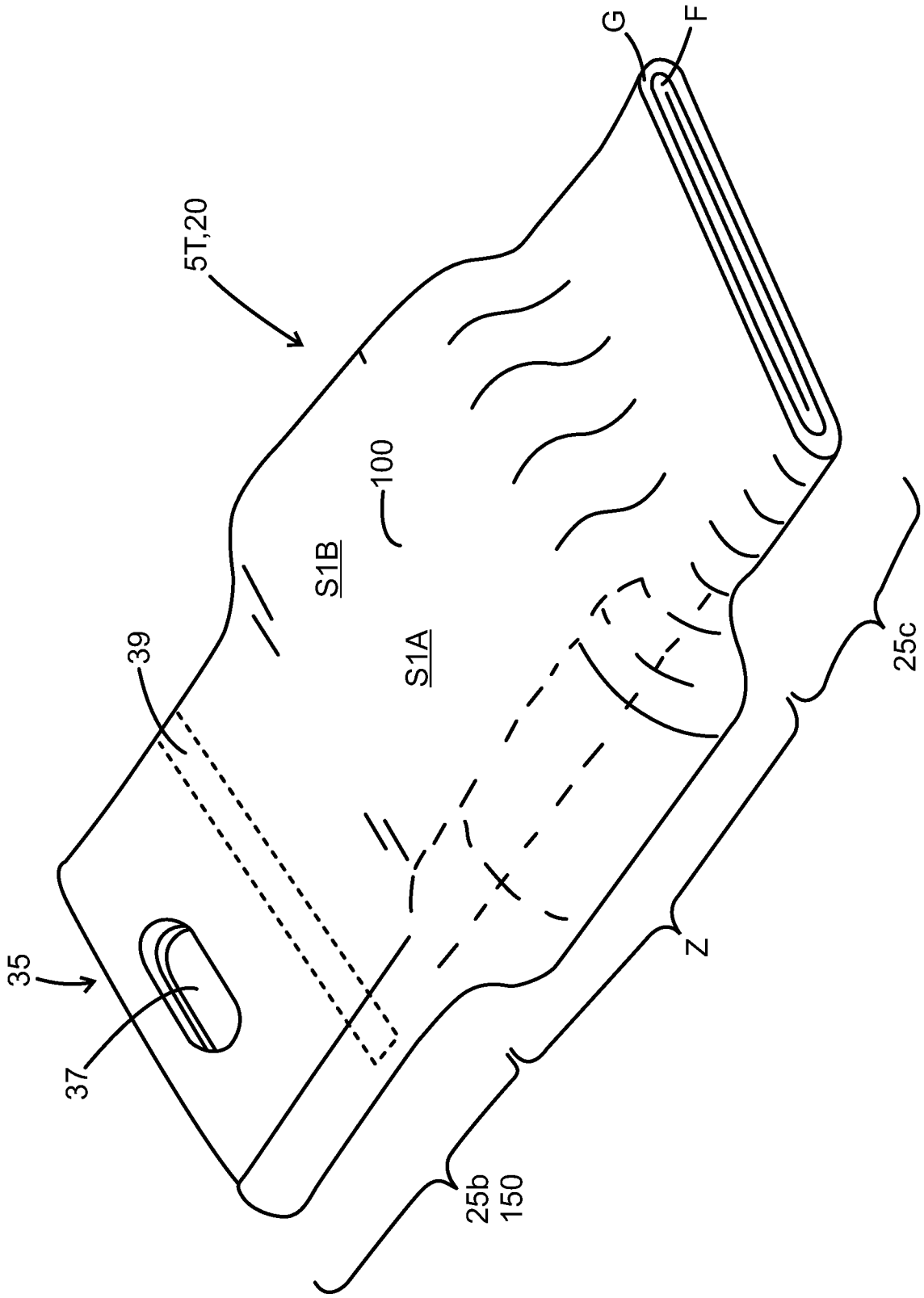

FIG. 16

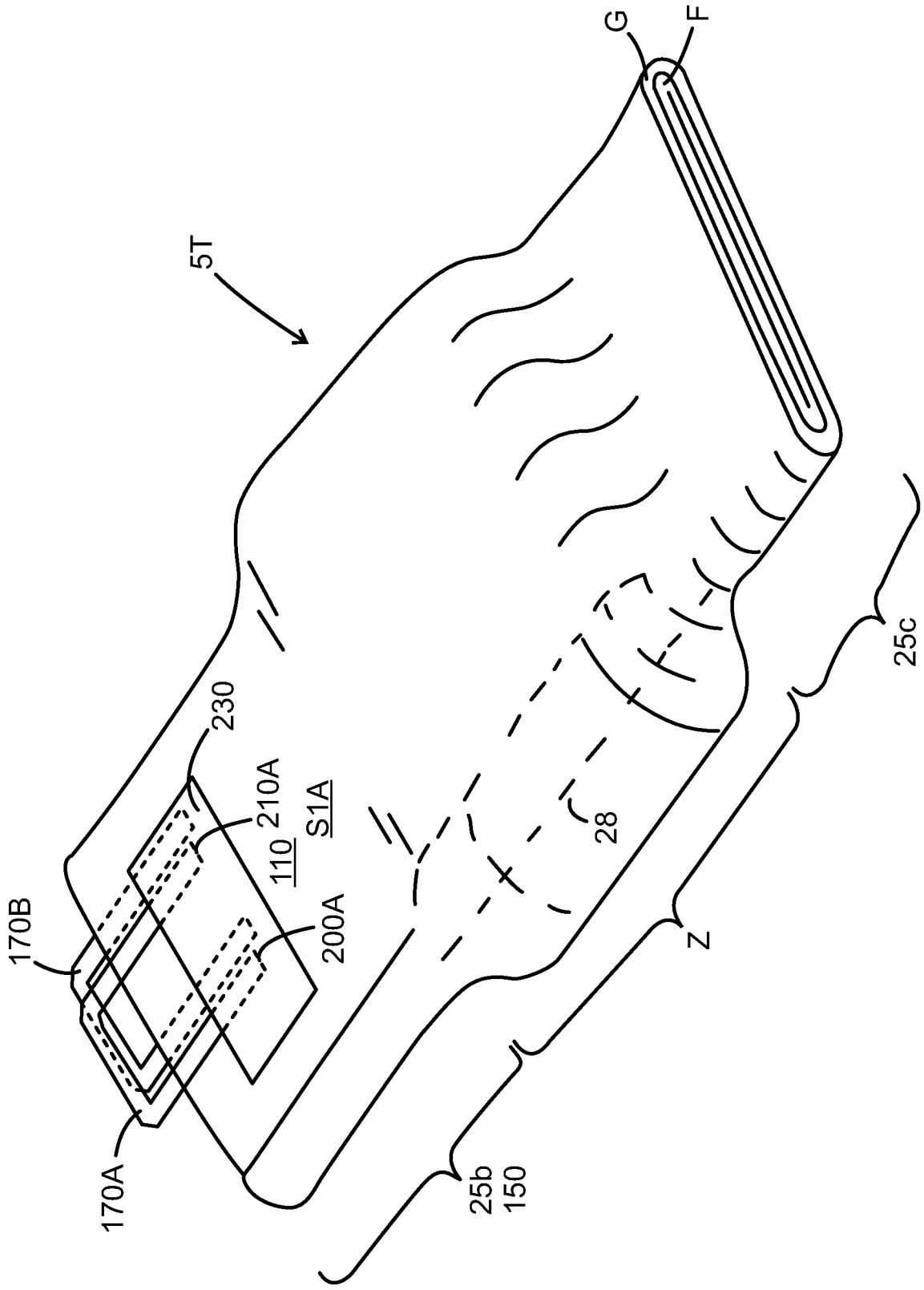

FIG. 17

FIG. 17A (3)

Row. No.	Intermediate material H (Bag Nr.)	Bag weight (g)	Testing date	Start time	Stop time	Testing time	Coolants	Amb. Temp .
1	Flax fibres (Swedish: Linisolering)	260	2018-05-31	11:21	15:22	04:01	None	24,93
2	Fluff pulp (bottom panel)	533	2018-05-31	11:22	15:23	04:01	None	24,93
3	Hemp	308	2018-05-31	11:23	15:24	04:01	None	24,93
4	Loose cellulose fibers	328	2018-05-31	11:24	15:25	04:01	None	24,93
5	Ifoodbag 27L	95	2018-05-30	13:57	17:58	04:01	None	25,30
6	Fluff pulp (bottom panel)	533	2018-05-30	13:59	18:00	04:01	None	25,30

FIG. 17A (2)

FIG. 17A (1)

FIG. 17A (4)

FIG. 17A (1)

Row. No.	Intermediate material H (Bag Nr.)	Bag weight (g)	Testing date	Start time	Stop time	Testing time	Coolants	Amb. Temp.
7	Fibres made from pine tree wood (Swedish: Barrträdsfiber)	284	2018-05-30	14:00	18:01	04:01	None	25,30
8	Loose cellulose fibers	328	2018-05-30	14:01	18:02	04:01	None	25,30
9	Ifoodbag 27L	95	2018-05-23	09:47	13:48	04:01	None	25,00
10	Flax fibers (Swedish: Linisolering)	260	2018-05-23	09:49	13:50	04:01	None	25,00
11	Textile stuffing, loose (Swedish:	254	2018-05-23	09:51	13:52	04:01	None	25,00
12	Versa-Pak (thin)	195	2018-05-23	09:51	13:52	04:01	None	25,00

FIG. 17A (2)

Row. No.	Logger nr.		Start temp.	End temp.	Temp. increase	Average temp inc.
1	side	25	3,41	8,75	5,34	5,19
	mid.	26	3,23	8,18	4,95	
	side	29	3,56	8,84	5,28	
2	side	2	2,84	9,16	6,32	6,35
	mid.	23	2,82	8,91	6,09	
	side	32	2,67	9,3	6,63	
3	side	30	4,06	10,19	6,13	6,2
	mid.	31	4,1	10,2	6,1	
	side	28	4,32	10,69	6,37	
4	side	6	4,11	10,05	5,94	5,93
	mid.	3	4,23	10,04	5,81	
	side	19	4,44	10,48	6,04	
5	side	32	4,67	13,79	9,12	9,30
	mid.	23	4,15	13,25	9,1	
	side	2	4,29	13,97	9,68	
6	side	30	3,3	10,03	6,73	6,67
	mid.	31	3,18	9,61	6,43	
	side	28	3,2	10,06	6,86	

FIG. 17A (1)

FIG. 17A (4)

FIG. 17A (3)

FIG. 17A (3)

Row. No.	Logger nr.		Start temp.	End temp.	Temp. increase	Average temp inc.
7	side	19	4,63	11,47	6,84	6,83
	mid.	3	4,59	11,37	6,78	
	side	6	4,7	11,57	6,87	
8	side	25	4	10,65	6,65	6,62
	mid.	29	3,56	10,02	6,46	
	side	26	3,54	10,28	6,74	
9	side	28	4,2	13,58	9,38	9,48
	mid.	30	4,19	13,62	9,43	
	side	2	4,66	14,28	9,62	
10	side	19	4,63	9,96	5,33	5,11
	mid.	3	4,84	9,63	4,79	
	side	6	5,31	10,53	5,22	
11	side	25	3,76	10,59	6,83	5,48
	mid.	29	3,13	9,21	6,08	
	side	36	3,39	9,93	6,54	
12	side	32	3,62	10	6,38	6,46
	mid.	23	3,57	9,85	6,28	
	side	31	3,88	10,59	6,71	

FIG. 17A (2)

FIG. 17A (4)

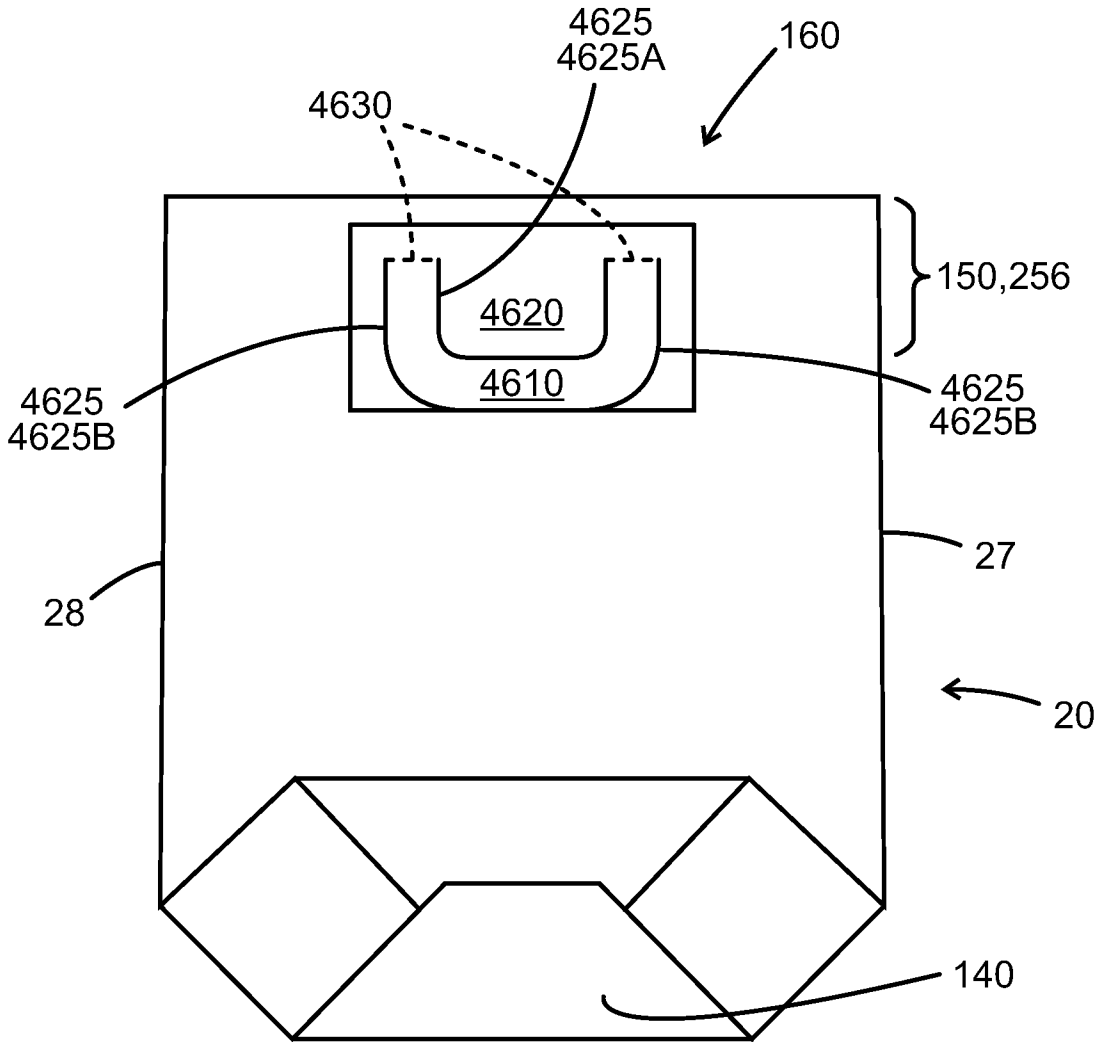

FIG. 18A

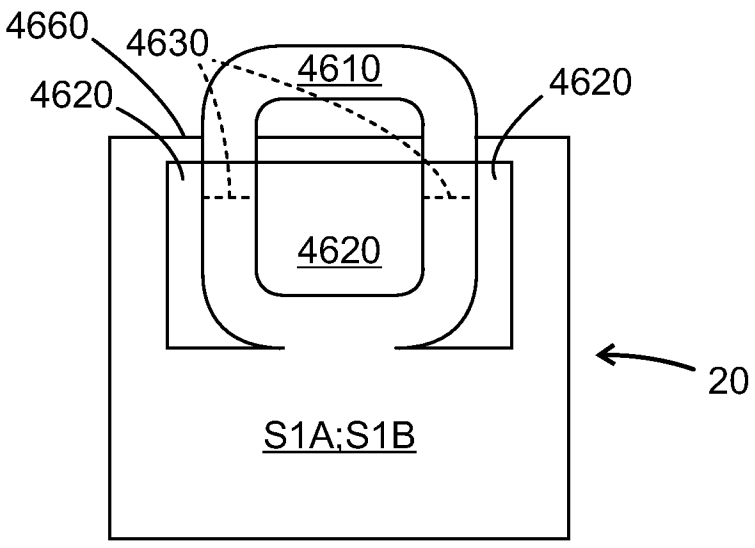

FIG. 18B

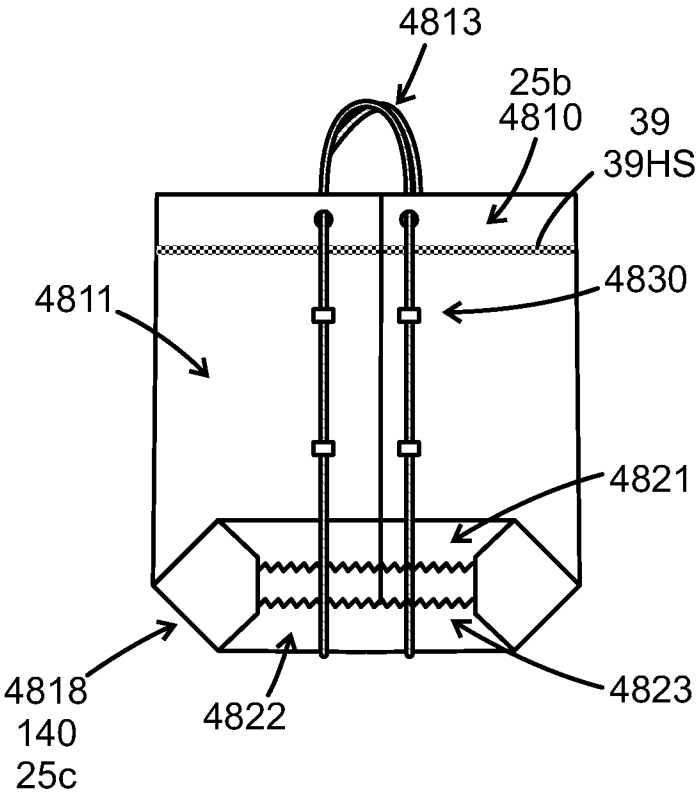

FIG. 18E

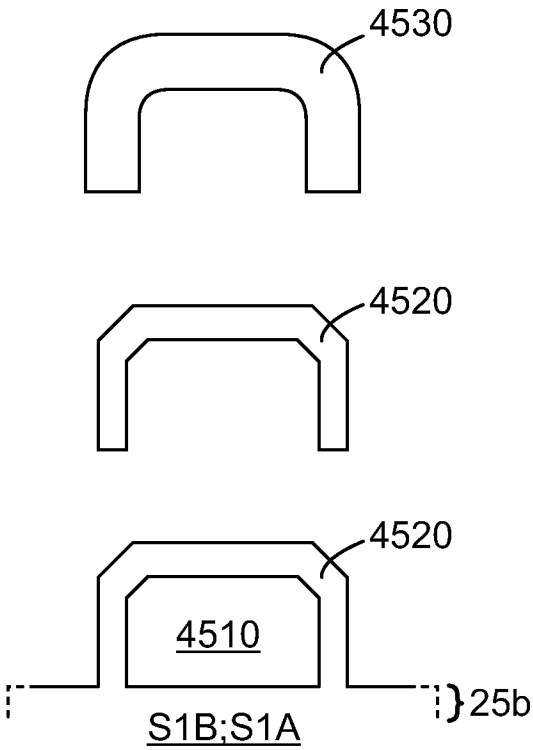

FIG. 18C

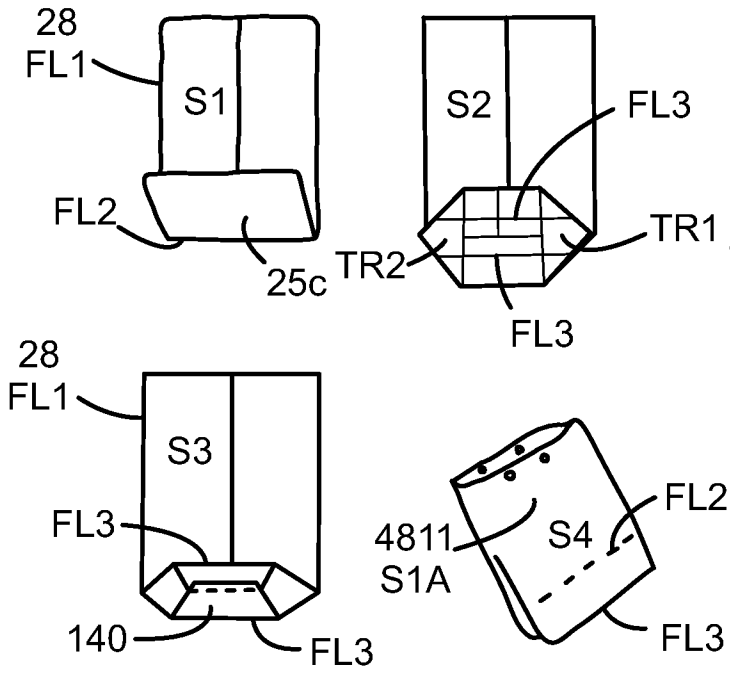

FIG. 18F

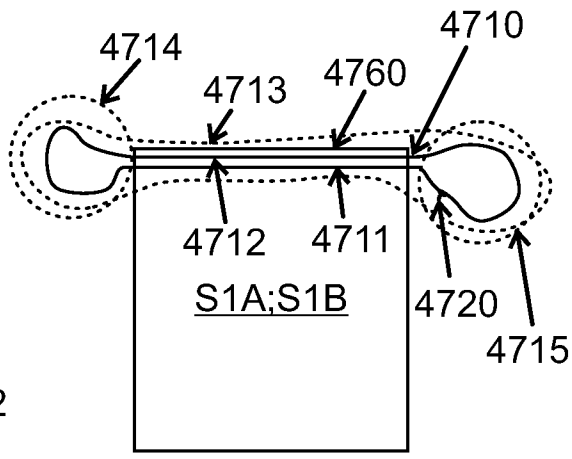

FIG. 18D

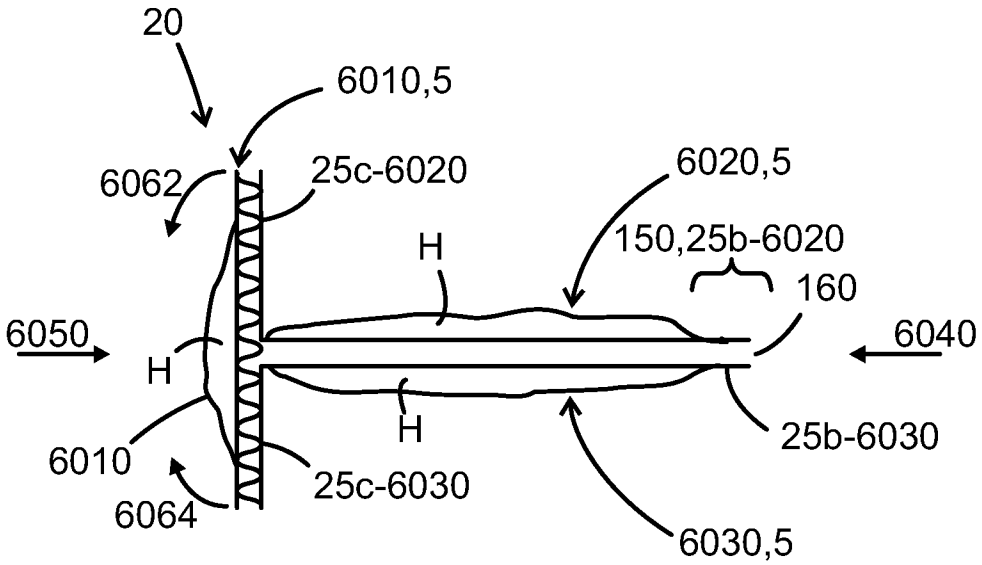

FIG. 18G

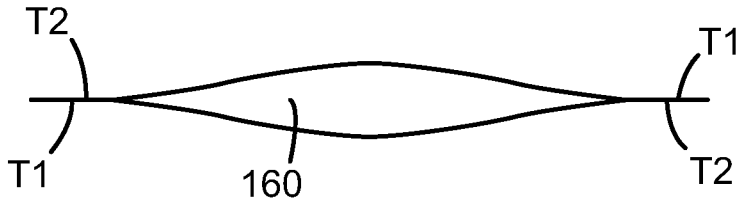

FIG. 18H

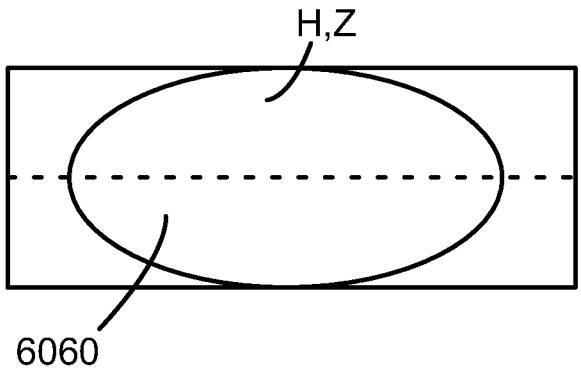

FIG. 18I

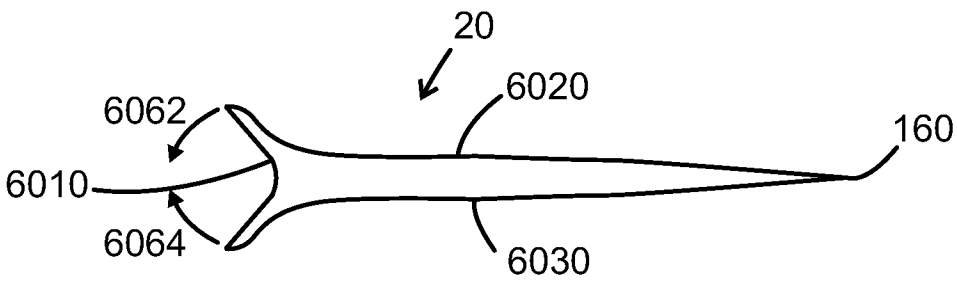

FIG. 18J

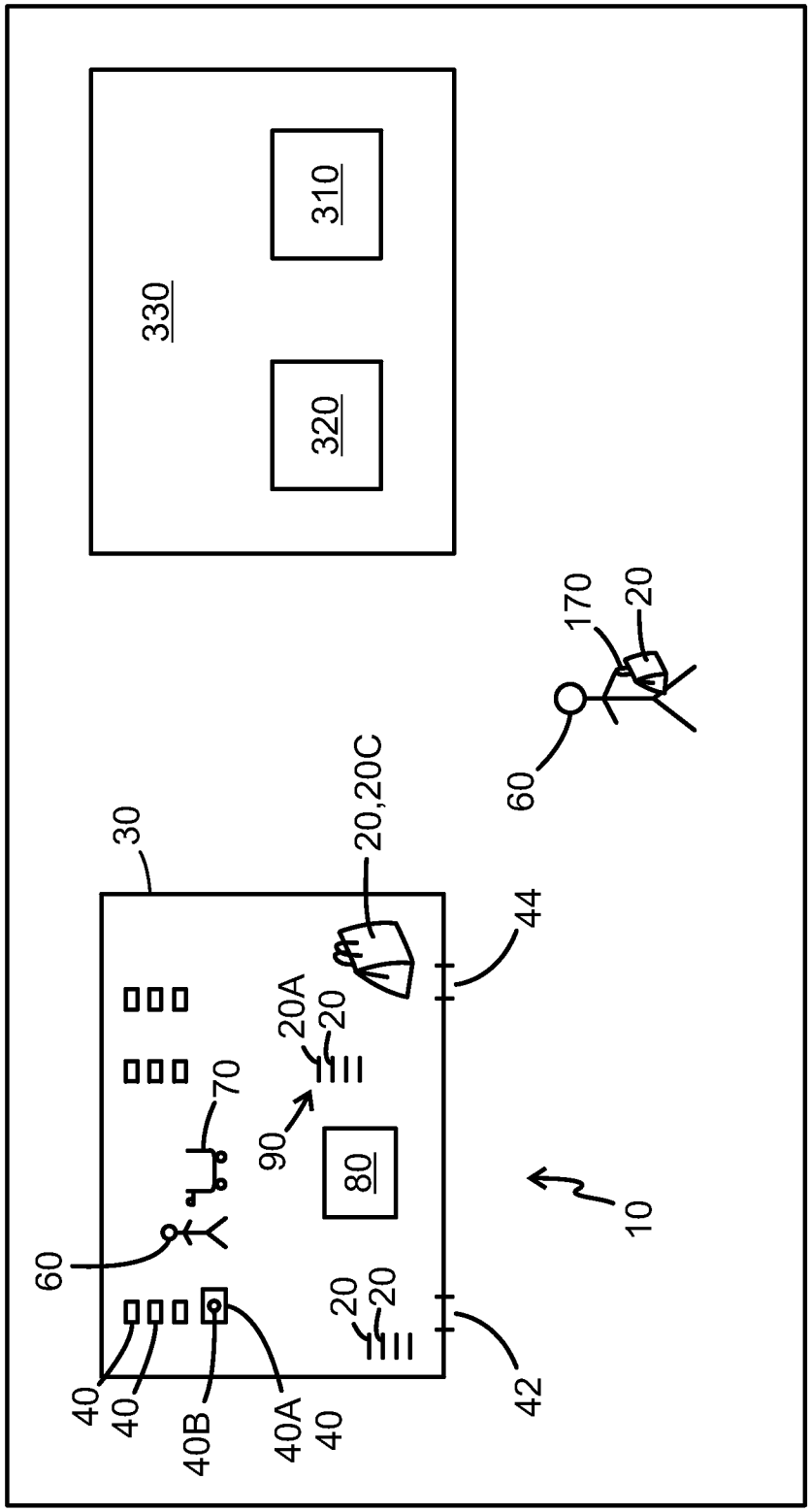
330
310
320
30
20,20C
44
20A
20
70
90
80
60
10
170
20
60
40
40
40B
40A
40
20
20
42

FIG. 19

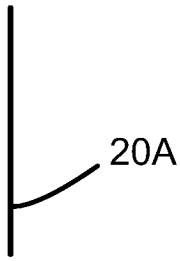

FIG. 20

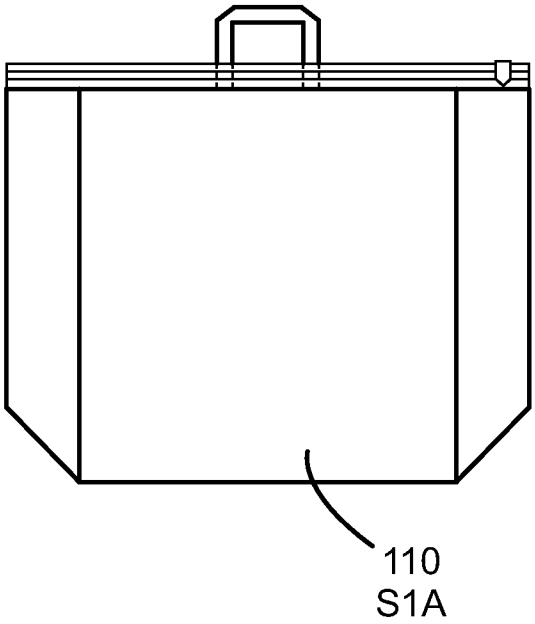

FIG. 21

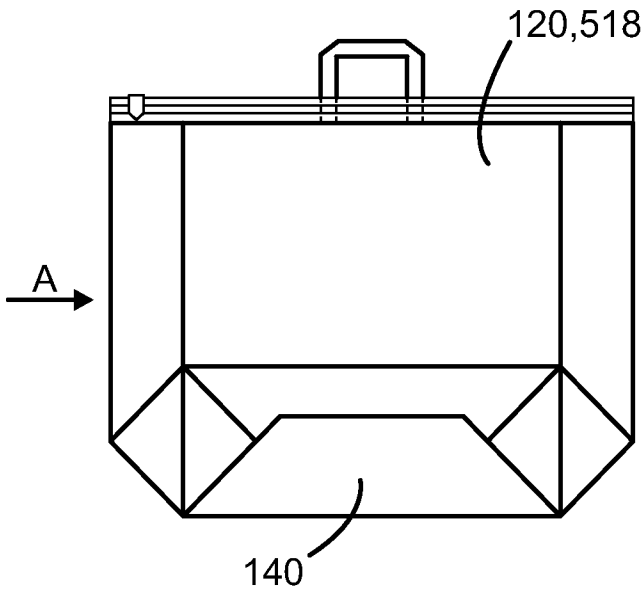

FIG. 22

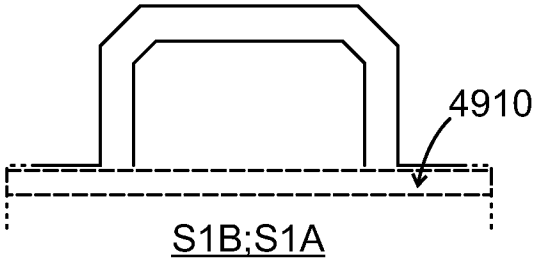

FIG. 22A

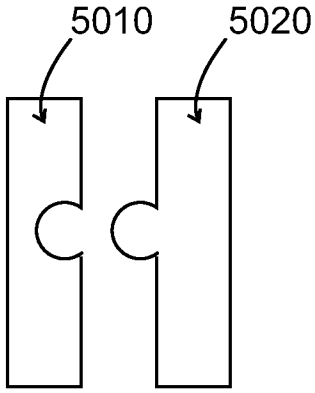

FIG. 22B

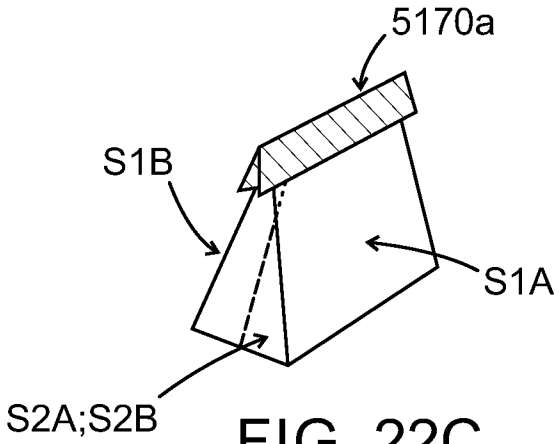

FIG. 22C

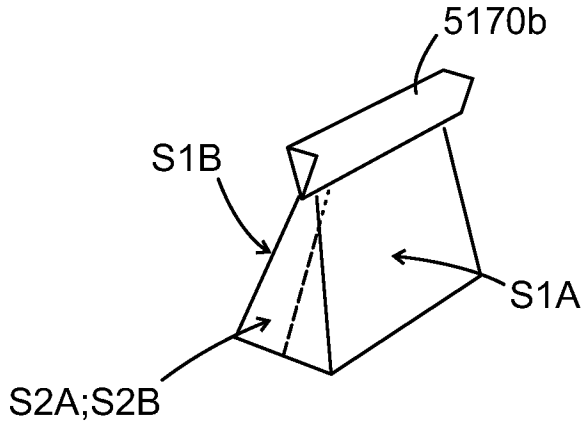

FIG. 22D

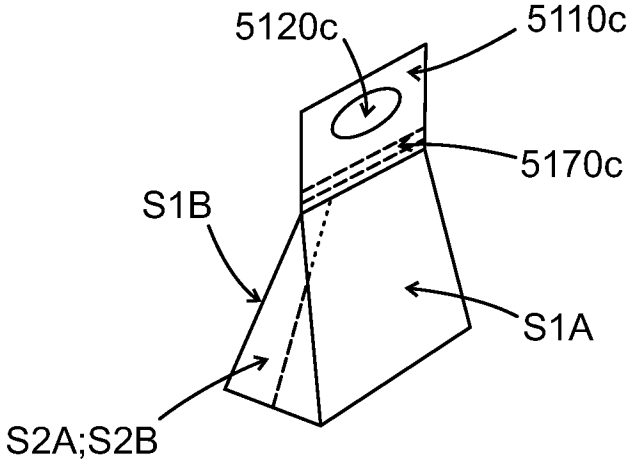

FIG. 22E

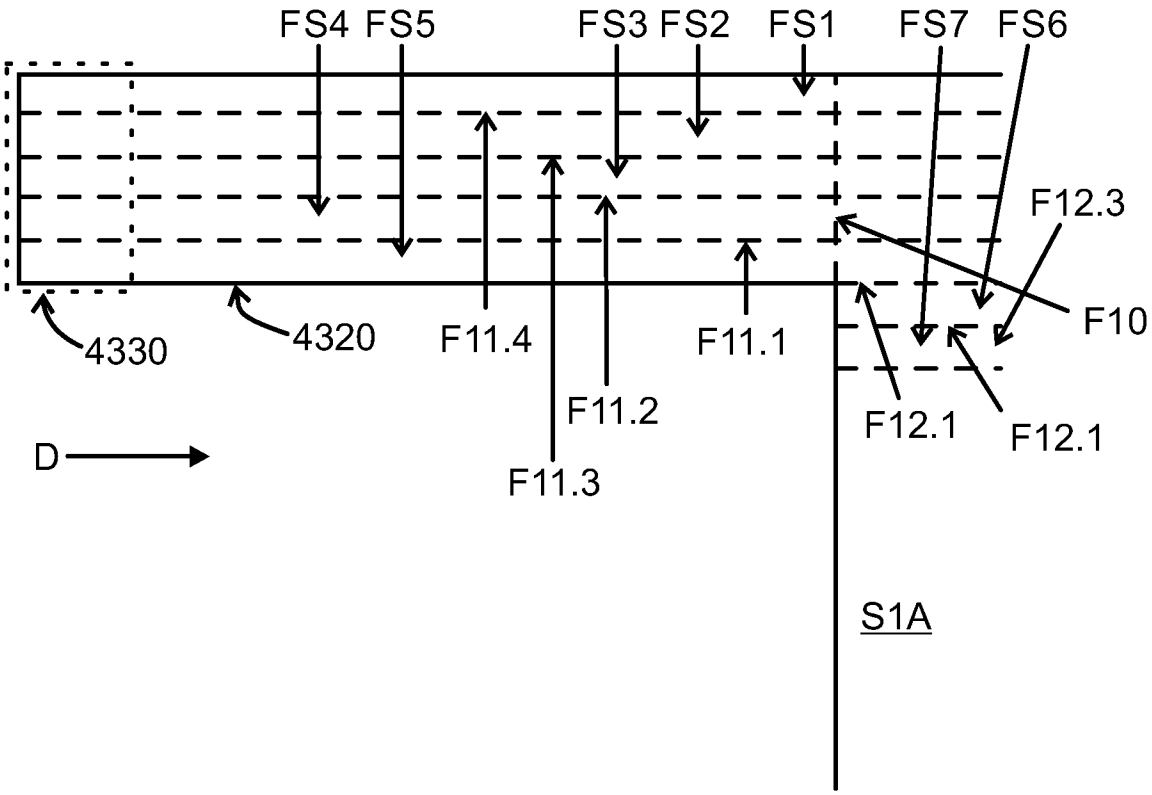

FIG. 22F

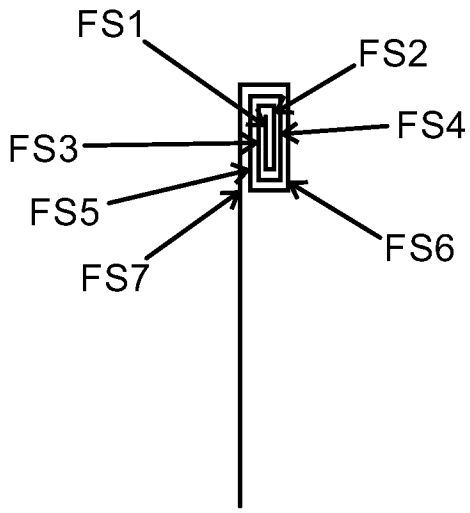

FIG. 22G


150
20A

FIG. 23

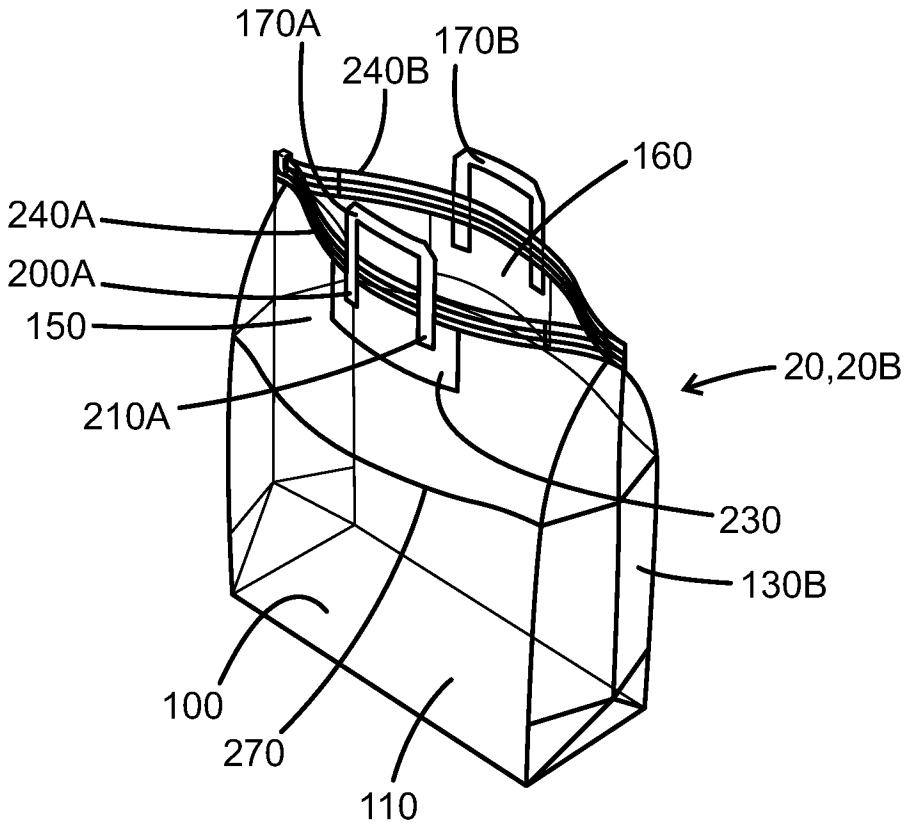
170A
240B
170B
160
240A
200A
150
20,20B
210A
230
130B
100
270
110

FIG. 24

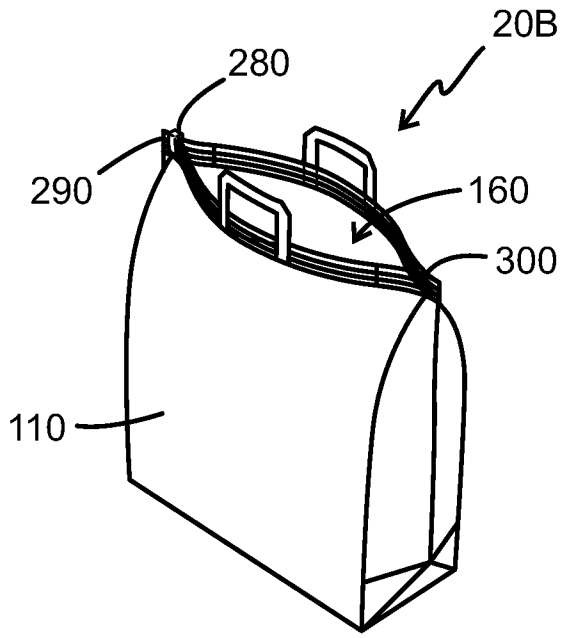

FIG. 25

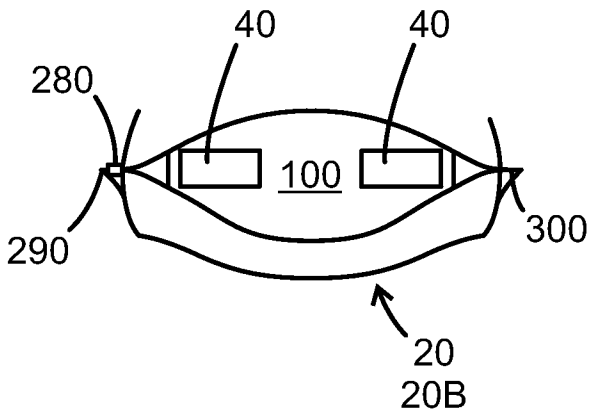

FIG. 26

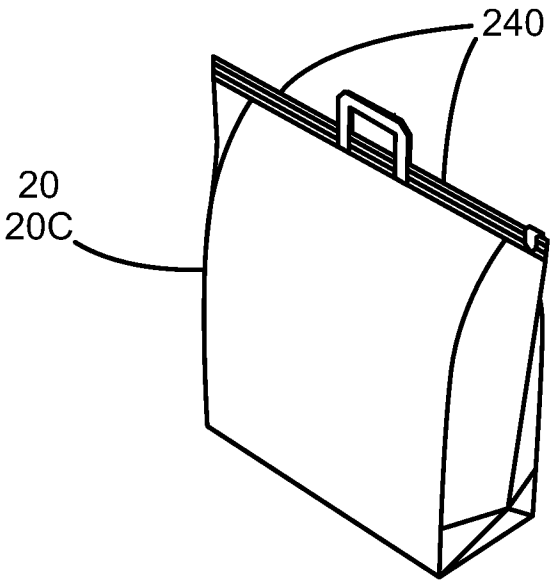

FIG. 27

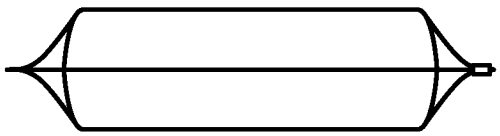

FIG. 28

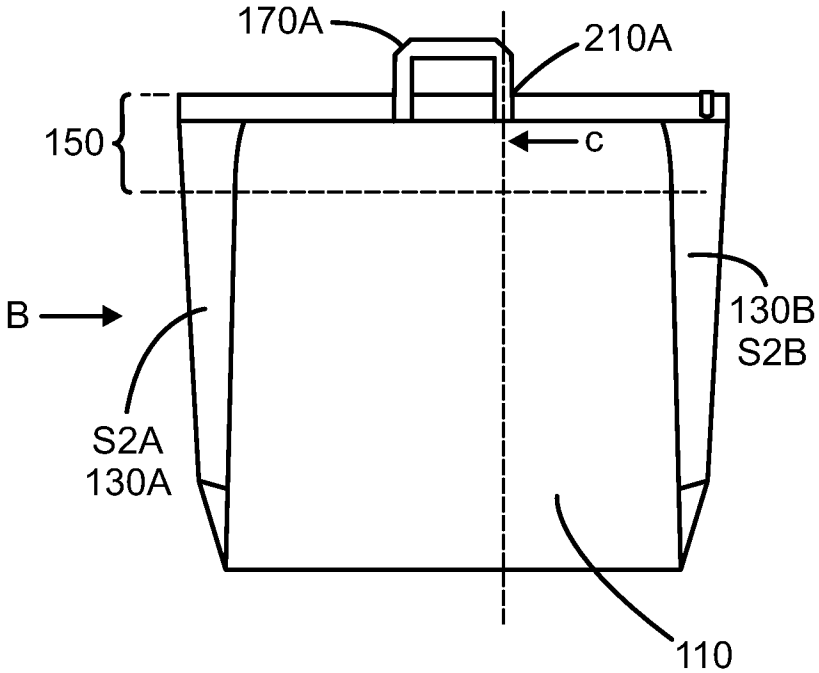

FIG. 29

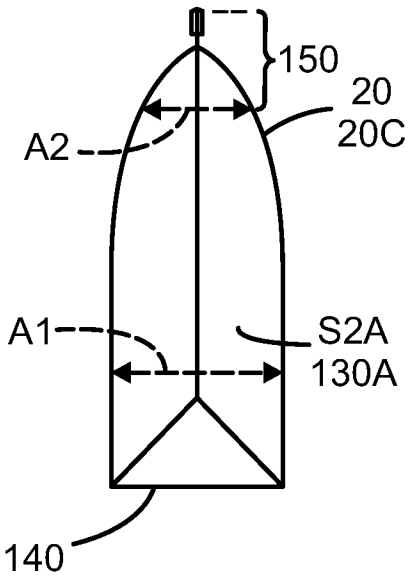

FIG. 30

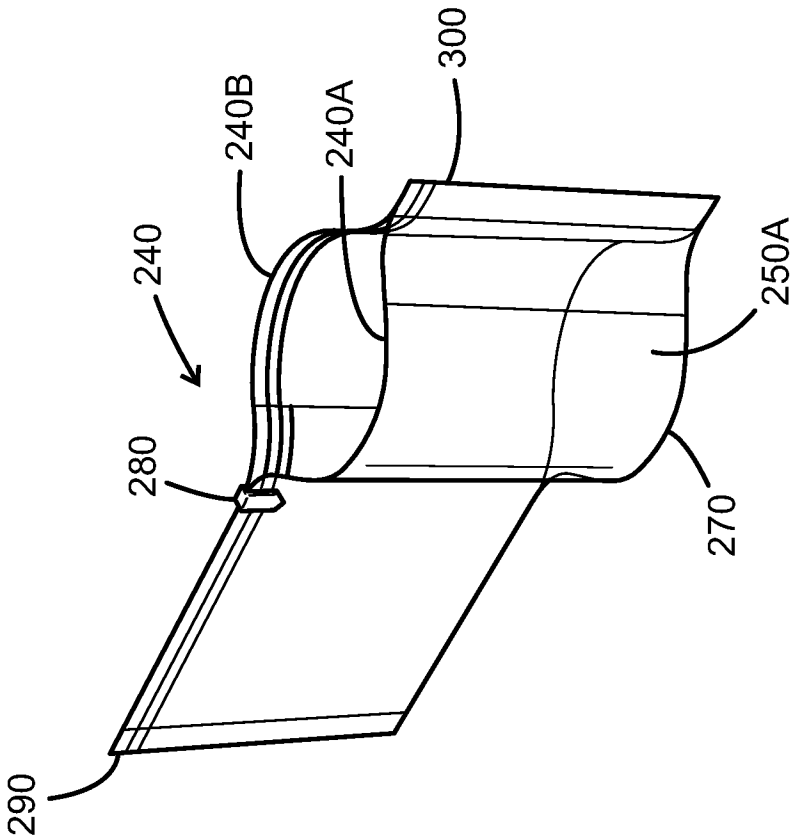

FIG. 31

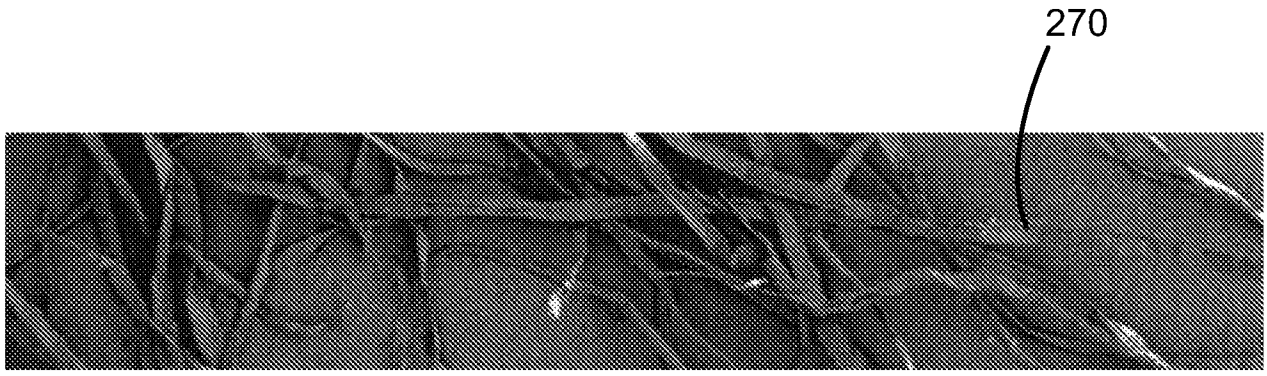

FIG. 32

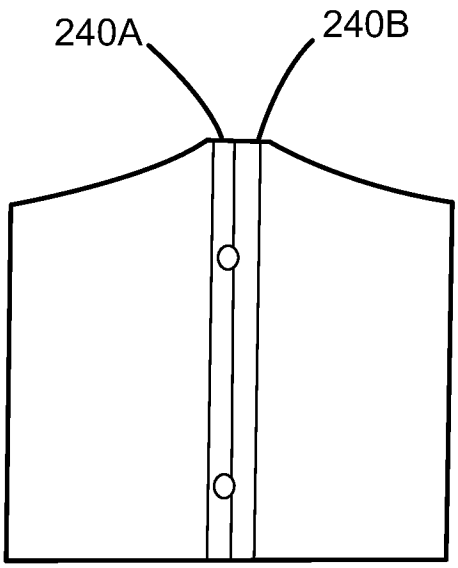

FIG. 33

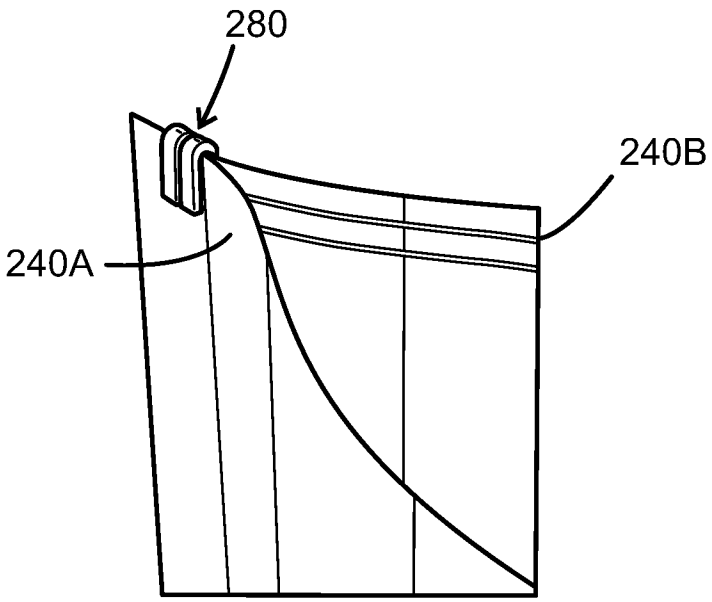

FIG. 34A

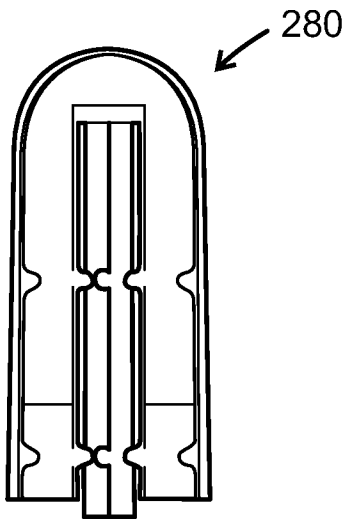

FIG. 34B

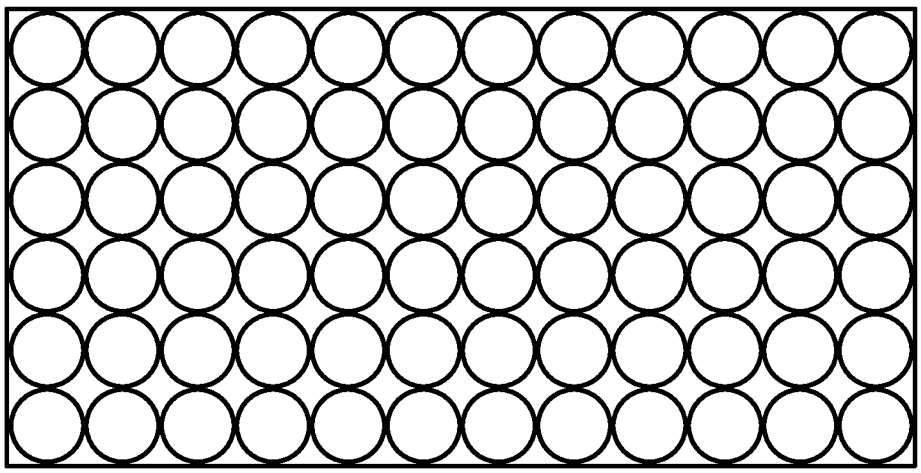

FIG. 35

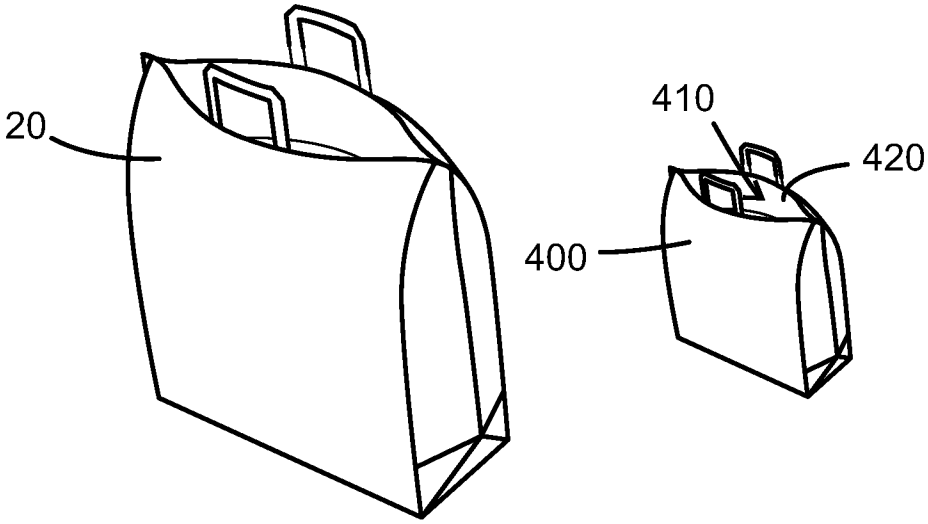

FIG. 36

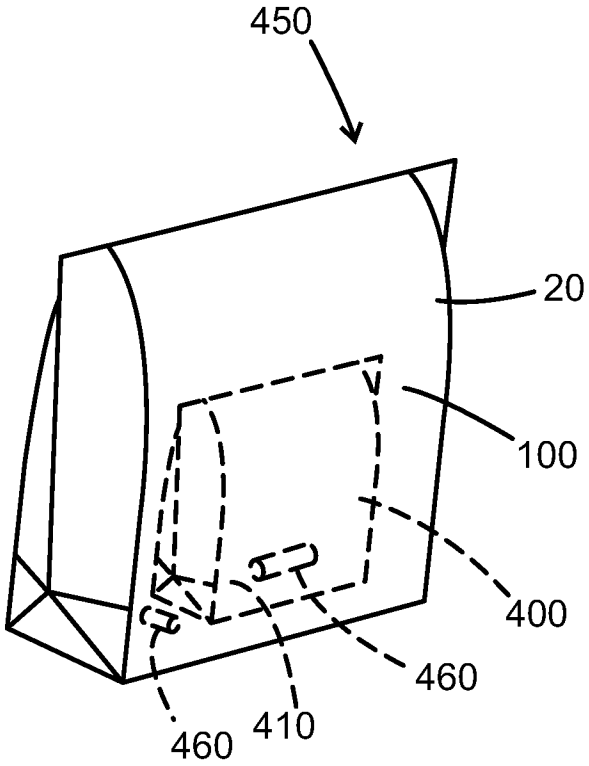

FIG. 37

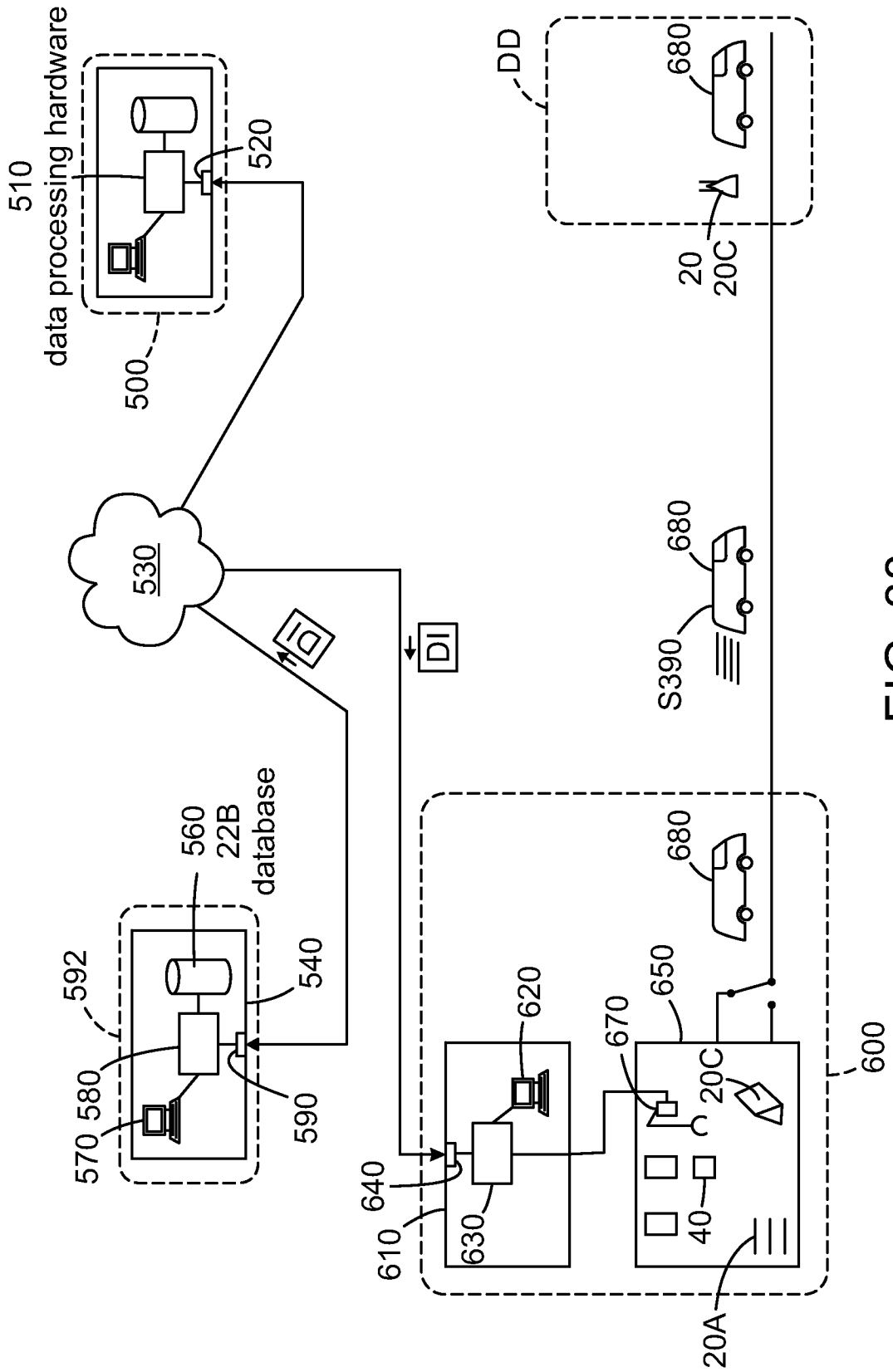
510
data processing hardware
520
500
530
DI
DD
680
20
20C
S390
560
22B
database
592
540
570
580
590
640
610
630
620
670
650
20C
40
20A
600

FIG. 38

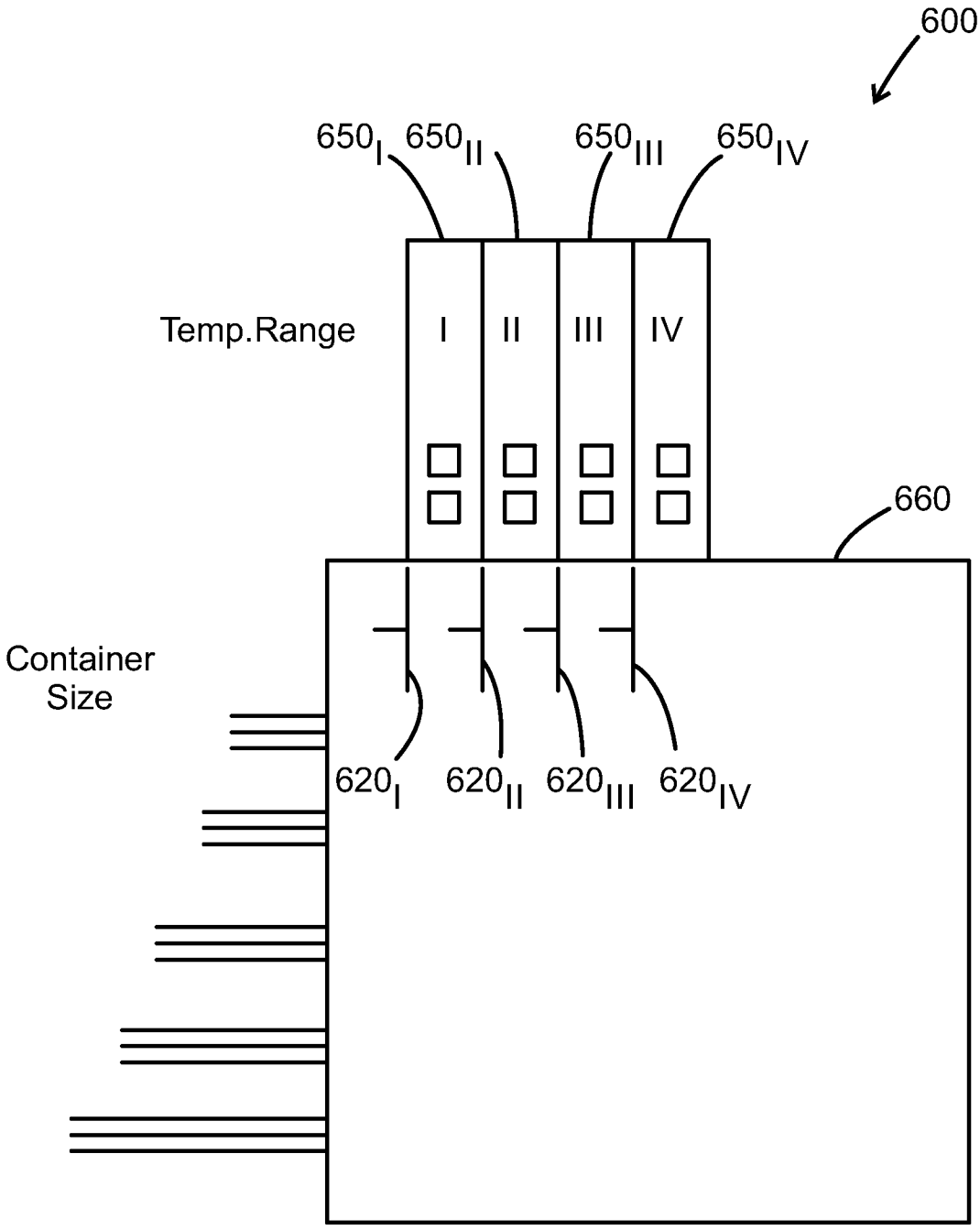
600
650I
650II
650III
650IV
Temp.Range
I
II
III
IV
660
Container Size
620I
620II
620III
620IV

FIG. 39

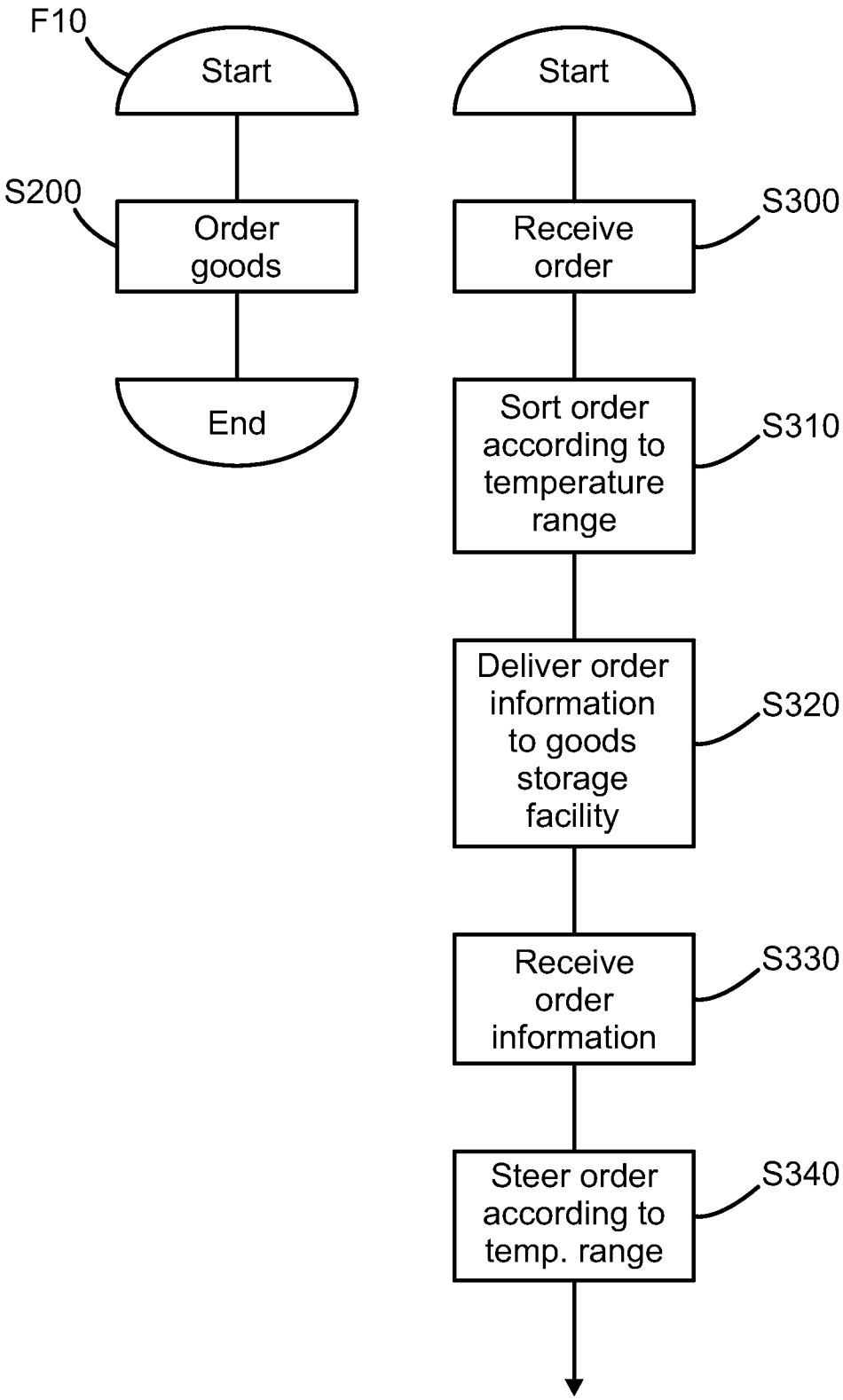
F10
Start
S200
Order goods
End
Start
S300
Receive order
Sort order according to temperature range
S310
Deliver order information to goods storage facility
S320
Receive order information
S330
Steer order according to temp. range
S340

FIG. 40A

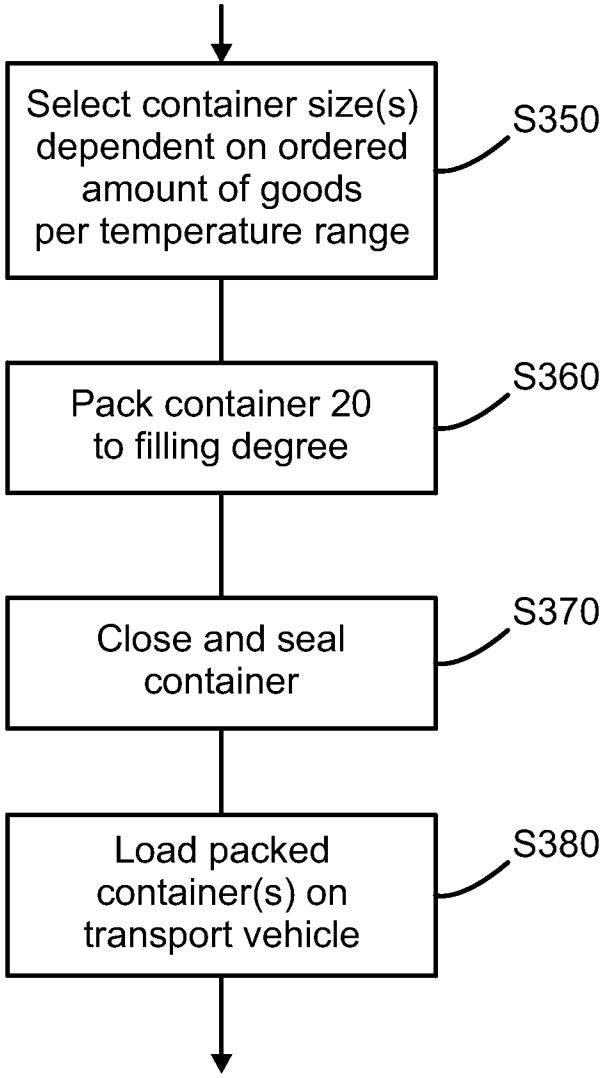

FIG. 40B

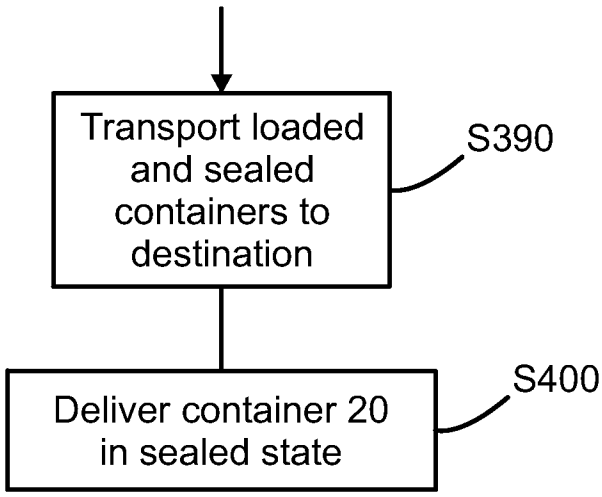

FIG. 40C

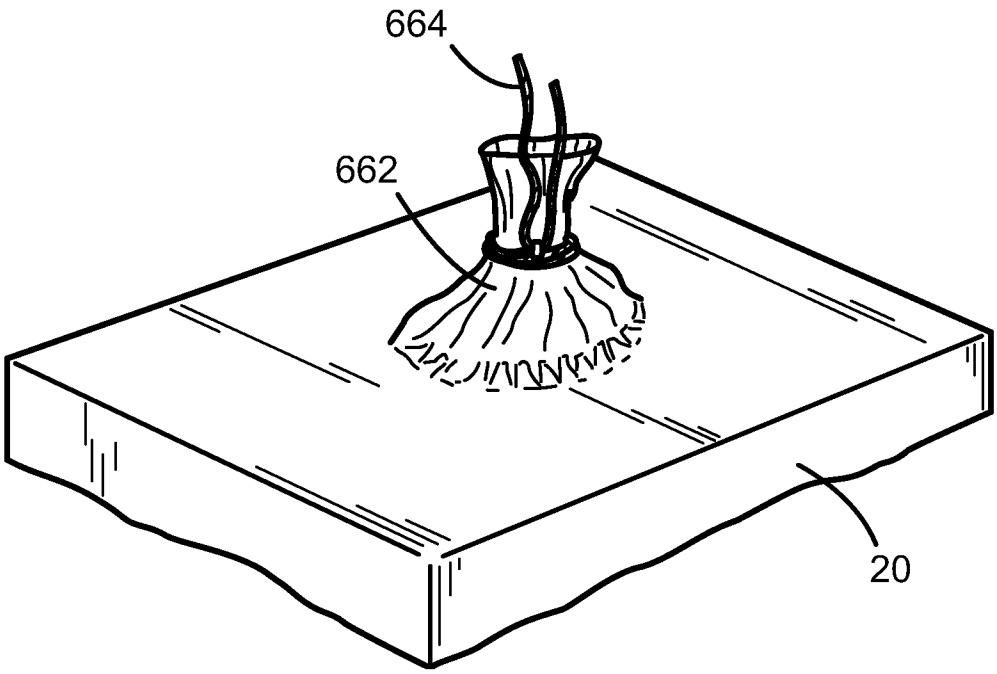

FIG. 41

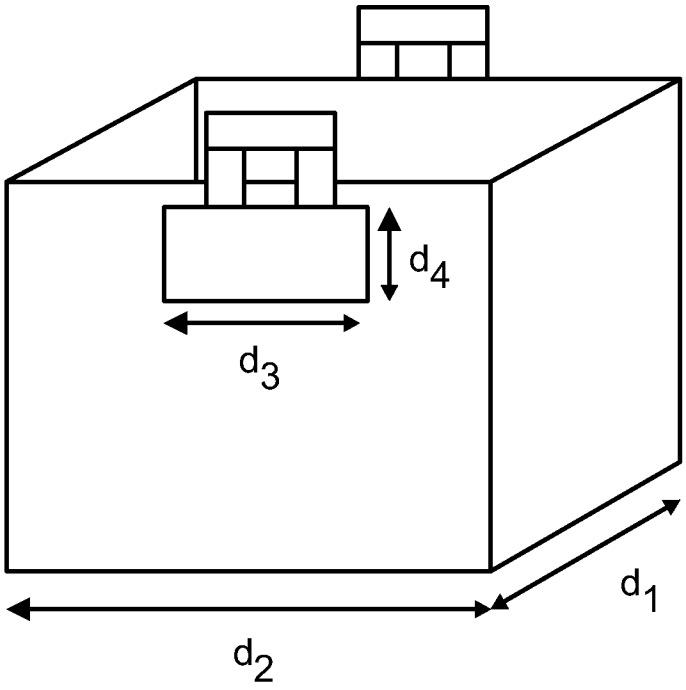

FIG. 41A

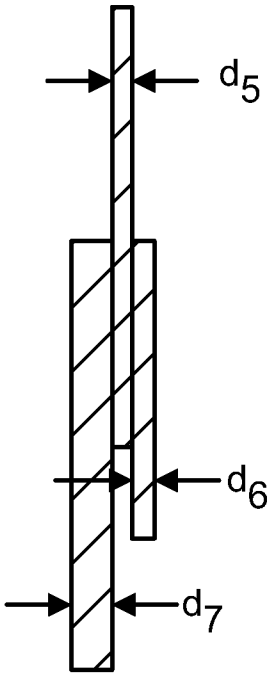

FIG. 41B

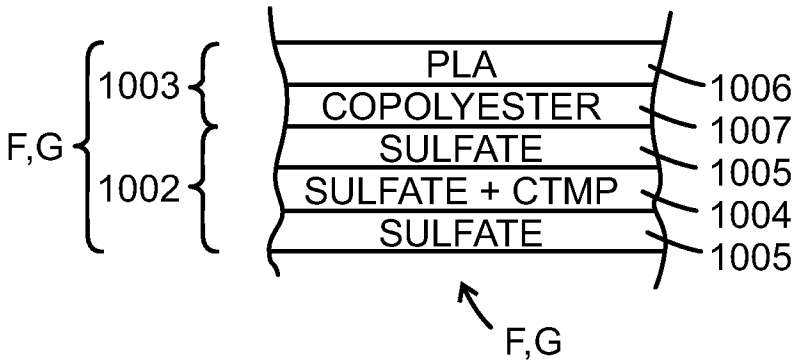

FIG. 41C

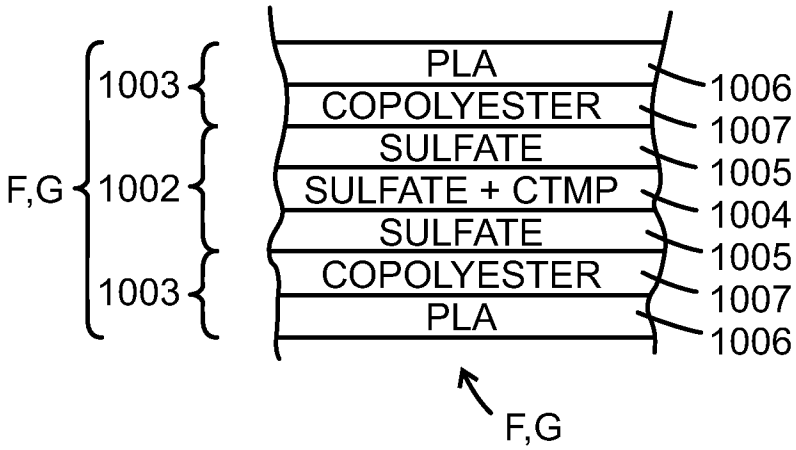

FIG. 41D

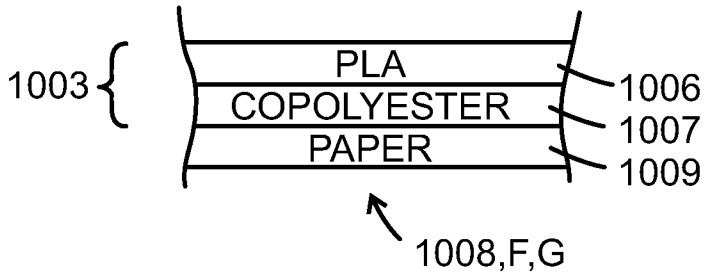

FIG. 41E

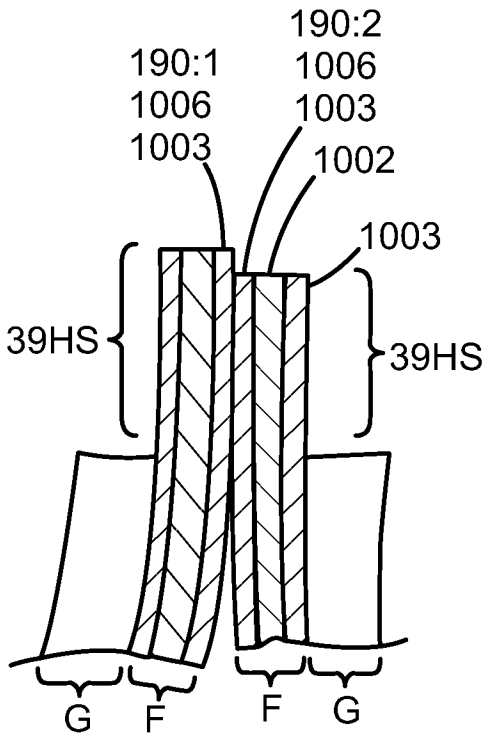

FIG. 41F

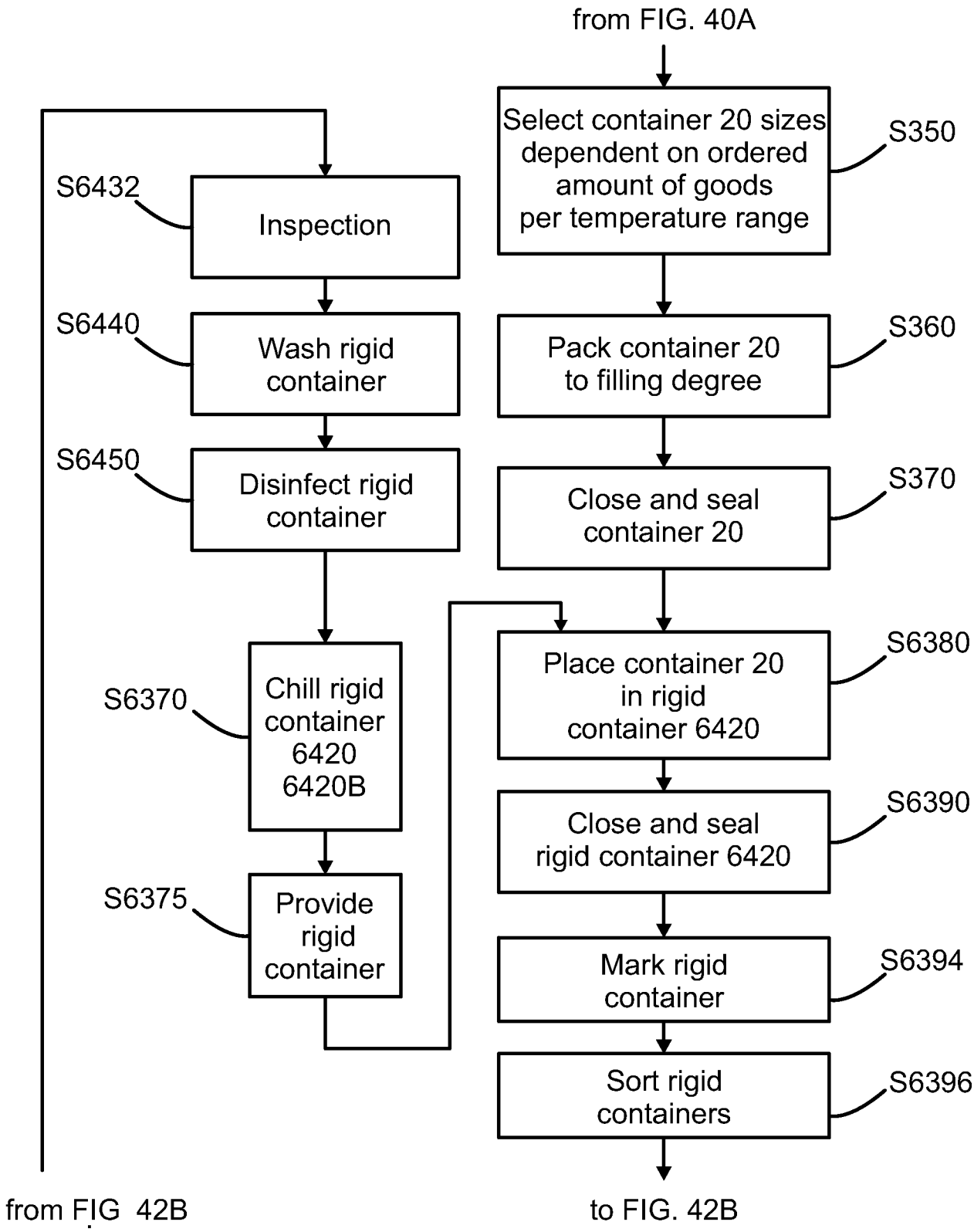
from FIG. 40A
Select container 20 sizes dependent on ordered amount of goods per temperature range
S350
Pack container 20 to filling degree
S360
Close and seal container 20
S370
Place container 20 in rigid container 6420
S6380
Close and seal rigid container 6420
S6390
Mark rigid container
S6394
Sort rigid containers
S6396
to FIG. 42B
from FIG 42B
S6432
Inspection
S6440
Wash rigid container
S6450
Disinfect rigid container
S6370
Chill rigid container 6420 6420B
S6375
Provide rigid container

FIG. 42A

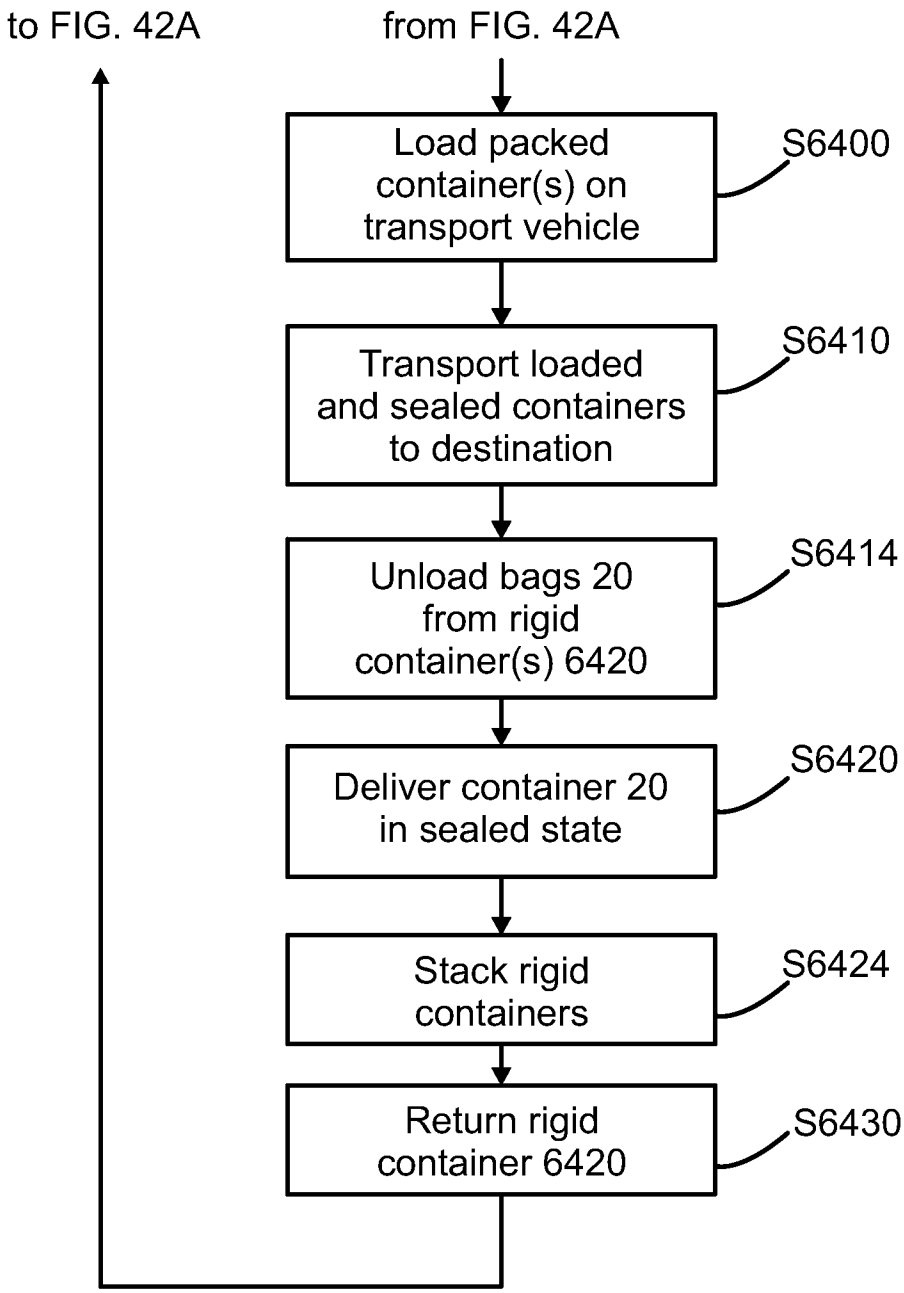
to FIG. 42A
from FIG. 42A
Load packed container(s) on transport vehicle
S6400
Transport loaded and sealed containers to destination
S6410
Unload bags 20 from rigid container(s) 6420
S6414
Deliver container 20 in sealed state
S6420
Stack rigid containers
S6424
Return rigid container 6420
S6430

FIG. 42B

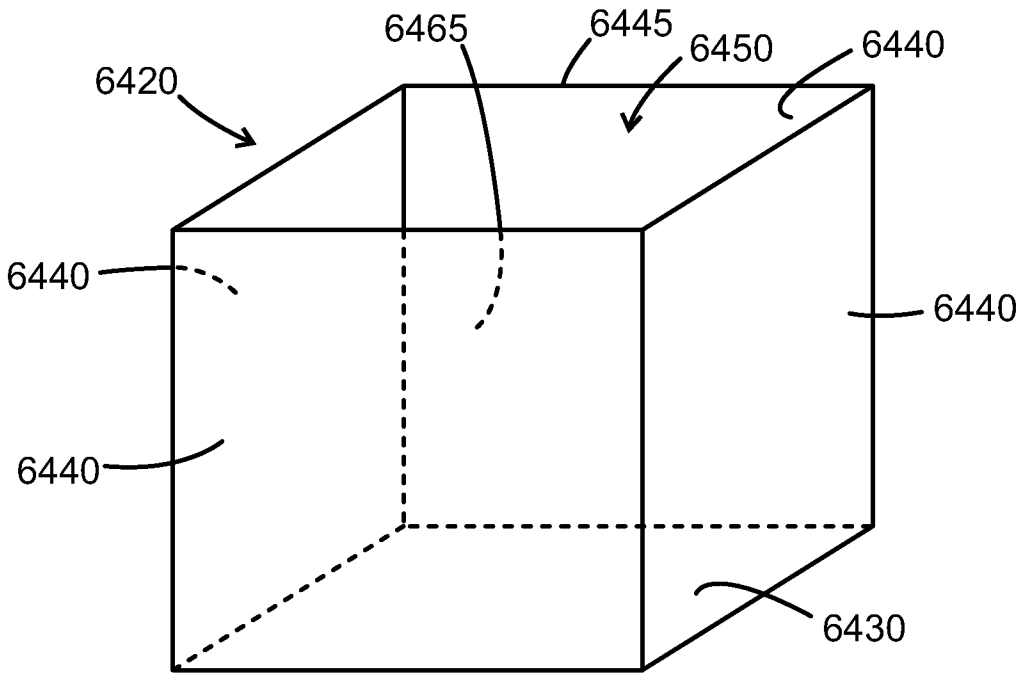

FIG. 43

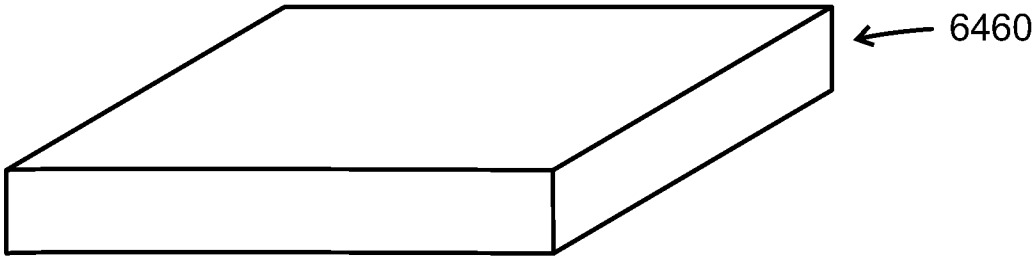

FIG. 44A

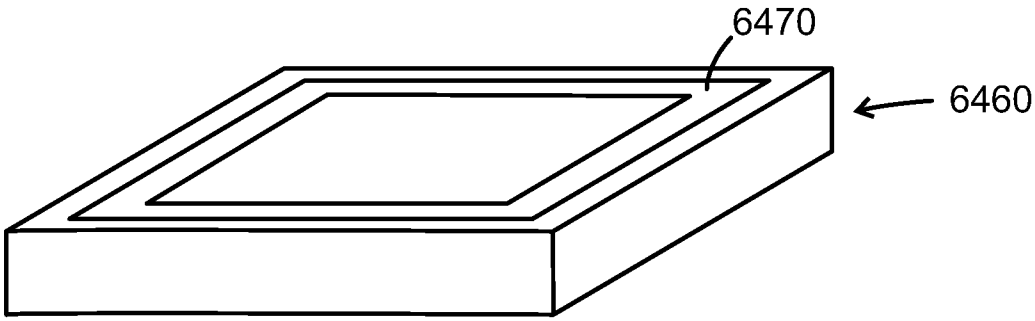

FIG. 44B

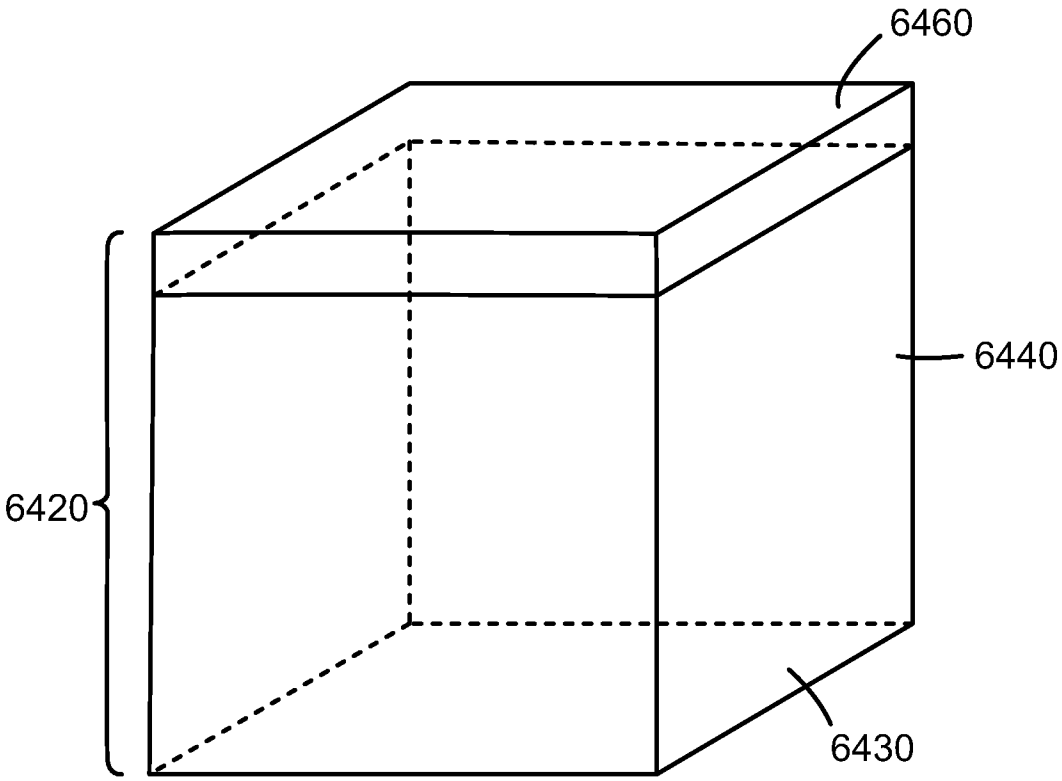

FIG. 45

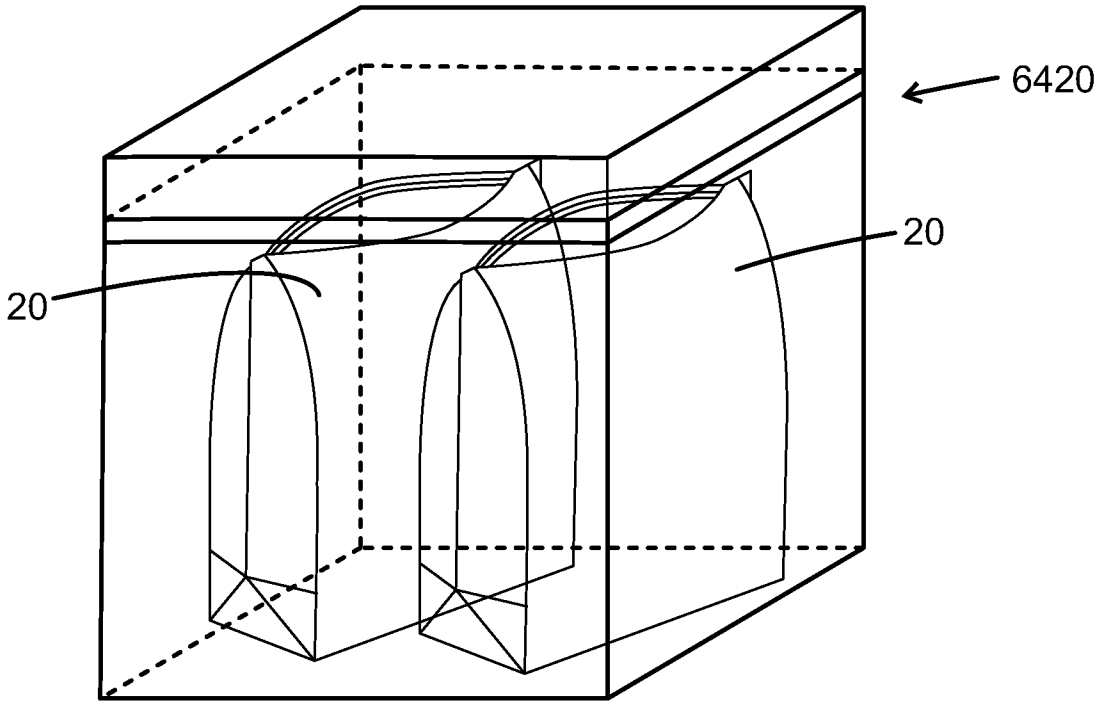
6420
20
20

FIG. 46

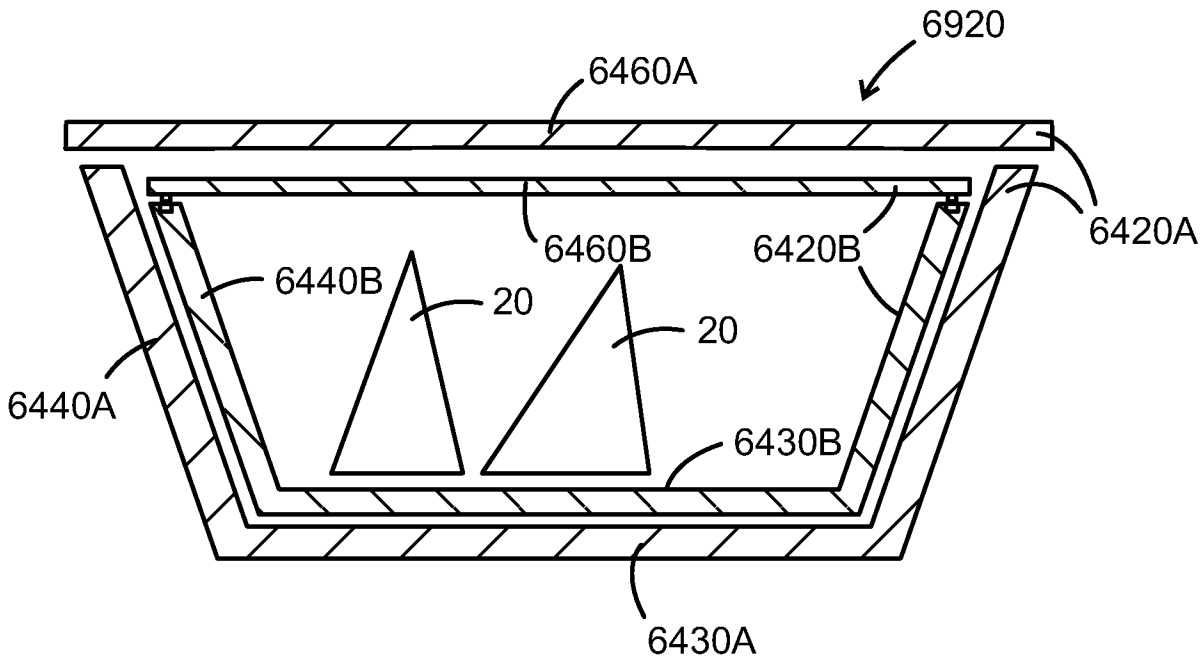
6920
6460A
6420A
6460B
6420B
6440B
20
20
6440A
6430B
6430A

FIG. 47

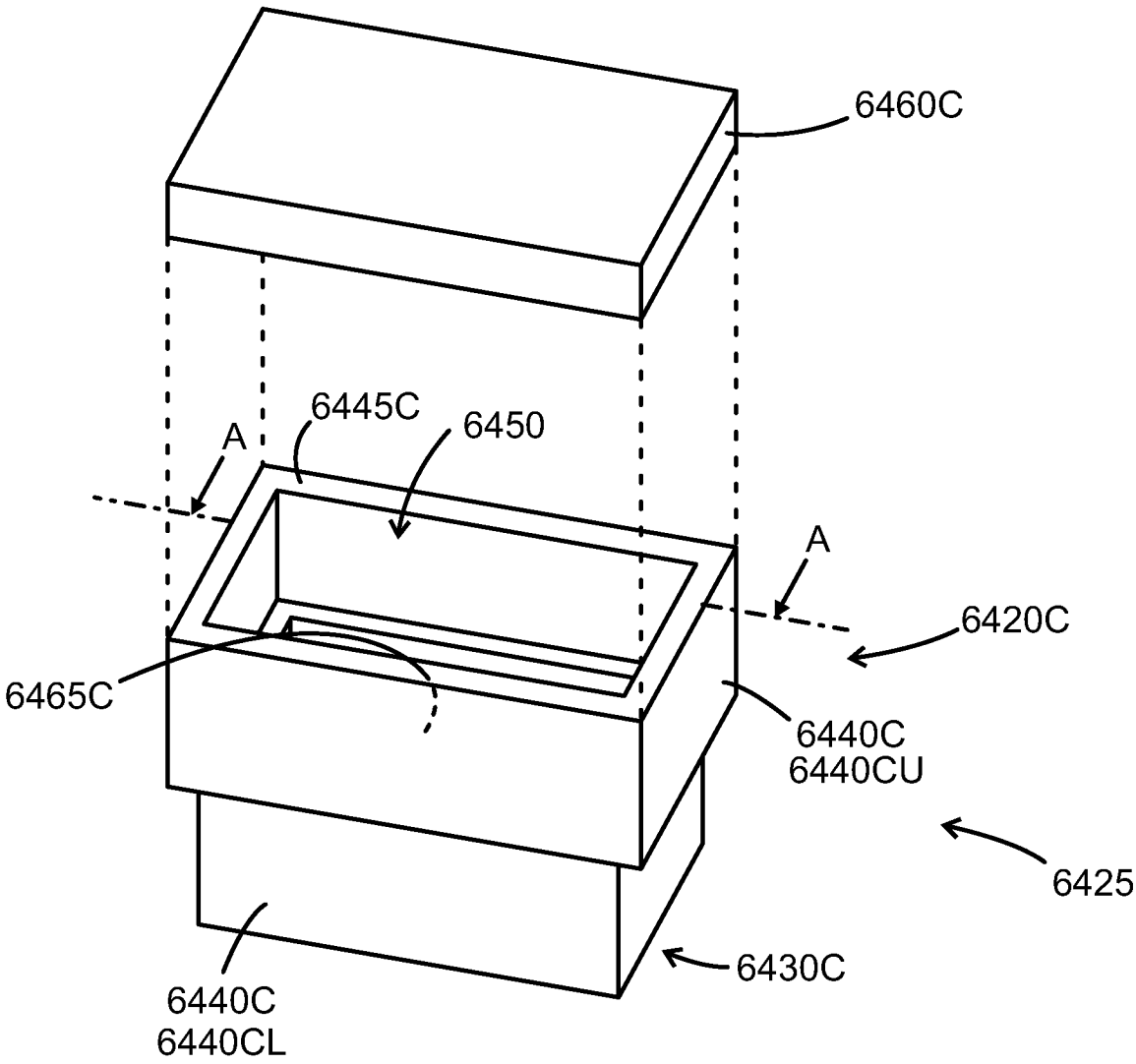
6460C
6445C
6450
A
A
6420C
6465C
6440C
6440CU
6425
6430C
6440C
6440CL

FIG. 48

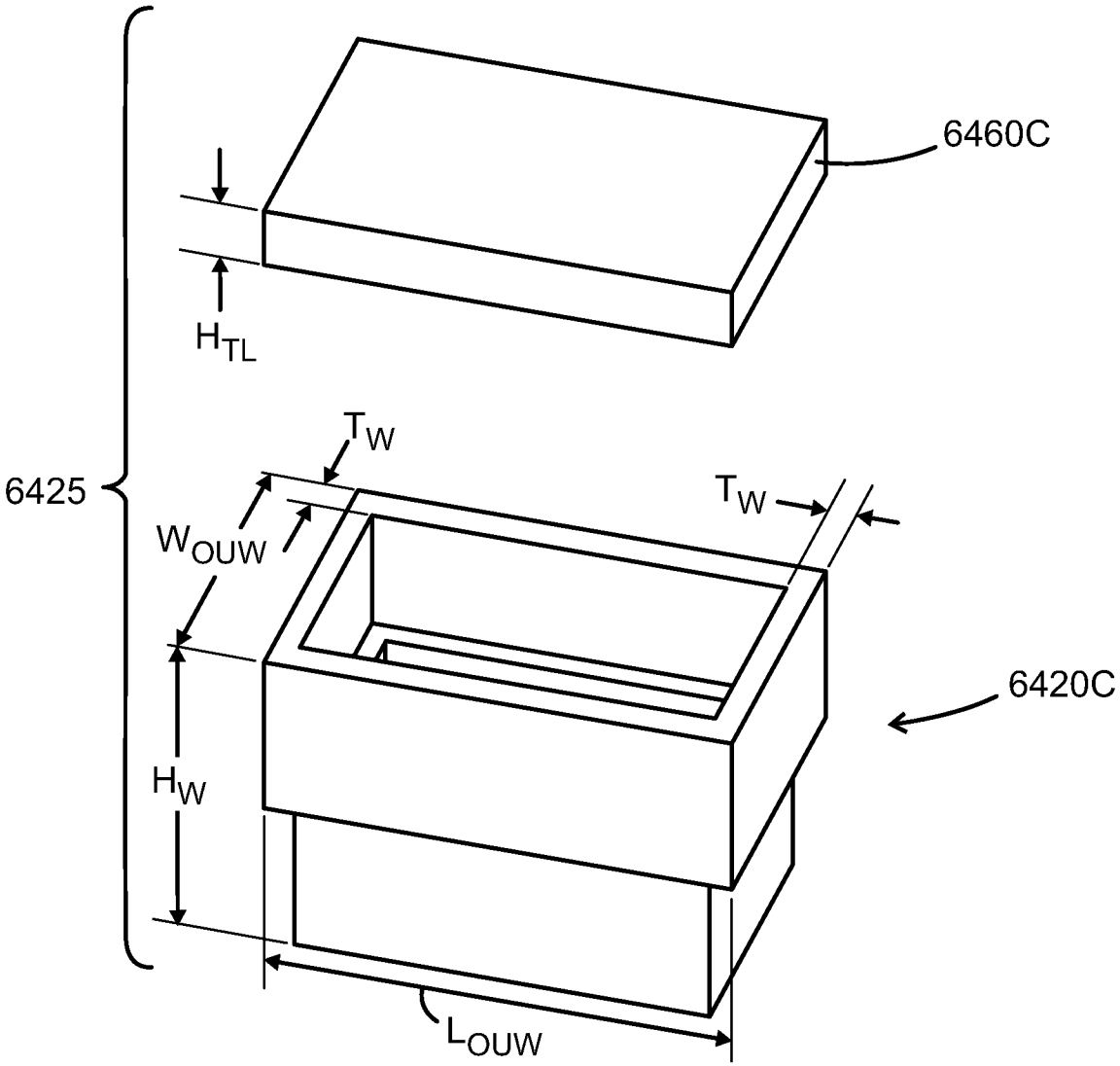

FIG. 49

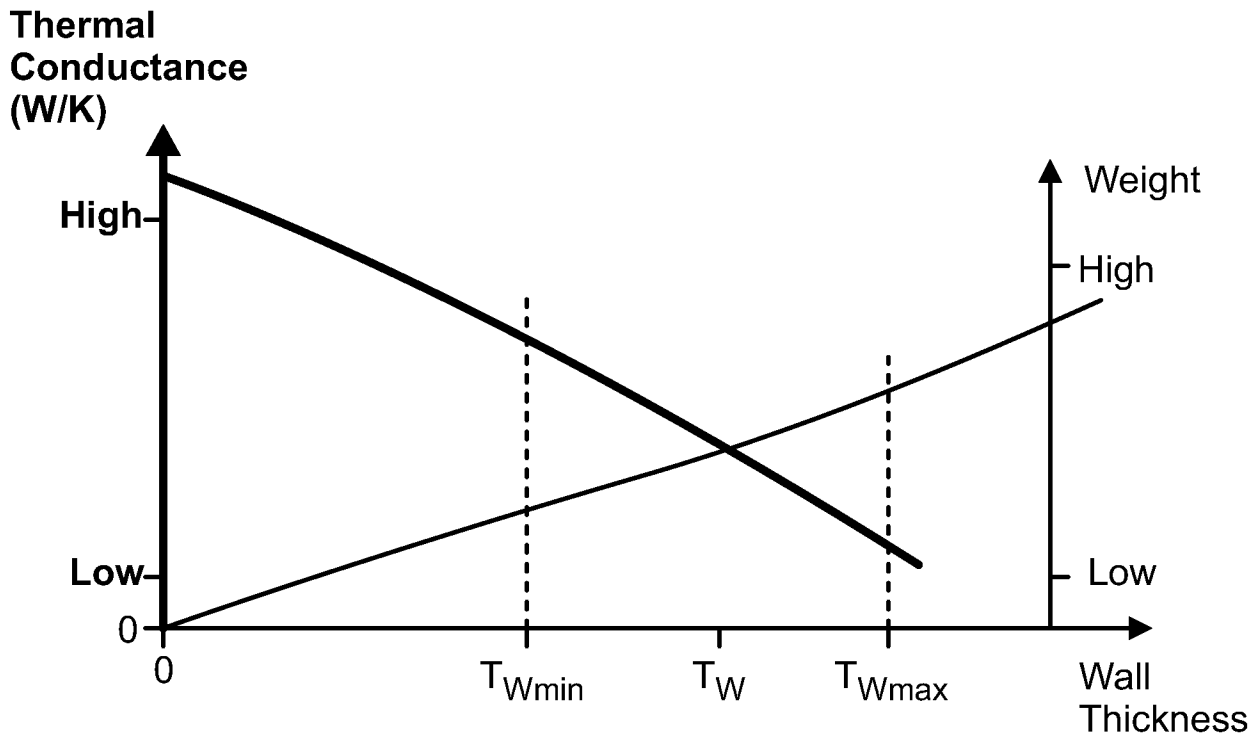
Thermal
Conductance
(W/K)
High
Low
0
0
T_{Wmin}
T_W
T_{Wmax}
Wall
Thickness
Weight
High
Low

FIG. 50

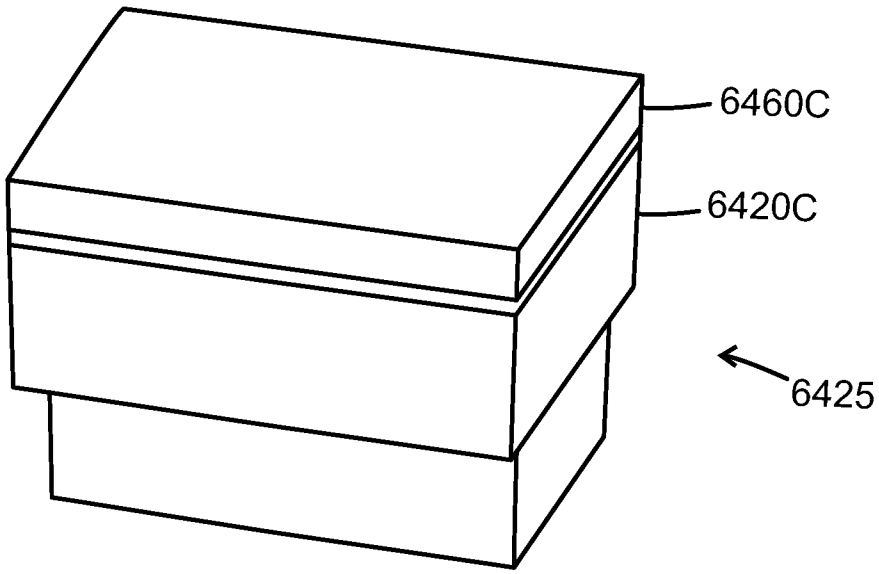
6460C
6420C
6425

FIG. 51

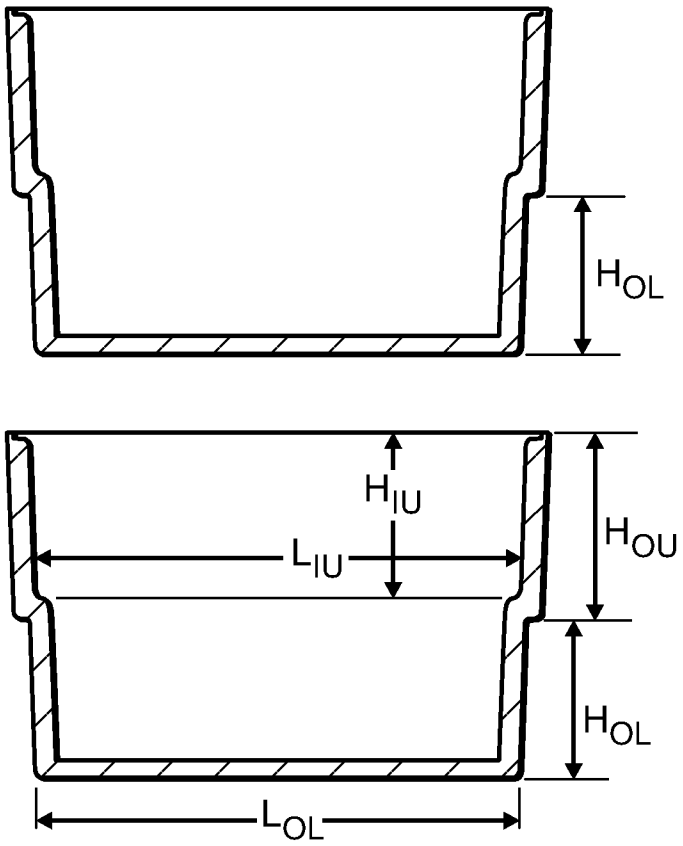

FIG. 52

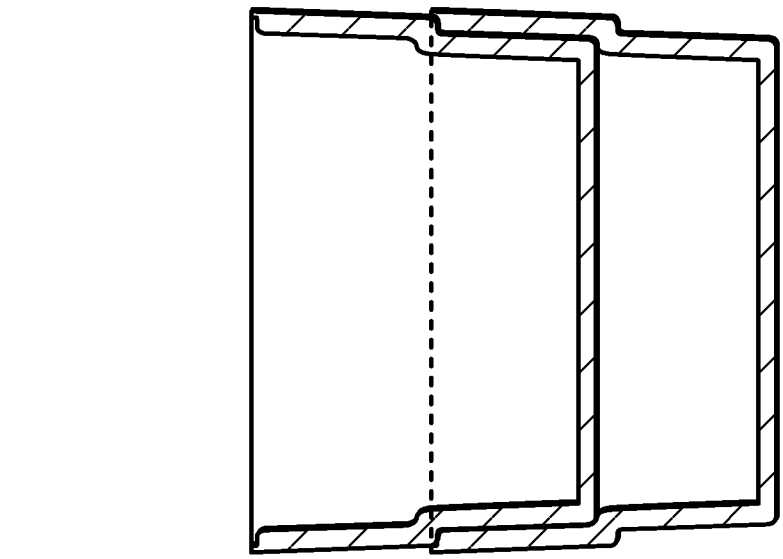

FIG. 53C

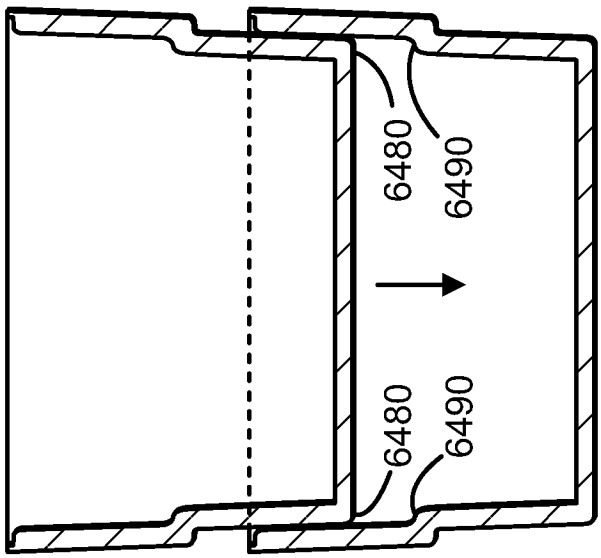

FIG. 53B

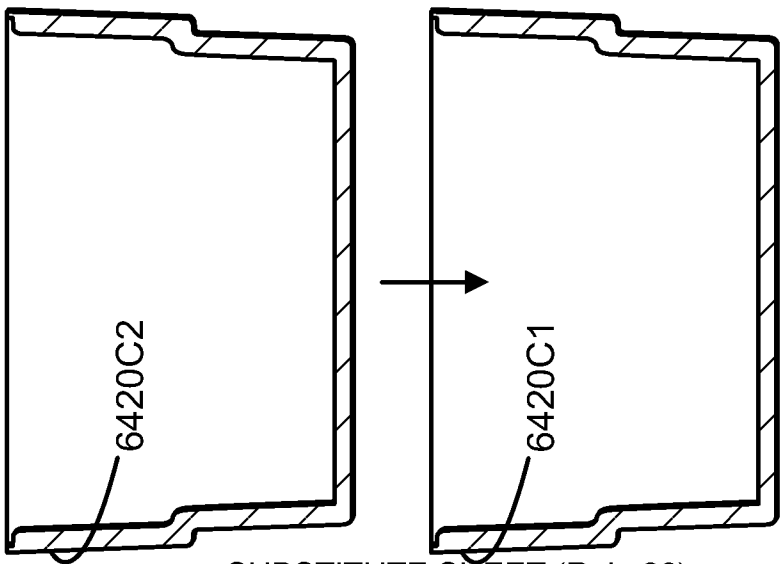

FIG. 53A

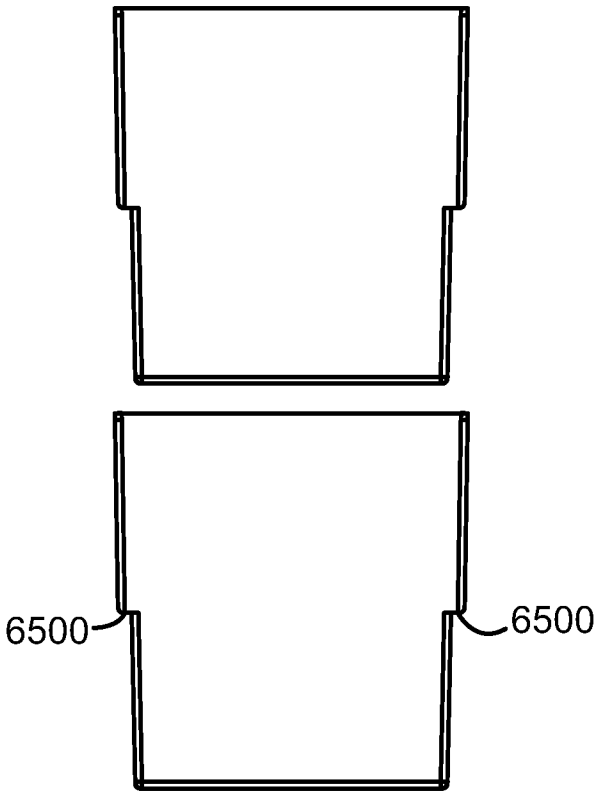

FIG. 54A

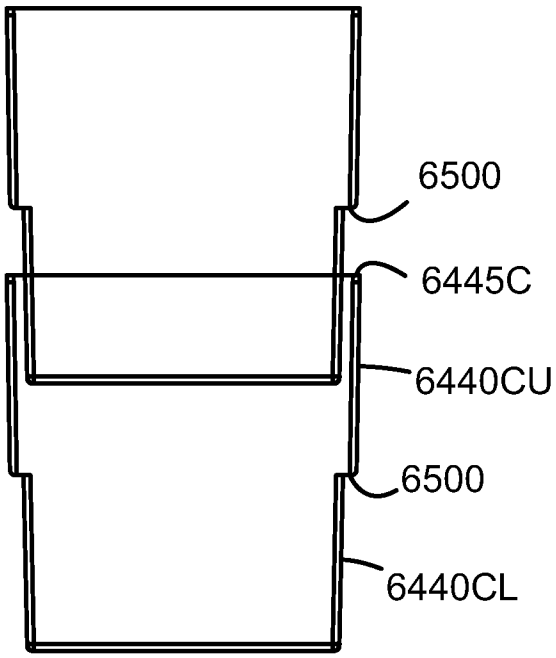

FIG. 54B

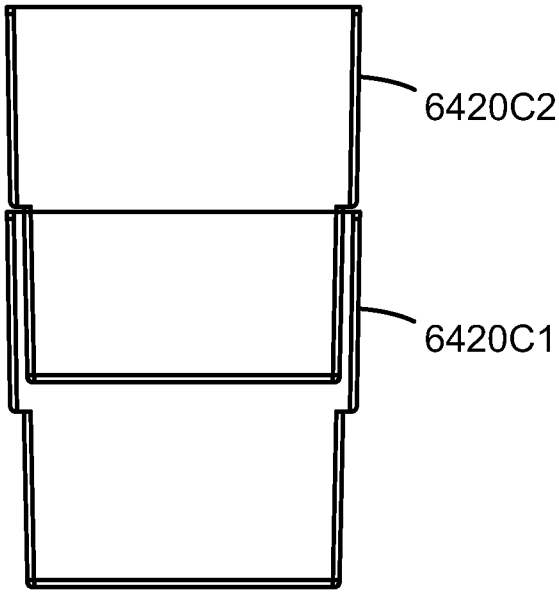

FIG. 54C

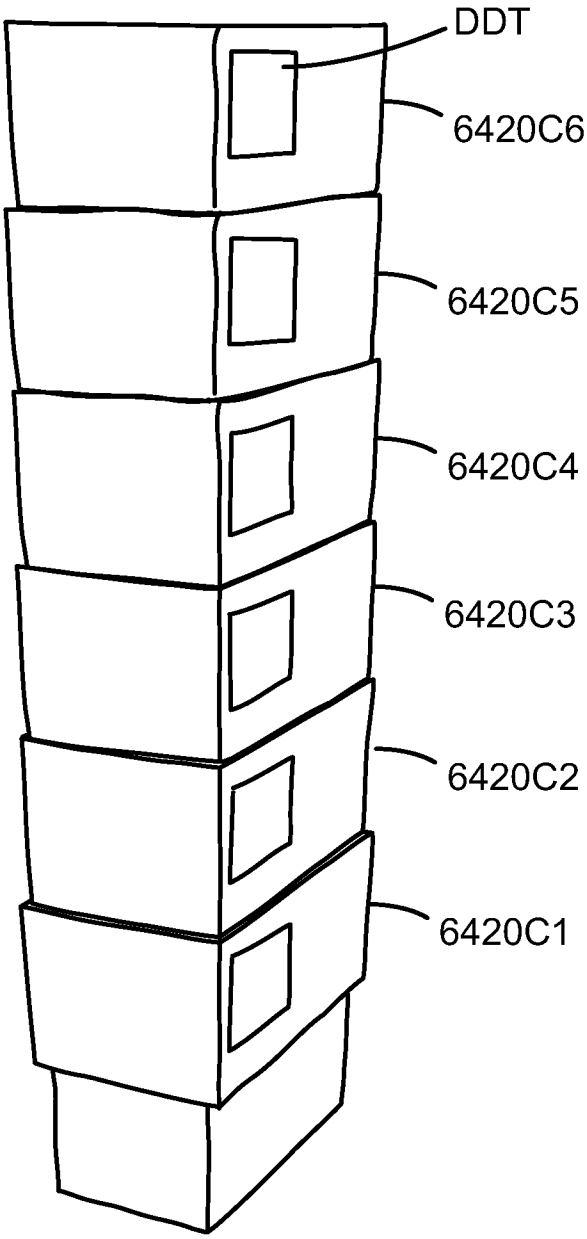
DDT
6420C6
6420C5
6420C4
6420C3
6420C2
6420C1

FIG. 55

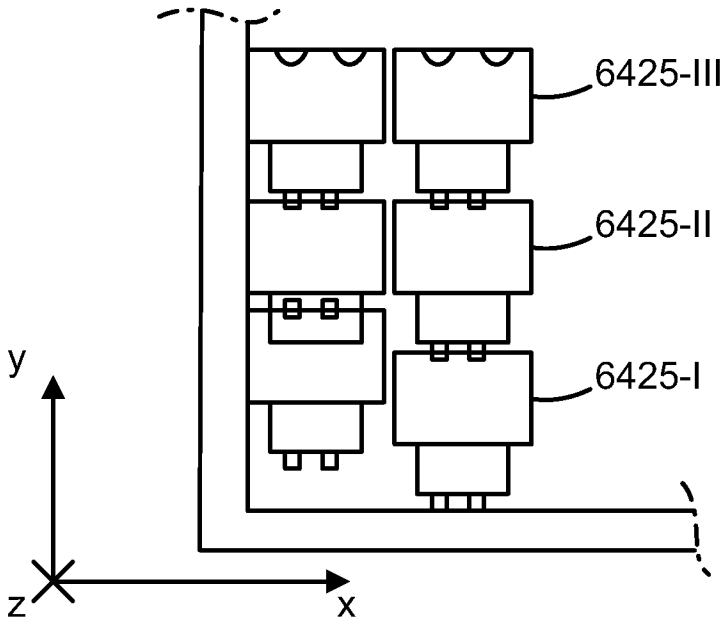
6425-III
6425-II
6425-I
y
z
x

FIG. 56

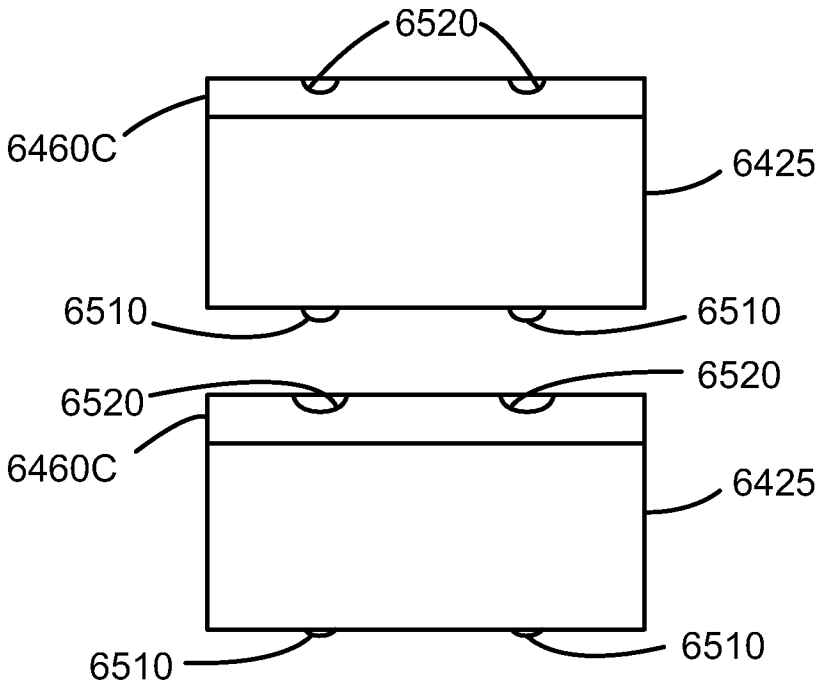
6520
6460C
6425
6510
6510
6520
6520
6460C
6425
6510
6510

FIG. 57

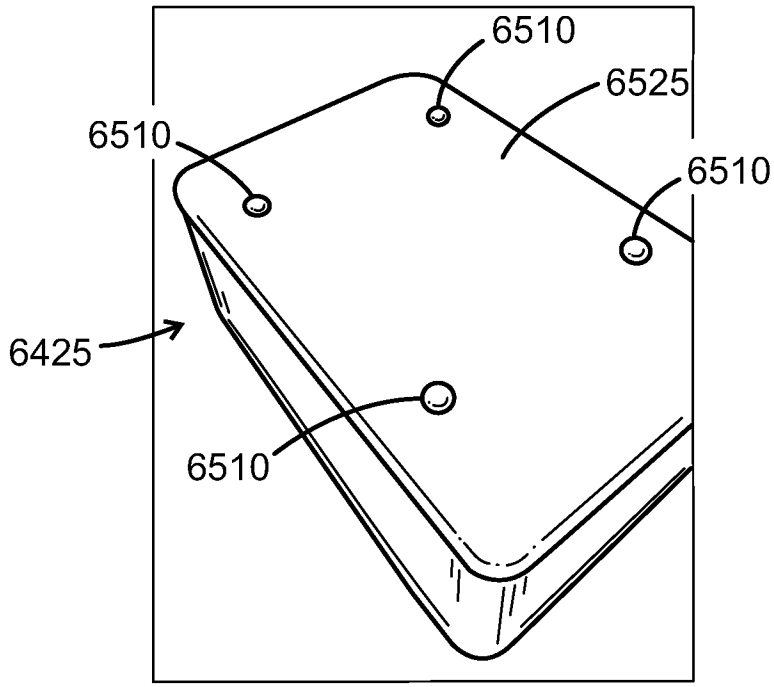
6510
6525
6510
6510
6425
6510

FIG. 58

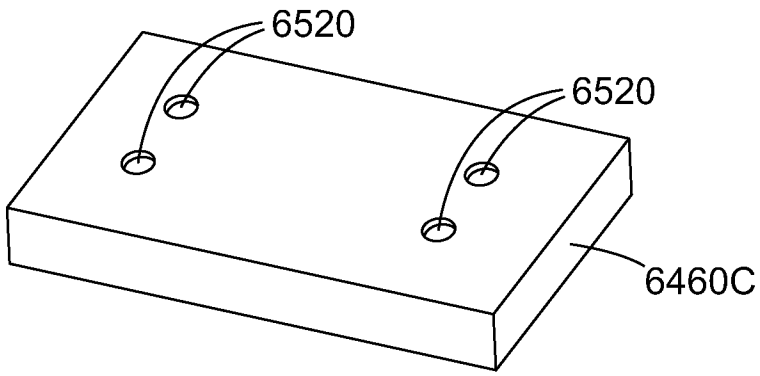

FIG. 59

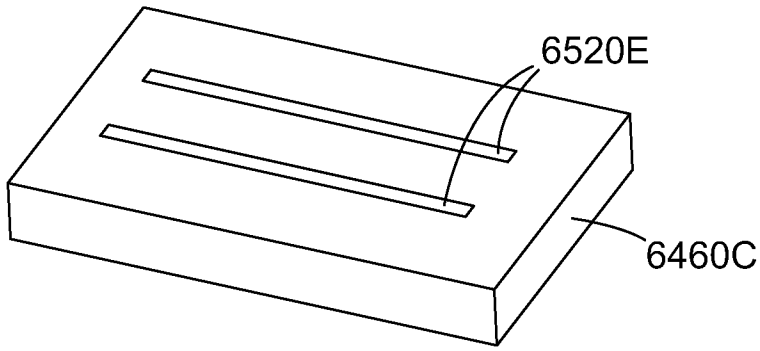

FIG. 60

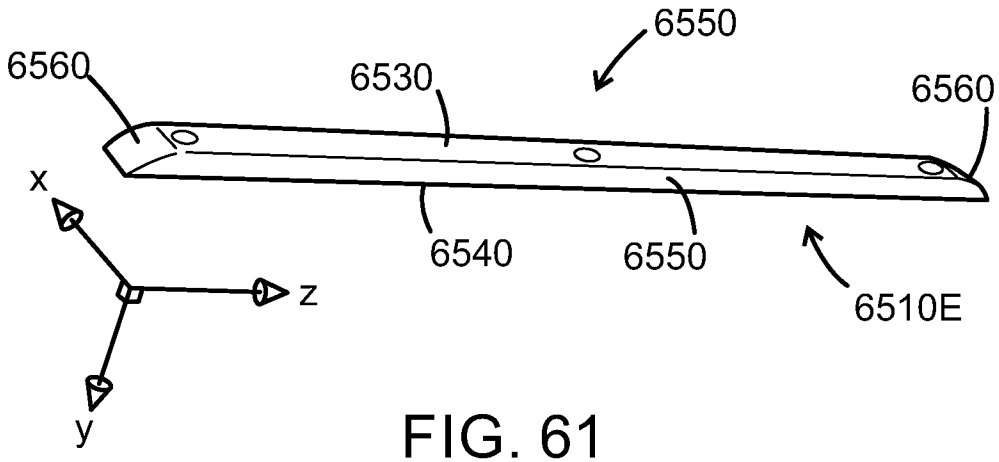

FIG. 61

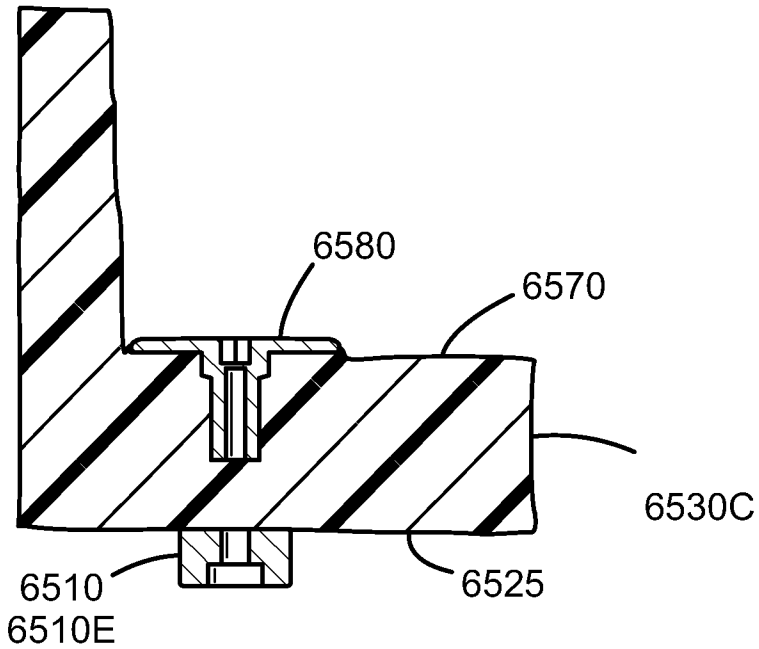

FIG. 62

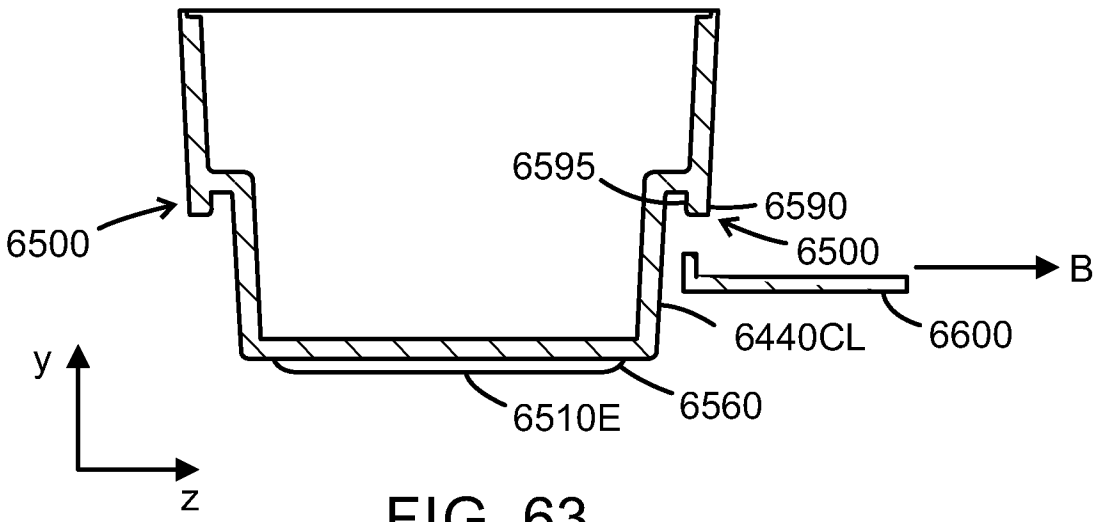

FIG. 63

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2020/000017

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65B25/00 B65D21/02 B65D30/08 B65D77/04 B65D81/38
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65B B65D G06Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2017/078587 A2 (IFOODBAG AB [SE]) 11 May 2017 (2017-05-11) See figures, in particular figures 63A-63B showing a block diagram of a method for delivering chilled or frozen goods; bags 20 and rigid containers 6420. -----	1-15
Y	US 2012/243808 A1 (DE LESSEUX LIONEL DE BAZELAIRE [US] ET AL) 27 September 2012 (2012-09-27) See figures; paragraph bridging columns 5 and 6 -----	1-15
Y	US 3 344 974 A (DONALD BOSTROM JOHN) 3 October 1967 (1967-10-03) Figure 10 -----	2,12
	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 November 2020	23/11/2020

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Ngo Si Xuyen, G

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2020/000017

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	BE 899 707 A (DINAMIC VERPAKKING B N L N V) 17 September 1984 (1984-09-17) Figures	2,12
Y	US 4 848 580 A (WISE THOMAS W [US]) 18 July 1989 (1989-07-18) Figure 2	13,14
Y	US 2015/021322 A1 (ROSENBLUM DEAN [US]) 22 January 2015 (2015-01-22) Figures 7-11	4,10
Y	DE 84 35 563 U1 (KOSLOWSKI HANS [DE]; ADORNO PETER [DE]) 24 January 1985 (1985-01-24) Figures 3-4	4,10
Y	US 2014/054308 A1 (LAM SAU CHEUK [US] ET AL) 27 February 2014 (2014-02-27) Figures 3-4, elongated "indentations 34 and/or 34'" and "protrusions 24 and/or 24'"	11
Y	US 2010/236965 A1 (HERNANDEZ ROLANDO [US] ET AL) 23 September 2010 (2010-09-23) Figure 4	11
A	DE 20 2017 107462 U1 (UNIV SHANGHAI OCEAN [CN]) 2 January 2018 (2018-01-02) Figures	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/SE2020/000017

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