

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
26 July 2007 (26.07.2007)

PCT

(10) International Publication Number  
**WO 2007/084012 A1**

(51) International Patent Classification:

*F25D 5/00* (2006.01)      *A47J 36/28* (2006.01)  
*B65D 81/18* (2006.01)      *B65D 81/34* (2006.01)  
*F24J 1/00* (2006.01)      *F25D 5/02* (2006.01)

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(21) International Application Number:

PCT/NZ2007/000005

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(22) International Filing Date: 12 January 2007 (12.01.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
544832                      20 January 2006 (20.01.2006)      NZ

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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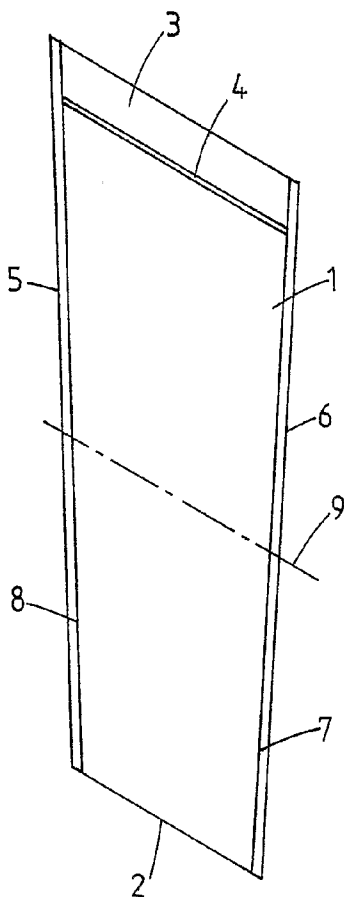
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,

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[Continued on next page]

(54) Title: FLEXIBLE FLAMELESS HEATING OR COOLING DEVICE



(57) Abstract: A heating or cooling device having a sleeve adapted to fit on or over an article to be heated or cooled, the sleeve having an outer layer and an inner layer, and at least one heat- or cold-generating chemical contained between the outer layer and the inner layer, where the device is constructed of a flexible material, and where the device has a re-closable seal to enable water or other chemical to be added to the at least one heat- or cold-generating chemical.

WO 2007/084012 A1



RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**Published:**

— *with international search report*

## FLEXIBLE FLAMELESS HEATING OR COOLING DEVICE

### TECHNICAL FIELD

The invention relates to a heating or cooling device, in particular a heating or cooling pack for heating or cooling foodstuffs and the like.

### BACKGROUND

Packages or apparatus containing chemicals capable of generating an exothermic or endothermic reaction have for some time been used as heating or cooling devices, finding use in a number of different situations.

Flexible heating/cooling packs are used to treat sports injuries, for example strained muscles or broken bones, as personal hand/body warmers and for treating mild hypothermia. A product marketed as the "Super Health Heater Pack" ([www.leeshealth.co.nz](http://www.leeshealth.co.nz)) is one example of a heat pack that can be used to treat mild injuries/illnesses such as arthritis, rheumatism, sports injuries and soft tissue injuries.

There are also a number of commercially available heat packs which can be used for reheating prepared food or beverages, or for keeping foodstuffs warm for an extended period of time. For example, "Self Heating Pack" ([www.selfheatingpack.com](http://www.selfheatingpack.com)) produces a variety of flameless heating packs for use in heating food, such as pre-packaged food used by the military.

A large amount of patent literature describes packages, apparatus and the like for heating foodstuffs or for use as heat packs for the body. Some examples are given below.

EP 0180375 describes one example of an apparatus where an inner container, which contains a substance to be heated, is surrounded by an outer housing, so that there is a space between the container and the outer housing. The space contains a liquid and a solid which, when mixed, react to liberate heat. The solid substance can be carried in a flexible bag or pouch that can be pierced to allow mixing of the reagents. Suitable reagents include water and lime. The container and the outer housing are constructed of a rigid material. For example, they may be in the form of a can.

WO 91/13296 describes a food heating device where a heat pack containing heat-generating chemicals, which are preferably reagents that give a redox reaction, may be placed into a container for heating food. The food to be heated essentially sits atop the heat pack.

WO 95/34788 describes a self heating meal package which has an outer flexible pouch and an inner pouch containing the food. The heating system is provided by a heat pack that is enclosed at the bottom of the space between the outer pouch and the food pouch. There is also a solvent bag, and a trigger mechanism that allows the solvent to escape from the solvent bag and make contact with a chemical compound in the heating pack, thereby generating heat and heating the food.

EP 1481921 describes another type of self heating apparatus for food and beverages. The outer casing is rigid. There is a main receptacle for the food or beverage product and below that there are two compartments, containing substances that can be reacted to produce heat. The two compartments which house the reagents are separated by a frangible portion that can be broken to allow mixing. There is also a heat conducting wall that facilitates the heat exchange between the reagent compartments and the food receptacle. The entire package can be used as a disposable feeding bottle.

US 6,629,603 describes a packet which contains a gargling solution (salt water), together with a heating system to heat the gargling solution. The solution is enclosed within an interior of the packet, surrounded by the heat source on the inside of the side walls. The heat source could be, for example, a chemical compound that reacts upon exposure to air. Alternatively, a multiple chambered structure is described, where two compounds produce heat when mixed.

US 4,753,085 describes a single use package for heating beverages or food. The package consists of a receptacle which contains the food or drink. The package is formed of a rigid material. There is a capsule inside the package, which can have separate compartments for the chemical reagents. One of the outside walls of the package can be pressed or "deformed" to trigger the bringing together of the reagents.

WO 94/11682 essentially describes a heat pack which is a flexible sachet having compartments containing various heat-producing reagents, for example calcium oxide and water. The heat pack can be used to heat a beverage or food. The heat pack may be incorporated into a container for heating, for example, soup or infants' milk.

US 6,289,889 also describes a flexible heat pack, which has two compartments separated by a breakable seal that allows the two reagents to mix. The heat pack can be associated with

various kinds of product containers, which contain an item to be heated. The heat pack and pouches may be manufactured of a flexible material.

5 US 5,477,847 describes an arrangement whereby "exothermic members", i.e. heat packs, are placed on either side of a bag, for example a bag containing cooked food, to be heated. The two heat packs, which can also be formed as one pack that folds around the item to be heated, contain a heat-generating chemical. The whole structure can sit atop a stand or base.

10 WO 03/021158 describes another kind of heat pack. Again, there are compartments containing the reagents to be mixed to generate heat. During the reaction, one of the frangible seals can be broken in order to allow for expansion of the contents during the reaction. The heat pack may be associated with a packet of food, enclosed in a disposable carton.

15 The commercially available heat packs have some disadvantages. For example, some use heat-generating chemicals which are environmentally unfriendly or potentially unsafe for users. In addition, the known flameless devices for heating foodstuffs can be difficult to transport, as they are manufactured from rigid materials. Such devices are of limited use, especially for travellers, hikers, military personnel and the like. In particular, these devices are not desirable for military use, as military personnel often travel on foot or need to carry only limited amounts of equipment.

25 Known heat packs also suffer from the disadvantage that the chemicals necessary for reacting together to generate heat must be contained within the pack, with a mechanism such as a frangible seal for enabling the chemicals to come into contact when the heat pack is used. The inventors of this application have devised a heating or cooling device which avoids this disadvantage by incorporating a re-closable seal that allows water to be added to one or more chemicals before resealing the device and using it to heat or cool.

30 A flexible heating or cooling pack, which is easily packed, stored and transported, and which is environmentally friendly, is more useful for persons on the go.

35 However, currently available food heating packs consist merely of a flat package that has to be wrapped around or stacked on/under a food item to be heated. More desirable would be a heating or cooling pack that, when in use, can surround the item to be heated or cooled, whilst still being able to be packed flat for easy storage and transport prior to use.

It is therefore an object of the invention to provide an improved heating or cooling pack, particularly for heating or cooling foodstuffs, or at least to provide a useful choice.

## 5 STATEMENTS OF INVENTION

In a first aspect, the invention provides a heating or cooling device having:

- a sleeve adapted to fit on or over an article to be heated or cooled, the sleeve having an outer layer and an inner layer; and
- at least one heat- or cold-generating chemical contained between the outer layer and  
10 the inner layer;

where the device is constructed of a flexible material, and where the device has a re-closable seal to enable water or other chemical to be added to the at least one heat- or cold-generating chemical.

15 Preferably the sleeve is open at one end and closed at the other end. Alternatively, the sleeve is open at both ends.

It is preferred that the device is a flat flexible pack including an outer layer comprised of two opposing faces, with two side seals each sealing the side edges of the two opposing faces.

20

It is preferred that the device is manufactured from a plastics material, preferably a foil plastic/laminate. The device may be manufactured in one piece.

The re-closable seal may be a zipper-type (zip lock) seal, a peelable seal, or an adhesive  
25 seals, or any other suitable seal.

The device may also include a permanent seal, such as a heat seal, at a location on the device to contain the at least one heat- or cold-generating chemical if inadvertent opening of the re-closable seal occurs. The device may further include a frangible portion located  
30 between the permanent seal and the re-closable seal.

It is preferred that the device is a heating device, containing one or more heat-generating chemicals, such as solid calcium oxide. Preferably the solid calcium oxide is combined with a solid form of an acid, such as citric acid, and both chemicals are distributed between the  
35 inner layer and the outer layer. Alternatively, the solid calcium oxide may be distributed between the inner layer and the outer layer, and an acid may be added by a user when the device is in use.

The relative amounts of calcium oxide and acid may be selected on the basis of a desired temperature increase. The ratio of acid to calcium oxide is preferably in the range 0:100 to 50:50 by weight. For example, a temperature increase of approximately 55°C may be achieved where no acid is combined with the calcium oxide. In another example, a ratio of acid to calcium oxide of approximately 50:50 by weight may give a temperature increase of approximately 120°C.

Alternatively it is preferred that the device is a cooling device containing one or more cold-generating chemicals, such as ammonium nitrate.

Preferably the article to be heated or cooled is a food or beverage, more preferably a food. Still more preferably the article to be heated is a food contained within a flexible package. The flexible food package may have the following approximate dimensions: height 420-500mm, width 120-190mm. In a preferred embodiment, the article to be heated is a standard issue army ration pack, containing a food.

In one preferred embodiment, the invention provides a heating device for heating a flexible package containing a food, said heating device having:

- an outer layer comprised of two opposing faces, with two side seals, sealing side edges of the two opposing faces;
- an inner layer;
- at least one heat-generating chemical contained between the outer layer and the inner layer;
- a closed end;
- an open end; and
- a re-closable seal located proximal to the closed end;

where the device is a flat flexible pack constructed in one piece of a flexible plastics material, and where the piece of a flexible plastics material is folded in on itself to form a sleeve so that an article to be heated may be located within the sleeve during heating.

In a second aspect, the invention provides the use of the device of the first aspect for heating or cooling an article. Preferably the use is for heating food.

In another aspect, the invention provides a method of using the device of the first aspect including the steps: fitting the sleeve over the article to be heated or cooled, and adding water to the at least one heat- or cold-generating chemical.

## 5 BRIEF DESCRIPTION OF THE FIGURES

Figure 1 shows a flexible heating device according to one aspect of the invention.

Figure 2 shows a front view of a flexible heating device according to one aspect of the invention.

10

Figure 3 shows an assembled heating device according to one aspect of the invention. The dashed line represents the inner layer.

Figure 4 is a perspective view of the heating device of Figure 3.

15

## DETAILED DESCRIPTION

A preferred embodiment of the invention is described, by way of example only, with reference to the accompanying figures.

20 Figure 1 shows a flexible heating device (1) according to one aspect of the invention, prior to folding and assembly (see below). The device is manufactured in one piece from a flexible plastics material, preferably a foil/plastic laminate. The plastics material must be suitable to withstand heating to about 150°C. It will also be clear to the skilled person that if the device is to be used for cooling, then the plastics material should be suitable to withstand cooling to  
25 about -10°C.

The device comprises a bottom end (2) where the flexible plastics material is folded in on itself. The dashed line shown on Figure 2 at the approximate mid-section (9) of the device shows the position of the fold. Figure 3 shows how this results in the formation of a cavity (or pocket) (10) at the bottom end (2) so that, in use, the device is essentially a sleeve, having  
30 an inner layer (shown as a dashed line in Figure 3) and an outer layer. The sleeve is of suitable dimensions that the inner layer fits over a package of food, so that the inner layer surrounds all or most of the food package.

35 One or more chemical compounds are distributed in the enclosed space (11) between the outer layer and the inner layer of the sleeve.



At the other end of the device there is provided a top edge (3), and a re-closable seal (4). Suitable re-closable seals include Ziploc®-type zipper seals, peelable seals or adhesive seals. This ensures that the one or more chemical compounds remain sealed between the inner and outer layer when the device is not in use.

5

The top edge (3) may furthermore be permanently sealed above the re-closable seal, such that, when used, the permanent seal can be removed, for example, by tearing a frangible portion between the permanent seal and the re-closable seal.

10 The device further includes two side edges (5) and (6). The side edges (5) and (6) are permanently sealed with side seals (7) and (8).

Referring to Figure 2, the heating device is a flat flexible package of the approximate dimensions: height 420-500mm, width 120-190mm. In a particularly preferred embodiment, 15 the shape of the device is tapered, so that the dimensions are: height 460mm, width 175 mm at the top end and 133mm at the bottom end. This enables the device to fit conveniently over a standard issue military ration pack when in use.

Between the inner layer and the outer layer, there is a space, inside which there is contained 20 one or more chemical compounds that can generate an exothermic or endothermic reaction, depending upon whether the device is to be used for heating or cooling.

The device may be used for heating a food item, in which case chemical compounds are selected so that they provide an exothermic reaction. Suitable chemical compounds are 25 calcium oxide and an acid (such as citric acid). In a preferred embodiment, these compounds are provided in the device in their solid forms so that a user can add a pre-determined amount of water to the chemical compounds in order to start a chemical reaction. The addition of water to calcium oxide results in an exothermic reaction as the calcium oxide dissolves.

30

One advantage of the calcium oxide/citric acid combination is that the reaction with water produces safe, environmentally friendly products, which may be disposed of easily. This is advantageous for military personnel, hikers, and others using the device in the field. Furthermore, the water used in the chemical reaction can be obtained from any convenient 35 source in the field and is not required to be potable.

Thus, the entire device is a single sealed unit, where the chemical reaction is activated by the user, by the addition of water. This differs from the currently available products, where it is possible for the package to be damaged and for the heat-generating reaction to be accidentally initiated.

5

The amounts of calcium oxide and citric acid to be used in the device will vary depending upon the size of the device. The weight ratio of citric acid to calcium oxide will vary from about 0% citric acid by weight/100% by weight calcium oxide to about 50% by weight citric acid/50% by weight calcium oxide depending on the temperature increase required from the reaction. With no citric acid the calcium oxide and water reaction will deliver a temperature increase of around 55°C. With equal amounts of calcium oxide and citric acid, heat generation of about 120°C is achieved. In the embodiment of the heating device shown in Figures 1 to 4, approximately 25 g of calcium oxide and approximately 25 g citric acid are contained in the space between the inner and the outer layer.

10

In order to heat a food item, a user places the heating device (1) over the item to be heated, which will preferably be enclosed in a package, such that the item to be heated fits almost entirely within the cavity at the bottom end (2). The user then opens the re-closable seal (4), or, if there is a permanent seal, the user breaks open the permanent seal and then opens the re-closable seal (4). He/she adds sufficient water to the space between the inner and outer layer in order to effect the exothermic dissolution of calcium oxide. In the embodiment shown, if approximately 25 g of calcium oxide and approximately 25 g citric acid are contained in the device, the user should add approximately 50 -100 mL of water. The preferred volume of water is 1.5 times the weight of reagents used. For the above stated amounts of citric acid and calcium oxide, the preferred amount of water is 75 mL. The user may agitate the device in order to mix the water and the chemicals if necessary.

15

20

The heating device (1) will expand as the reaction proceeds, and as heat is produced. The device (1) will therefore tighten over the item to be heated.

The chemicals used with the heating device (1) are stable and safe, and have low toxicity. The products of the exothermic reaction of calcium oxide with water in the presence of an acid are biodegradable and non-toxic, so the residue can easily be disposed of after use, for example by burying. This is particularly advantageous if the device is to be used by military personnel, hikers and the like.

25

30

35

Although the it is preferred that the exothermic reaction used in the heating device is the dissolution of calcium oxide in the presence of an acid, it will be clear to the skilled person that alternative heat-producing chemical compounds may be used.

5 The device may also be used for cooling, in which case the chemical compounds are selected so that they provide an endothermic reaction. One suitable chemical compound is ammonium nitrate. The dissolution of this compound in water produces an endothermic reaction, so water could be added to a device of the invention which contains ammonium nitrate distributed between the inner and outer layers. Then, in the same manner as  
10 described above for a heating device, the endothermic dissolution of ammonium nitrate would cool an item to be cooled.

Although the embodiment shown in Figures 1 and 2 is a sleeve where the devices fits entirely over an object to be heated, it will be clear to the skilled person that alternative  
15 embodiment exists where the top edge is open, so that the sleeve fits over the object to be heated or cooled, and the object protrudes from the top of the device. In this alternative embodiment, the top edge is sealed, preferably with a re-closable seal, so that the chemicals can be held between the inner and outer layers. However, the shape of the entire device approximates a cylindrical sleeve, rather than the sleeve shown in Figures 1 and 2.

20 The heat- or cold-generating device of the present invention is advantageously a compact flexible pack, which can be packed flat for easy transportation. The device can be manufactured of suitable dimensions so that it can be used with a military standard issue ration pack retort pouch or a military standard issue water canteen. The device is easy and  
25 safe to use, and can be used in confined spaces, as it does not produce smoke, flames or toxic residue.

In addition, the fact that the heat- or cold-generating chemicals are sealed into the device minimises the risk of loss of the chemical compounds during transport and use, and makes  
30 the device easy to transport and carry by persons such as hikers, campers and military personnel. The device is also safe for transportation in bulk, even by air.

A heating device according to the invention can maintain its heat for some time after activation of the heat-producing reaction (for example dissolution of calcium oxide). This  
35 means that the device can be used for other purposes such as a hand- or body-warmer, or to heat water for washing. This is particularly advantageous for persons on the go.

Although the invention has been described by way of example, it should be appreciated that variations or modifications may be made without departing from the scope of the invention. Furthermore, when known equivalents exist to specific features, such equivalents are incorporated as if specifically referred to in the specification.

5

**INDUSTRIAL APPLICABILITY**

The device of the invention is useful for heating or cooling substances, particularly foodstuffs. The device contains heat-generating or cold-generating chemicals which can be activated to heat or cool substances in contact with the device.

10

**CLAIMS**

1. A heating or cooling device having:

i) a sleeve adapted to fit on or over an article to be heated or cooled, the sleeve having an outer layer and an inner layer; and

5 ii) at least one heat- or cold-generating chemical contained between the outer layer and the inner layer;

where the device is constructed of a flexible material, and where the device has a re-closable seal to enable water or other chemical to be added to the at least one heat- or cold-generating chemical.

10

2. A device as claimed in claim 1 where the sleeve is open at one end and closed at the other end.

3. A device as claimed in claim 1 where the sleeve is open at both ends.

15

4. A device as claimed in any one of claims 1 to 3 which is a flat flexible pack including an outer layer comprised of two opposing faces, with two side seals each sealing the side edges of the two opposing faces.

20 5. A device as claimed in any one of claims 1 to 4 which is manufactured from a plastics material.

6. A device as claimed in claim 5 where the plastics material is a foil plastic/laminate.

25 7. A device as claimed in any one of claims 1 to 6 which is manufactured in one piece.

8. A device as claimed in any one of claims 1 to 7 where the re-closable seal is a zipper-type (zip lock) seal, a peelable seal, or an adhesive seal.

30 9. A device as claimed in any one of claims 1 to 8 further including a permanent seal at a location on the device to contain the at least one heat- or cold-generating chemical if inadvertent opening of the re-closable seal occurs.

10. A device as claimed in claim 9 where the permanent seal is a heat seal.

35

11. A device as claimed in any one of claims 1 to 10 further including a frangible portion located between the permanent seal and the re-closable seal.

12. A device as claimed in any one of claims 1 to 11 which is a heating device containing one or more heat-generating chemicals.

5 13. A device as claimed in claim 12 where the one or more heat-generating chemicals is solid calcium oxide.

10 14. A device as claimed in claim 13 where the solid calcium oxide is combined with a solid form of an acid and the combination is distributed between the inner layer and the outer layer.

15 15. A device as claimed in claim 14 where the relative amounts of calcium oxide and acid are selected on the basis of a desired temperature increase.

16 16. A device as claimed in claim 15 where the ratio of acid to calcium oxide is in the range 0:100 to 50:50 by weight.

17. A device as claimed in claim 16 where no acid is combined with the calcium oxide to give a temperature increase of approximately 55°C.

20 18. A device as claimed in claim 16 where the ratio of acid to calcium oxide is approximately 50:50 by weight to give a temperature increase of approximately 120°C.

25 19. A device as claimed in claim 13 where the solid calcium oxide is distributed between the inner layer and the outer layer, and an acid is added by a user when the device is in use.

20. A device as claimed in any one of claims 13 to 19 where the acid is citric acid.

30 21. A device as claimed in any one of claims 1 to 11 which is a cooling device containing one or more cold-generating chemicals.

22. A device as claimed in claim 21 where the one or more cold-generating chemicals is ammonium nitrate.

35 23. A device as claimed in any one of claims 1 to 22 where the article to be heated or cooled is a food or beverage.

24. A device as claimed in claim 23 where the food is contained within a flexible package.

25. A device as claimed in claim 24 where the flexible food package has the dimensions: height 420-500 mm and width 120-190 mm.

5 26. A device as claimed in any one of claims 1 to 25 where the article to be heated is a standard issue army ration pack containing food.

27. A heating device for heating a flexible package containing a food, said heating device having:

- 10 i) an outer layer comprised of two opposing faces, with two side seals, sealing side edges of the two opposing faces;
- ii) an inner layer;
- iii) at least one heat-generating chemical contained between the outer layer and the inner layer;
- 15 iv) a closed end;
- v) an open end; and
- vi) a re-closable seal located proximal to the closed end;

where the device is a flat flexible pack constructed in one piece of a flexible plastics material, and where the piece of a flexible plastics material is folded in on itself to form a sleeve so  
20 that an article to be heated may be located within the sleeve during heating.

28. The use of a device of any one of claims 1 to 27 for heating or cooling an article.

29. The use as claimed in claim 28 which is for heating food.

25

30. A method of using the device of any one of claims 1 to 27 including the steps:

- i) fitting the sleeve over the article to be heated or cooled; and
- ii) adding water to the at least one heat- or cold-generating chemical.

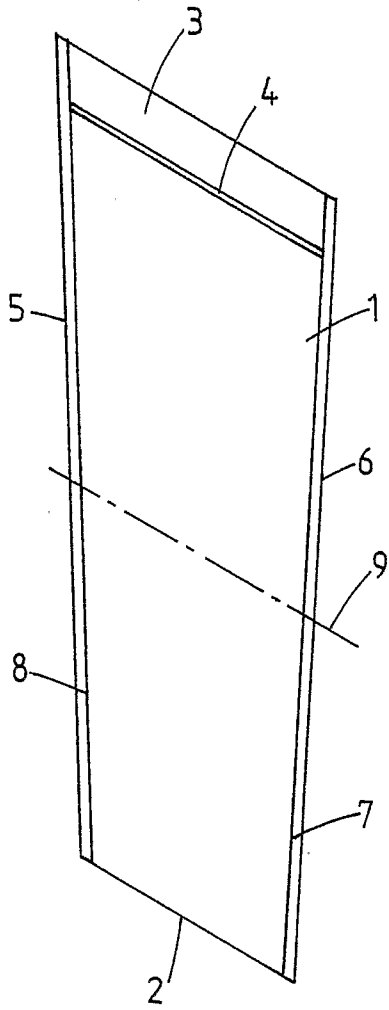


FIG. 1

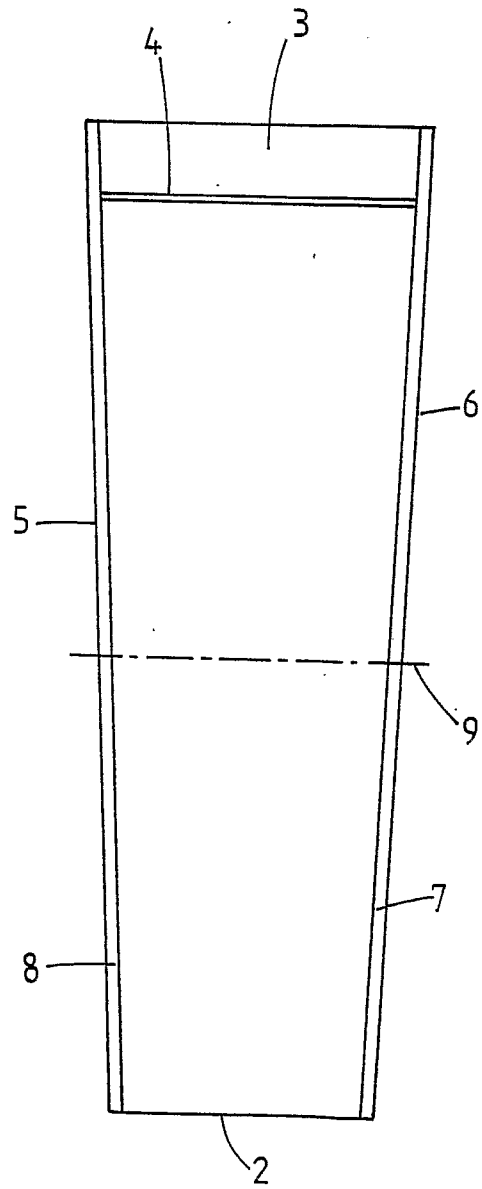


FIG. 2



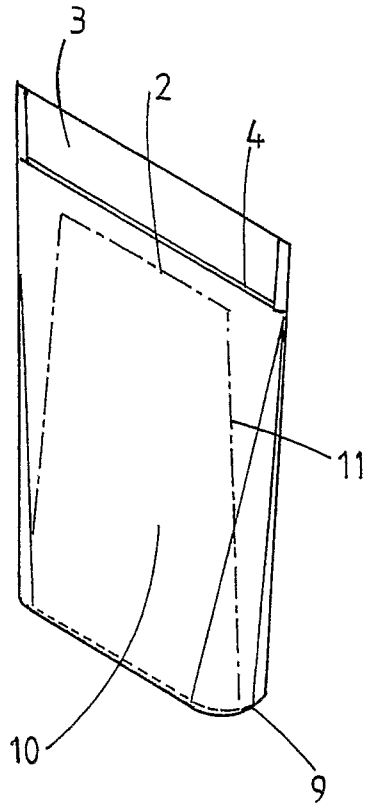


FIG. 3

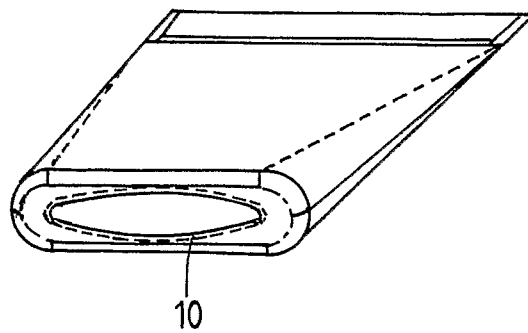


FIG. 4

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ2007/000005

## A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

*F25D 5/00* (2006.01)      *B65D 81/18* (2006.01)      *F24J 1/00* (2006.01)  
*A47J 36/28* (2006.01)      *B65D 81/34* (2006.01)      *F25D 5/02* (2006.01)

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)

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)

**DWPI:** IPC - A61F 7/1C, F25D 5/00, F25D 5/02, F24J 1/00, A47J 36/28, B65D 81/18, B65D 81/34; **Keywords** - seal+, +close+, pack+, wrap+, pad+, sleeve+, pouch+, pocket+, endothermic, cold, cool+, exothermic, hot, heat+, flexible+, add+, introduc+, throw+, dispos+ discard+

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2004/0065315 A (FISH ET AL) 8 April 2004 Whole document	1-30
A	US 6248257 B (BELL ET AL) 19 June 2001 Whole document	1-30
A	US 5117809 A (SCARINGE ET AL) 2 June 1992 Whole document	1-30

 Further documents are listed in the continuation of Box C See patent family annex

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20 March 2007

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29 MAR 2007

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ2007/000005

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3980070 A (KRUPA) 14 September 1976 Whole document	1-30
A	US 3893834 A (ARMSTRONG) 8 July 1975 Whole document	1-30

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/NZ2007/000005

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
US	2004065315	AU	2003245369	CA	2499615	CN	1681719
		EP	1546004	KR	2005006739	MX	PA05002902
		US	6827080	WO	2004033340		
US	6248257	AU	38094/97	CA	2261688	EP	0917637
		US	5935486	WO	9805906		
US	5117809	NONE					
US	3980070	NONE					
US	3893834	NONE					
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.							
END OF ANNEX							