HOT OR COLD PACK

Inventor: Vernon L. Williams, Dana Point, Calif.

Assignee: Kay Laboratories, Inc., San Diego, Calif.

Filed: Aug. 5, 1971

Appl. No.: 169,328

U.S. Cl. ............................................. 126/263, 62/64
Int. Cl. ............................................. B65d 79/00
Field of Search .......... 62/4, 345; 128/82.1, 399, 128/401–403, 150/2.1; 206/47 A

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ABSTRACT

A hot or cold pack is provided in which two materials are normally separated from each other in separate compartments and in which the materials are mixed to produce a chemical reaction between the materials when one of the compartments is ruptured. The pack includes a third material such as a form of starch which is stored in one of the compartments and which responds to the mixture of the two materials to produce a gel. The production of the gel has certain advantages. One advantage is that the gel provides for the application of heat or cold continuously to a desired position such as the knee of a patient without having the materials in the pack slide to the opposite ends of the pack. Another advantage is that the gel prolongs the time during which the heat or cold can be applied to the desired position.

13 Claims, 5 Drawing Figures
BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to hot and cold packs for generating heat or cold through the reaction of chemicals and more specifically to the addition of a material which forms a gel with the other materials in such packs. The formation of a gel in such packs prolongs the period during which heat is transferred to or from the apparatus. The formation of a gel also prevents the heat-producing material in the packs from being displaced to insure that the heat or cold is applied continuously and efficiently to a desired object.

2. Description of the Prior Art

Hot and cold packs are now in use for applying heat or cold to desired objects such as localized positions on a person's body. The hot or cold packs generally employ a first material in a first compartment and a material such as water in a second compartment which is sealed within the first compartment. The first and second materials have properties of reacting chemically with each other when the second compartment is ruptured as by a sharp blow to the pack. When heat is to be produced, the first and second materials react chemically in an exothermic reaction. When cold is to be produced, the first and second materials react chemically in an endothermic reaction.

It is always desirable to prolong the period of time during which the pack can effectively develop a desired temperature differential with the object to which it is to be applied. In the prior packs, the materials reacting chemically have remained in constant contact with each other until one of the materials has been consumed. Various means have been provided for slowing the chemical reaction to increase the time during which the pack can be effective to transfer heat or cold but such means have not been completely effective.

When the packs of the prior art have been applied to a convex surface such as the top of a leg, a significant disadvantage has become apparent. With the pack so oriented, its sides extend down over the sides of the leg and the materials in the pack have naturally tended to flow to these lower regions. This, of course, has resulted in the generation of heat or cold at the lower regions with no generation at the top of the pack where the heat or cold has been primarily desired. This problem has persisted in spite of considerable effort to solve it.

SUMMARY OF THE INVENTION

This invention provides hot and cold packs which overcome the above disadvantages. The invention includes water in a compartment containing a first material such as calcium chloride or ammonium nitrate. Particles of a suitable material such as a starch are mixed with the particles of the first material in the first compartment. The first compartment is preferably disposed within a sealed second compartment containing a second material such as water and having rupturable properties.

When the second compartment is ruptured as by a sharp blow and the pack is shaken back and forth, the materials in the two compartments become mixed. The first material in the first compartment reacts chemically with the water in the second compartment to generate heat if the reaction is exothermic and to generate cold if the reaction is endothermic.

When the reaction is exothermic, the starch in the first compartment forms a paste when the temperature of the pack reaches a particular temperature such as approximately 160°F. The paste serves as a gel to partially solidify the pack. The gel allows the pack to be bent to any desired shape such that it can be applied to objects of particular shape such as a person's knee. However, the gel prevents the material in the pack from moving downwardly to the bottom of the pack. This is important in insuring that the heat will be generated continuously at the position where it is desired to apply the heat such as a patient's knee.

Although the starch forms a gel and impedes the movements of the materials in the pack, it does not prevent the chemical reaction between the materials in the pack. Actually, the inclusion of the starch in the pack is advantageous to the chemical reaction between the materials in the pack since it slows the rate at which the chemical reaction occurs and thus prolongs the life of the pack. The starch is further advantageous since it is compatible with the other materials in the pack and does not react chemically with any of these other materials in the pack to prevent these materials from reacting chemically with each other to produce heat or cold.

When a cold pack is provided, a modified form of starch such as tapioca is included in the first compartment. The tapioca is precooked so that it will form a paste immediately when the materials in the two compartments react chemically. Because of this, the starch in the cold pack forms a paste immediately and without any requirement that the cold pack reach a specified temperature.

IN THE DRAWINGS

FIG. 1 is a side-front perspective view of one embodiment of the invention;
FIG. 1a is a section view of the embodiment shown in FIG. 1 and is taken substantially on the line 1a–1a of FIG. 1;
FIG. 2 is a front-side perspective view of another embodiment of the invention;
FIG. 2a is a section view of the embodiment shown in FIG. 2 and is taken substantially on the line 2a–2a of FIG. 2; and
FIG. 3 is a side-perspective view of another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

A pack generally indicated at 11 capable of producing heat or the absence thereof is shown in FIG. 1. The pack is capable of being applied to humans, animals, birds, reptiles, and inanimate objects. The pack 11 is composed of a container or bag 13 having walls 15. The container 13 will typically be formed from a flexible plastic such as polyethylene so that the container 13 can be sealed by heat treating the walls 15. A rupturable bag 21 is preferably disposed within the container 13. A first chemical 19 is disposed within the container 13 and at least one second chemical 17 such as water is disposed in the rupturable bag 21. The first and second chemicals 17 and 19 react with each other upon contact to either give off or absorb heat in a temperature-altering reaction. At least one of the chemicals
necessary to this reaction is separated from the other chemicals by isolating it in the rupturable bag 21. The rupturable bag 21 is preferably enclosed within the walls 15 of the container 13 so that, when container 13 is struck, the rupturable bag 21 breaks thereby permitting the chemical 17 to come into contact and react with the chemical 19.

There are many different chemicals and reactions which can be used to either generate heat or cold. One criteria for application within the pack 11 is that the chemicals 17 and 19 be easily mixed so that the timing of the temperature-altering reaction can be predetermined and controlled. The chemicals 17 and 19 must also be compatible with the materials used for the walls 15 of container 13. The walls 15 must be capable of containing not only the chemicals 17 and 19 but also any chemicals or compounds which are produced as a result of the temperature-altering reaction.

In designing the pack 11 I have found calcium chloride and water to be particularly effective for the generation of heat and also compatible with the polyethylene walls 15 of container 13. Water is particularly effective for the chemical 17 since the rupturable bag 21 performs its function more easily with a fluid than with a solid. Water is also desirable since it is inexpensive and since it is chemically neutral before it is mixed with the chemical 19.

In designing the pack 11 for the generation of cold, I have found ammonium nitrate and water to be effective wherein the water is particularly adapted for use in the rupturable bag 21 as the chemical 17 and the ammonium nitrate is disposed within the container 13. The pack 11 with the features described above may be constructed in a manner similar to that described and claimed in application Ser. No. 809,870 filed on Mar. 24, 1969, by Thomas E. Cornwall and Maurice A. Lynch, Jr., now abandoned, and assigned of record to the assignee of this application.

At a predetermined time, the bag 13 can be struck, thereby rupturing the rupturable container 21 and releasing the water in one container to be mixed with the first chemical 19 in the container 13. The chemical reaction is facilitated by shaking the container 13 back and forth to expedite the mixture of the chemicals 17 and 19. When the first chemical 19 constitutes calcium chloride, the reaction is exothermic so that heat is released. When the first chemical 19 constitutes ammonium nitrate, the reaction is endothermic so that heat is absorbed from the surrounding area and cold is generated in this area. Materials such as calcium chloride and ammonium nitrate are desirable as the first chemical 19 since they are inexpensive and since they release or absorb considerable heat per unit of volume. The use of water as the chemical 17 is desirable since it is plentiful and inexpensive and reacts fully and efficiently with the chemical 19. The chemicals 17 and 19 are further advantageous in that they are chemically neutral relative to their respective bags 13 and 21 before and after their chemical reaction with each other.

A suitable material such as a starch 23 is mixed with the chemical 19 in the container 13. When the chemical 17 and 19 are mixed by rupturing the bag 21, the starch 23 inhibits the temperature-altering reaction by placing at least a portion of the chemicals 17 and 19 in suspension so that they are temporarily isolated from the temperature-altering reaction. As the isolated chemicals become available to the reaction, more heat or cold is developed. In this manner, the starch 23 is also a prolonging means which extends the period during which the temperature-altering reaction effectively generates heat or cold.

The starch 23 offers certain additional advantages. One advantage is that it forms a paste with the water in the container 13 when the bag 21 is ruptured and the materials are mixed. The paste forms a gel with the other materials in the pack. The gel has physical characteristics which allow the pack to be shaped to any desired contour but which inhibits the movement of the materials within the container. This is particularly important when different portions of the pack are disposed at different vertical levels since the material in the pack would otherwise tend to flow relatively quickly to the lowest position. By inhibiting the flow of the material within the pack, the starch 23 provides for an efficient transfer of heat between the pack and an individual object, particularly when the object has an individual shape. For example, when the object constitutes a person's knee or leg 25 such as shown in FIG. 5, the pack 11 may be wrapped over the leg 25. In forming a gel with the other materials in the pack 11, the starch 23 retains the material in the pack along the full length of the pack so that the leg 25 receives heat from the chemical reaction of such materials along the full length of the pack. This is in contrast to the prior art where the material in the pack has tended to flow to the opposite ends of the pack because these opposite ends constitute the lowest positions in the pack.

The inclusion of the starch 23 in the pack also offers other advantages. For example, since the starch forms a gel with the other materials in the pack, it inhibits the opportunity of the water to reach the first chemical 19 immediately. However, the gel has characteristics which allow the first and second chemicals to reach each other to provide for a continued chemical reaction since the gel is physically consistent and does not coagulate. This tends to prolong the time during which the chemical reaction between the first chemical 19 and the chemical 17 such as water occurs so that the operative life of the pack is accordingly enhanced. For example, the operative life of the pack has been increased by as much as 20 per cent by including the starch 23.

By producing a gel with the other materials in the pack 11, the starch 23 also serves the function of resisting the convection of heat from the interior regions 27 of the container 13 to the walls 15. This results from the fact that the gel formed in the pack prevents the material in the pack from sloshing around to present different material to the surface of the pack. With the convection of heat thus inhibited, heat transfer from the interior regions 27 to the walls 15 is substantially accomplished by conduction. For example, heat which exists in a molecule at the interior regions 27 of container 13 cannot be carried by that molecule to the walls 15. That heat must be passed between adjacent molecules until it reaches the wall 15. Since this passing of the heat by conduction takes a greater period of time than does the convection of the heat, the starch 23 thereby prolongs the period of time in which the pack is able to transfer heat between the pack and a contiguous object to which the pack is applied. The transfer of heat is also prolonged because the starch provided the pack with an increased mass for the same volume...
within the pack 11 and for the same surface area of the pack so that the heat is retained within the pack for an increased period of time.

The inclusion of the starch 23 in the pack 11 offers another advantage since it indicates when the pack should be applied to a person or an object to obtain a transfer of heat. For example, after the bag 21 is ruptured, the pack 11 is shaken to facilitate a mixture of the materials in the bag. During the time that the mixture is occurring, a rumbling sound is produced. However, when the starch 23 forms a gel with the other materials in the pack 11, the rumbling stops since the mixture of the materials is impeded. This indicates to the person shaking the pack that the pack should be applied to the intended person or object.

When used in a hot pack, the starch 23 may be any suitable type of corn starch and may be included in the pack in an amount of approximately 12 to 16 grams when approximately 66 grams of calcium chloride are used and approximately 100 grams of water are used. The starch 23 is preferably not precooked. Because of this, the calcium chloride and the water react chemically to produce a temperature of approximately 160°F to cook the starch. When the starch becomes cooked, it is able to form a paste with the water in a manner similar to that described above. Be delaying the formation of the paste, the reaction between the calcium chloride and the water is facilitated for a limited period of time.

The starch 23 may be "Binasol 81" supplied by A. E. Staley Mfg. Co., Decatur, Illinois when the starch is included in a cold pack. This starch has a coarse granulation and constitutes a pregelatinized (precooked) tapioca starch which provides high water-binding properties and relatively high viscosity. A suitable amount of starch such as approximately 11 to 15 grams of tapioca may be used with approximately 127 grams of ammonium nitrate and 100 grams of water. Since the starch is precooked, it operates immediately to form a paste with the water. This in turn produces a gel with the other materials in the pack. This is desirable because ammonium chloride reacts with water at a different rate in the cold pack than the rate at which calcium chloride reacts with water in the hot pack. The starch used in the cold pack is also precooked in the cold pack since the pack is not able to generate any heat to cook the starch.

Preferably the starch in the hot and cold packs is in the form of particles rather than granules. This is desirable since granules would tend to accumulate at the position of sealing the container 13 and would tend to prevent the container from being effectively sealed.

A second embodiment of the pack 11 is shown in FIG. 2. In this embodiment the container or bag 13 is shown with a marginal region 29 around the periphery of the container 13 and a seam 31 connecting the marginal region 29 with the bag 21. In this embodiment the container or bag 13 is typically constructed of a flexible plastic such as polyethylene and the marginal region 29 and the seam 31 is typically formed by heat sealing. The seam 31 is weaker than the seals around the remaining portions of the container 13 and the bag 21. In this embodiment, the first chemical 19 and the starch 23 are disposed in the container 13. The second chemical 17 such as water is disposed in the bag 21.

In operating this embodiment, the bag 21 is typically struck, thereby opening seam 31 so that the first and second chemicals 19 and 17 can be mixed. The opening in the seam 31 occurs so that the container 13 and the bag 21 form a single sealed compartment. The chemicals 19 and 17 react chemically when mixed and the starch 23 forms a gel with these chemicals in a manner similar to that described above.

Although this application has been disclosed and illustrated with reference to particular applications, the principles involved are susceptible of numerous other applications which will be apparent to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

Other embodiments may be used without departing from the scope of the invention. For example, the material such as calcium chloride and ammonium nitrate may be mixed in a bag with the material such as starch which is to form a paste when the pack is used. When the pack is to be used, water is poured through an opening in the container holding the chemicals. In other embodiments of the invention, a clip may be provided in the bag 21 and may be removed to provide a mixing of the chemicals when the pack is to be used.

1. A pack for transferring heat or cold to an object comprising:
a container having walls for transferring heat or cold to the object;
at least a pair of chemicals disposed within said container and capable of reacting chemically in a temperature-altering reaction to generate heat or cold whereby said heat or cold is readily transferred through the walls of said container to the object; and
means disposed within said container and reacting with at least one of said pair of chemicals to produce a gel, the gel providing the pack with characteristics throughout the chemical reaction of said chemicals for being shaped to any desired configuration while inhibiting the flow of the chemicals in the pack.

2. A pack as defined in claim 1 wherein:
said gel-producing means comprises particles of a material having properties of holding at least one of said chemicals in suspension whereby said chemical is temporarily isolated at least in part from said temperature-altering reaction and the time during which said chemical enters said reaction is prolonged.

3. A pack as defined in claim 2 wherein:
one of the chemicals is water and the gel-producing means has the property of absorbing water and wherein means are provided for separating the water from the other chemical and the gel-producing means and for providing for a mixing of the water with the other chemical and the gel-producing means when the pack is to be used to generate heat or cold.

4. A pack for transferring heat or cold to an object comprising:
at least a pair of chemicals capable of reacting chemically to generate heat or the absence thereof in a temperature altering reaction;
a sealed container retaining said chemicals and having walls through which heat or cold is readily transferred;
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first means disposed within the sealed container releasably isolating a particular one of said chemicals from the other of said chemicals so that their reaction can be prevented prior to a pre-determined time; and
second means disposed within said container in mixed relationship with the other chemical and having properties of forming a gel-like, viscous fluid with at least one of the pair of chemicals, upon the release of the particular one of the chemicals by the first means, to provide for a shaping of the pack to any desired configuration during the temperature-altering reaction while inhibiting the movement of the chemicals within the pack.

5. A pack as defined in claim 4 wherein said second means has a particular configuration and properties of forming a paste with the particular one of the chemicals.

6. A pack as defined in claim 4 wherein said second means is in the form of a starch having properties of becoming cooked when the chemicals in the pack react chemically to produce a particular temperature and wherein the particular one of the chemicals comprises water and wherein the starch forms a paste with the water when cooked and wherein the paste forms a gel with the chemicals in the pack to inhibit the movement of the chemicals in the pack and to prolong the period of time during which heat is transferred from the pack.

7. A pack as defined in claim 5 wherein the particular one of said chemicals is water; and
said second means comprises a precooked starch and
said other chemical reacts chemically with the water to produce an endothermic reaction and wherein the starch produces a paste with the water and wherein the paste forms a gel with the chemicals in the pack to inhibit the movement of the chemicals within the pack and to prolong the time during which cold is transferred from the pack.

8. A pack for transferring heat or cold to an object, comprising:
a first chemical;
at least one other chemical having characteristics for reacting chemically with said first chemical to generate heat or cold in a temperature altering reaction,
a sealed container enclosing said first chemical and including walls which readily transfer heat or cold to said object;
a rupturable bag disposed within said sealed container and holding said other chemical for mixing with the first chemical within said sealed container upon rupture of said bag;
said gel-producing means comprises particles of a material having properties of holding at least one of said chemicals in suspension whereby said chemical is temporarily isolated in at least part from said temperature-altering reaction and the time during which said chemical enters said reaction is prolonged; and wherein
one of the chemicals is water and the gel-producing means has the property of absorbing water and wherein means are provided for separating the water from the other chemical and the gel-producing means thereby providing for a mixture of the water with the other chemical and the gel-producing means when the pack is to be used to generate heat or cold.

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