A disposable self-heating assembly for use for heating the contents of a container, including a container pre-filled with liquid, a heating unit support element, and a disposable heating unit. The disposable heating unit includes a first region containing a first combination of at least two solid substances which undergo an exothermic chemical reaction which is non-spontaneous at room temperature requiring relatively high activation energy. Adjacent to the first region is a second region containing a second combination of at least two solid substances which undergo an exothermic chemical reaction which is non-spontaneous at room temperature requiring relatively low activation energy. A primer is configured for ignition in close proximity to the second combination of solid substances in the ignition region. The second combination of solid substances undergoes an exothermic chemical reaction when exposed to the ignition of the primer, thereby initiating the exothermic chemical reaction of the solid substances.
DISPOSABLE SELF-HEATING CONTAINER

FIELD AND BACKGROUND OF THE INVENTION

[0001] The present invention relates to a disposable self-heating container assembly for use for heating the contents of a container.

[0002] It is known to provide self-contained, self-heating devices for quickly heating liquid foods such as beverages, soups and the like, in circumstances in which conventional heat sources are either unavailable or inconvenient.

[0003] For ease of presentation, the devices may be classified according to the mechanism used for heat generation into four groups. A first group employs hydration processes, a second employs acid-base reactions. A third employs spontaneous oxidation-reduction reactions in aqueous solutions, and a fourth employs kinetically non-spontaneous oxidation-reduction reactions between solid oxidant and a solid reductant. Each group will now be addressed in turn.

[0004] Turning firstly to devices employing hydration processes, these devices generate heat by adding water onto an ionic solid, such as calcium oxide or calcium chloride. Examples of this type may be found in U.S. Pat. No. 5,626,022 to Scudder et al., U.S. Pat. No. 5,388,565 to Ou, and U.S. Pat. No. 4,773,389 to Hamasaki.

[0005] These devices have been found relatively simple to implement and use. However, the hydration processes used suffer from a number of inherent limitations. Firstly, the specific heat of the reactions employed is relatively low (roughly 100 Cal/ml), requiring the use of a large storage volume to provide a given heating effect. This problem is exacerbated by the significant heat energy which is absorbed by heating up the aqueous phase. Furthermore, the presence of significant quantities of water inherently limits the temperature of the heating unit to 100°C, such that the liquid food rarely reaches in excess of about 80°C.

[0006] A second approach employs mixing of acids and bases. A recent patent that takes advantage of this approach is U.S. Pat. No. 5,935,486 to Bell et al. that involves mixing of various organic and inorganic acids and bases.

[0007] The third approach uses oxidation-reduction reactions occurring in the aqueous phase. Examples of this type include U.S. Pat. No. 5,517,981 to Taub et al. in which magnesium is mixed with cupric chloride in the presence of water and the U.S. Pat. No. 3,998,749 to Hydro et al. where aluminum and cupric chloride are mixed in a mixture of aqueous and organic solvents.

[0008] Oxidation reactions of this type are highly exothermic, providing greater heat per unit storage volume than hydration reactions. However, the use of such reactions also presents certain problems. Firstly, the reactions tend to progress very rapidly, making it difficult to ensure efficient heat transfer to the liquid food. Furthermore, because of the need for the presence of some water, substantial energy is wasted in heating the water or boiling part of it. Finally, most reactions in this group produce significant quantities of dangerous gases such as hydrogen, and the waste solution may include hazardous substances, leading to numerous safety and environmental problems.

[0009] A fourth group of devices achieve significant advantages of efficiency, simplicity of structure and controllability by using solid phase self-propagating high-temperature synthesis (SHS) reactions, which include oxidation-reduction processes in the solid-state (such as thermit reactions). These reactions are basically redox reactions between metals or semimetals and metal oxide, such as aluminum, silicon and ferric oxide. In addition, these reactions are gas-less processes that involve harmless materials, and generate large amounts of heat per unit volume (or weight) of the reagents. The temperature of SHS reactions is above 1000°C, which requires good heat transfer and a safe metallic inner container. The rate of reaction may be controlled by appropriate choice of metals and metal oxides, grain size of the solids and path of reaction. Since the reactions are not kinetically spontaneous at room temperature, the components may be safely and conveniently mixed within a single chamber until activated by the user.

[0010] Self-heating devices based on various thermite reactions have been proposed. Examples include U.S. Pat. No. 4,506,654 to Zellweger et al., U.S. Pat. No. 4,819,612 to Okamoto et al., U.S. Pat. No. 4,949,702 to Suzuki et al., U.S. Pat. No. 5,020,509 to Suzuki et al., and U.S. Pat. No. 5,220,908 Iizuna et al. In all of these examples, the fuel is a mixture of a metal or alloys, such as silicon or ferrosilicon and a metal oxide, such as ferric oxide or cupric oxide.

[0011] Despite all of the above-mentioned advantages of solid-phase oxidation reactions, implementation of self-heating devices using these reactions is complicated by the need for an ignition system. Actuation of the chemical reaction is typically achieved by means of friction (similar to a match), by an electric ignition, or by manual ignition of an external fuse. An ignition system which provides the initiation energy by mixing small amounts of reagents which undergo a spontaneous exothermic chemical reaction, such as that used in U.S. Pat. No. 6,257,110 to Tenenbaum et al., involves several elements which require an accurate production and assembly and though inexpensive and uncomplicated, compared to previous designs, might not be the least expensive design possible.

[0012] There is therefore a need for a self-heating-container assembly and heating unit for use therewith which would employ a solid-phase oxidation reaction with a low-cost ignition system. It would also be highly advantageous to provide a device for heating the contents of a container according to which a main solid-phase oxidation reaction would be initiated by an intermediate exothermic chemical reaction ignited by a primer. It would be further desirable to provide the container with a dispensing apparatus that discourages direct oral consumption, and a serving receptacle that provides an opportunity for a reduction of the temperature of the liquid before consumption.

SUMMARY OF THE INVENTION

[0013] The present invention provides a disposable self-heating container assembly for use for heating the contents of a container, a heating unit for use in the assembly, a disposable self-heating container convenience package for storage, sales and end usage, and corresponding method for heating the contents of a container.

[0014] According to the teachings of the present invention there is provided, a disposable self-heating-container assem-
by for storing and heating a stored liquid, the container assembly comprising (a) container having a contained volume substantially enclosed by a plurality of walls including at least one side wall, a bottom and a cover, at least one of said walls providing a recessed cavity extending into said contained volume, at least one of said walls configured for structural interconnection with a heating unit support element; (b) a heating unit support element configured so as to support a heating unit at least partially inserted into said recessed cavity; and for structural interconnection with said container; (c) a disposable heating unit fixed to said base; and (d) a spout apparatus associated with a dispensing aperture, said spout apparatus including a pressure-released seal assembly, said spout apparatus being configured so as to inhibit direct oral consumption of the heated liquid contents of said container.

[0015] According to a further feature of the present invention, the recessed cavity is provided in the bottom.

[0016] According to a further feature of the present invention, the configuration for structural interconnection is provided in said at least one side wall proximal to and in association with said bottom.

[0017] According to a further feature of the present invention, the structural interconnection allows for relative displacement between said heating unit support element and said container.

[0018] According to a further feature of the present invention, the actuation is by relative displacement of said container and said heating unit support element.

[0019] According to a further feature of the present invention, the spout apparatus is deployed within dispensing aperture, the pressure-released seal configured to seal the container until a contained pressure with the container reaches a predefined level above atmospheric pressures.

[0020] According to a further feature of the present invention, when the pressure-release seal opens at the predefined level of pressure, the heated liquid is thereby allowed to be dispensed from the container by way of the spout apparatus.

[0021] According to a further feature of the present invention, the spout is located in a recess between structural portions of the container which inhibit direct oral consumption of contents of the container.

[0022] According to a further feature of the present invention, structural dimensions of the spout apparatus inhibit direct oral consumption of contents of the container.

[0023] According to a further feature of the present invention, there is also provided a cooling receptacle associated with the container.

[0024] There is also provided according to a further feature of the present invention, a disposable heating unit for use with the disposable self-heating-container assembly of claim 1, the disposable heating unit comprising a housing including: a first combination of at least two solid substances which undergo an exothermic chemical reaction which is kinetically non-spontaneous at room temperature, the exothermic chemical reaction having a second activation energy; and an ignition mechanism including a primer and an ignition implement, the ignition implement deployed so as to ignite the primer when the ignition mechanism is actuated, the ignition of the primer initiating the exothermic chemical reaction of the second combination of solid substances thereby initiating the exothermic chemical reaction of the first combination of solid substances.

[0025] According to a further feature of the present invention, the first activation energy is higher than the second activation energy.

[0026] According to a further feature of the present invention, the first combination of at least two solid substances includes at least one substance selected from the group consisting of metals, semimetals, metal alloys and metal-semimetal alloys.

[0027] According to a further feature of the present invention, the first combination of at least two solid substances includes at least one metal oxide.

[0028] According to a further feature of the present invention, the second combination of solid substances includes at least one substance selected from the group consisting of metals, semimetals, metal alloys, and metal-semimetal alloys.

[0029] According to a further feature of the present invention, the second combination of at least two solid substances includes at least one metal oxide.

[0030] According to a further feature of the present invention, the first combination of solid substances is located within a first region, the ignition region being substantially circumscribed by the first region, the ignition mechanism being associated with the ignition region such that ignition of the primer occurs substantially within the ignition region.

[0031] According to a further feature of the present invention, the ignition mechanism is configured such that the actuation is by relative displacement between the ignition implement and the primer.

[0032] There is also provided according to a further feature of the present invention, a disposable self-heating-container convenience package for storing, selling, heating, and serving a stored liquid, the convenience package comprising: a container having a contained volume substantially enclosed by a plurality of walls including at least one side wall, a bottom and a cover, at least one of the walls providing a recessed cavity extending into the contained volume; a heating unit disposed within the recessed cavity; and at least one serving receptacle associated with the container.

[0033] According to a further feature of the present invention, there is also provided a heating unit support element configured so as to support the heating unit in alignment with the recessed cavity.

[0034] According to a further feature of the present invention, the heating unit is the heating unit referred to above.

[0035] According to a further feature of the present invention, there is also provided a spout apparatus associated with the container, the spout apparatus including a pressure-
released seal assembly, the spout apparatus being configured so as to inhibit direct oral consumption of contents of the container.

[0036] According to a further feature of the present invention, the serving receptacle is additionally configured for use as a cooling receptacle.

[0037] According to a further feature of the present invention, at least one serving receptacle is deployed so that together with the container cover there is provided a substantially enclosed storage volume for storage of food items.

[0038] There is also provided according to a further feature of the present invention, a method for heating the contents of a container comprising: providing a housing in thermal communication with the contents of the container, the housing containing a mixture of at least two solid substances which undergo a main chemical reaction which is exothermic but is not kinetically spontaneous at room temperature; and activating the main chemical reaction by ignition of a primer which initiates an intermediate exothermic chemical reaction.

[0039] According to a further feature of the present invention, there is also provided a safety device which prevents accidental activation and which can be removed prior to usage.

BRIEF DESCRIPTION OF THE DRAWINGS

[0040] The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

[0041] FIG. 1 is a vertical cross-section taken through a first embodiment of a disposable self-heating-container assembly, constructed and operative according to the teachings of the present invention, for storing and heating a stored liquid;

[0042] FIG. 2 is an enlarged view of a preferred embodiment of an ignition mechanism, constructed and operative according to the teachings of the present invention;

[0043] FIG. 3 is an enlarged view of a pressure-released seal and dispensing spout for use with various embodiments of the present invention, shown in its closed state; and

[0044] FIG. 4 is a vertical cross-section taken through a first embodiment of a disposable self-heating-container convenience package, constructed and operative according to the teachings of the present invention, for storing, selling and heating a stored liquid.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0045] The present invention provides a disposable self-heating container assembly for use for heating the contents of the container, a heating unit for use in the container assembly, a disposable self-heating container convenience package for storage, sales and end usage, and corresponding methods for heating the contents of a container.

[0046] The principles and operation of disposable self-heating assemblies according to the present invention may be better understood with reference to the drawings and the accompanying description.

[0047] Referring now to the drawings, FIG. 1 shows a preferred embodiment of a disposable self-heating-container assembly, constructed and operative according to the teachings of the present invention, which employs a disposable heating unit for heating a stored liquid.

[0048] The assembly employs a disposable heating unit which has a housing 10 including a first region 12 containing a combination of at least two solid substances which undergo a primary reaction that is an exothermic chemical reaction which is kinetically non-spontaneous at room temperature requiring relatively high activation energy. The housing further contains an ignition region 14, adjacent to first region 12, which contains a second combination of solid substances which undergo an exothermic chemical reaction defining at least one intermediate reaction. This intermediate reaction is also kinetically non-spontaneous at room temperature but has a relatively low activation energy. This provides the relatively high activation energy for the primary reaction. An ignition mechanism 16, containing a primer and an ignition pin, is configured for ignition of the primer substantially within the ignition region 14. Pyrotechnic primers, such as percussion primers and stab primers are devices well known to those skilled in the art of pyrotechnics. The composition and structure of primers is taught in numerous patents, such as U.S. Pat. Nos. 5,466,315 and 5,717,159. The primer used here is a stab primer. As the ignition pin penetrates into the primer, the primary pyrotechnic material is ignited as a result of the heat generated by the friction of the penetration.

[0049] Operation of the assembly is as follows. Firstly, the ignition pin ignites the primer initiating an intermediate exothermic reaction of the substances in the ignition region 14. The heat generated by this reaction is sufficient to provide the required activation energy to initiate the reaction of the solid substances in the first region 12. This latter reaction then progresses, generating heat which is transferred through housing 10 to the contents of the container. This method of using a chain of reactions to initiate a primary reaction is well known within the art of pyrotechnics.

[0050] It should be noted that the present invention is applicable to a very wide range of applications in which a liquid (used herein to refer also to a mixture of solids together with a liquid) needs to be warmed, heated, boiled or cooked in circumstances in which conventional heat sources are unavailable, unsafe or inconvenient. In domestic applications, the invention may be used for heating water which may be used for preparing drinks, instant soups and the like, or for a range of other uses such as personal hygiene. Alternatively, beverages, soups or solids such as vegetables mixed in water or other liquids may be heated directly within the container. All such applications are referred to generally as "liquid food" applications. Other possible non-food applications include, but are not limited to, heating of fumigants and various chemicals for any purpose required.

[0051] In structural terms, the heating element of the present invention may be produced in numerous forms suited to a wide range of different applications. In one particularly preferred application which will be used herein to illustrate the principles of the present invention, the heating unit is part of a disposable container which is used to store a liquid prior to use, and then to heat and dispense
the liquid on demand. The entire assembly is then discarded. In an alternative set of applications, the heating element may be a replaceable insert within a reusable container, forming what may be regarded as a kettle operated by single-use replaceable inserts. In yet a further set of applications, the heating unit may be implemented as a free-standing heating element for immersion into a container in a manner similar to an electric immersion heater.

[0052] It should be noted that the only essential characteristics of the primary and intermediate reaction are that the primary reaction is a solid-solid exothermic reaction which is kinetically non-spontaneous at room temperature and pressure requiring relatively high activation energy while the intermediate reaction is a solid-solid exothermic reaction which is kinetically non-spontaneous at room temperature and pressure requiring relatively low activation energy, and the intermediate reaction being initiated by ignition of a primer. Preferably, the primary reaction is an oxidation reaction between a metal, semimetal, metal alloy, metal-semimetal alloy or mixtures thereof with one or more metal oxide. In a particularly preferred implementation, silicon is combined with a metal, typically iron or aluminum, to achieve a slower rate of reaction than when using a metal alone. An advantageous rate of reaction has been observed when using a ratio, by weight, of silicon to aluminum of greater than 1:1, and preferably about 2:1. A preferred example of the metal oxide is ferric oxide (Fe₂O₃). Thus, a preferred example of the overall composition of the solid substances of the primary reaction is about 22% silicon, about 11% aluminum and about 67% ferric oxide, by weight.

[0053] In addition to adjustment of the composition, the rate of reaction can be further adjusted by varying the mechanical properties of the mixture. Relevant parameters include the grain size of the particles, the degree of consolidation, and the path of the reaction as defined by the shape of the container.

[0054] With regard to the intermediate reaction, this preferably employs a solid oxidant as the first reagent. Preferred examples include, but are not limited to, at least one of potassium permanganate, manganese oxide, potassium chloride, barium peroxide and potassium nitrate. The solid oxidant in the ignition region 14 is present together with a metal and/or semi-metal or alloy thereof. A typical preferred example employs 22% aluminum, 5% silicon, and 73% KMnO₄. The ignition region 14 is preferably separate from the first region 12 which contains the mixture for the primary reaction, but can optionally be implemented overlapping or intermixed therewith. The physical properties of the solid within the ignition region 14 may be varied to affect the rate of reaction. In order to minimize the quantities of reagents required to reliably initiate the primary reaction, it is a preferred feature that at least part of the ignition region 14 is disposed within a recess formed in first region 12 so that at least part of the ignition region 14 is substantially circumscribed by first region 12.

[0055] Turning now to the features of the embodiment of FIG. 1 in more detail, this illustrates what is believed to be a particularly advantageous configuration for the disposable self-heating-container assembly of the present invention. Specifically, there is shown a container 18 which has a contained volume 20 substantially enclosed by a plurality of walls including at least one side-wall 22, a bottom 24 and a cover 26. At least one of the walls, most preferably bottom 24, provides a recessed cavity 28 projecting into contained volume 20. Housing 10 is disposed within recessed cavity 28 so as to be displaceable relative to container 18. The ignition mechanism 16 is deployed between housing 10 and a surface of recessed cavity 28, the ignition pin actuation block 40 is supported by the ignition mechanism housing 42 which also contains the primer which is ignited by relative displacement between housing 10 and container 18. Thus, displacement of housing 10 relative to container 18 serves as an actuation mechanism to cause ignition of the primer substantially within the ignition region 14 to initiate heating. With regard to the embodiment shown here, the displacement of the housing relative to the container is achieved by pressing the container 18 toward the base 110 thereby causing the ignition actuation block 40 to come into contact with the bottom 24 of the container. The actuation block is then displaced into the ignition mechanism housing 42 thereby igniting the primer.

[0056] Various precautions are preferably taken to avoid exposure of the user and proximal surfaces to the very high temperatures generated by the heating unit. Firstly, a part of first region 12 closest to the outside of container 18 may be provided with a layer of material 34 which is stable at high temperatures and has a high heat-capacity, such as ceramics. This serves as a heat storage device, prolonging the period over which heat is given out by the heating unit. At the same time, material 34 provides an additional safety buffer zone between the intense heat of the reaction region and proximal surfaces external to the container.

[0057] For additional safety and convenience of handling, the entire container 18 is preferably made from materials which can withstand high temperatures, typically steel or other metals approved for use with food, and is coated with an insulating material, typically plastic.

[0058] It should be noted structural implementations of the present invention may vary widely with respect to numerous features described in the non-limiting examples provided herein. For example, it should be noted that the heating element may optionally be located in positions other than in bottom 24. By way of example, the recessed cavity may be formed in the cover.

[0059] This embodiment also illustrates certain additional safety features which, it should be appreciated, are equally applicable to any other embodiments of the invention described above. It should be noted that various options may be used to prevent accidental actuation of heating unit 10 prior to use. In the example illustrated here, actuation of heating element 10 is achieved by relative displacement of container 18 and a base portion 110 which are temporarily locked against relative movement by a spring locking element 112 which engages a slot 114 in each and must be removed prior to initiation. Additional or alternative structures which may be used to advantage to offer similar or complementary preventive properties include, but are not limited to, bayonet structures which must be rotated to allow relative vertical motion, and tear-off retaining elements such as a plastic retaining ring.

[0060] The ignition mechanism 16 is shown clearly in FIG. 2. Specifically, ignition pin actuation block 40 is supported by the ignition mechanism housing 42 so as to align the ignition pin 46 with the primer 44. As the base and
container sections of the disposable self-heating-container assembly are pressed together, the ignition pin actuation block comes into contact with the bottom of the container. This, in turn, causes the ignition pin actuation block to move further into the ignition mechanism housing, causing the ignition pin to come into contact with the primer, thereby igniting the primer.

[0061] A further important feature is the use of a spout apparatus 88 that also acts as a pressure-released seal, and includes a dispensing spout 104. It is an important safety consideration that there should not be a build up of pressure within container 18 during operation of the heating unit. In the prior art, this was addressed by ensuring that the container was opened prior to actuation the heating unit. This, however, raises a different safety issue, namely, the risk of overheating in the event that the user were to pour out the contents of the container prior to or during operation of the heating unit. An alternative approach to avoiding problems of pressure build up, while also preventing premature emptying of the container, is the use of a pressure-released seal such as is shown here.

[0062] The structure of spout apparatus 88 is shown more clearly in FIG. 3. Specifically, spout apparatus 88 is formed from a flexible hollow plug 90 which fits into an aperture 92. Plug 90 has a radially projecting ridge 94 which is slightly oversized for aperture 92 but which can be inserted due to the flexibility of the plug material. Plug 90 also features a cylindrical recess 96 that narrows to an opening 98 in the portion of the plug that is inserted through the aperture. A lock element 100 is slidably within recess 96 of plug 90 between a locked position, shown here, and a pressure-released dispensing position.

[0063] When plug 90 is inserted into aperture 92 and lock element 100 is displaced to its locked position, lock element 100 becomes locked by friction against side of the recess that is pressed between the lock element and the periphery of aperture 92 such that lock element 100 cannot be removed. This prevents premature emptying out of the contents of container 18, since lock element 100 blocks the dispensing passageway between holes 98 and 102. When the heating unit is actuated, the temperature of the contents of the container starts to rise. When the water content reaches a predefined temperature, typically about 95° C., sufficient steam pressure is generated to place lock element 100 to its pressure-released dispensing position. When lock element is displaced to its pressure-released dispensing position, the hot contents of the container may be dispensed through holes 98 and 102, and spout 104 respectively. As shown here, the spout 104 is positioned back from the edge of the container cover so as to inhibit oral consumption of the heated liquid directly from the container. It should be noted that lock element 100 may further be held in place by components such as shear-pins or having a small protrusion from lock element 100, which is releasable at a predetermined pressure, fit into a groove in plug 90.

[0064] It will be appreciated that this spout apparatus provides a highly advantageous combination of properties for applications in which a fluid to be heated is stored in container 18 prior to use, since the container cannot be emptied prior to or during operation of the heating unit. At the same time, since the seal is released automatically by pressure increase within the container, excessive pressure build up is avoided. In addition, in cases of extreme pressure build, possibly caused by the malfunction of the moving parts of the seal, the entire flexible plug would be ejected from the aperture thereby releasing the pressure. In such an event, the flexible plug would remain connected to the container by the safety retaining strap 106 which is fixed to the cover of the container.

[0065] Additionally, at the end of the heating process, the liquid food within the container is at boiling temperature, which is too hot to consume. In fact, a major consideration in the design of the spout is to prevent the user from consuming the liquid food directly from the container. The spout enables the user to conveniently pour the liquid food into the receptacle described in FIG. 4 below. During this process, the liquid food comes into contact with the ambient air and is thereby sufficiently for consumption. This is the same principle as pouring a liquid from a kettle into a cup.

[0066] Finally, FIG. 4 shows additional features of the disposable self-heating-container convenience package for storing, selling and heating a stored liquid. In addition to the features of the assembly mentioned above, at least one serving receptacle may be secured over the cover of the container. The attached serving receptacle serves two purposes. Firstly, it directly provides the needed serving receptacle to aid in the cooling process of the heated liquid as mentioned above. Further, it provides a storage volume for supplemental food items such as cookies, crackers, or candies. The serving receptacle may vary in size and shape depending on the size of the container and the serving requirements of the liquid inside. For soups, the container may have a larger circumference and the serving receptacle may be in the form of a bowl with a spoon and crackers inside. For beverages, the serving receptacle may be in the form of a cup with a cookie, and sugar and creamer packets inside. For multiple-serving sized containers there may be two or more serving receptacles, each containing a supplemental food item. The embodiment shown here includes an elongated larger sized container 18, fitted with two cups 120. The convenience package, as illustrated, could provide heated beverage, cups, cookies, sugar and creamer for two people.

[0067] It will be appreciated that the above descriptions are intended only to serve as examples, and that many other embodiments are possible within the spirit and the scope of the present invention.

What is claimed is:

1. A disposable self-heating-container assembly for storing and heating a stored liquid, the container assembly comprising:

(i) a container having a contained volume substantially enclosed by a plurality of walls including at least one side wall, a bottom and a cover, at least one of said walls providing a recessed cavity extending into said contained volume, at least one of said walls configured for structural interconnection with a heating unit support element;

(ii) a heating unit support element configured so as to support a heating unit at least partially inserted into said recessed cavity, and for structural interconnection with said container;

(iii) a disposable heating unit fixed to said base; and

(iv) a spout apparatus associated with a dispensing aperture, said spout apparatus including a pressure-released seal assembly, said spout apparatus being configured so as to inhibit direct oral consumption of the heated liquid contents of said container.
2. The container assembly of claim 1, wherein said recessed cavity is provided in said bottom.

3. The container assembly of claim 1, wherein said configuration for structural interconnection is provided in said at least one side wall proximal to and in association with said bottom.

4. The container assembly of claim 1, wherein said structural interconnection allows for relative displacement between said heating unit support element and said container.

5. The container assembly of claim 1, wherein said actuation is by relative displacement of said container and said heating unit support element.

6. The container assembly of claim 1, wherein said spout apparatus is deployed within dispensing aperture, said pressure-release seal configured to seal said container until a contained pressure with said container reaches a predefined level above atmospheric pressures.

7. The spout apparatus of claim 6, wherein when said pressure-release seal opens at said predefined level of pressure is reached, the heated liquid is thereby allowed to be dispensed from said container by way of said spout apparatus.

8. The container assembly of claim 1, wherein said spout is located in a recess between structural portions of said container which inhibit direct oral consumption of contents of said container.

9. The container assembly of claim 1, wherein structural dimensions of said spout apparatus inhibit direct oral consumption of contents of said container.

10. The container assembly of claim 1, further comprising a cooling receptacle associated with said container.

A disposable heating unit for use with the disposable self-heating-container assembly of claim 1, the disposable heating unit comprising a housing including:

(i) a first combination of at least two solid substances which undergo an exothermic chemical reaction which is kinetically non-spontaneous at room temperature, said exothermic chemical reaction having a first activation energy;

(ii) an ignition region containing at least a second combination of at least two solid substances which undergo an exothermic chemical reaction which is kinetically non-spontaneous at room temperature, said exothermic chemical reaction having a second activation energy; and

(iii) an ignition mechanism including a primer and an ignition implement, said ignition implement deployed so as to ignite said primer when said ignition mechanism is actuated, said ignition of said primer initiating the exothermic chemical reaction of said second combination of solid substances thereby initiating the exothermic chemical reaction of said first combination of solid substances.

12. The heating unit of claim 11, wherein said first activation energy is higher than said second activation energy.

13. The heating unit of claim 11, wherein said first combination of at least two solid substances includes at least one substance selected from the group consisting of metals, semimetals, metal alloys, and metal-semimetal alloys.

14. The heating unit of claim 11, wherein said first combination of at least two solid substances includes at least one metal oxide.

15. The heating unit of claim 11, wherein said second combination of solid substances includes at least one substance selected from the group consisting of metals, semimetals, metal alloys, and metal-semimetal alloys.

16. The heating unit of claim 11, wherein said second combination of at least two solid substances includes at least one metal oxide.

17. The heating unit of claim 11, wherein said first combination of solid substances is located within a first region, said ignition region being substantially circumscribed by said first region, said ignition mechanism being associated with said ignition region such that ignition of said primer occurs substantially within said ignition region.

18. The heating unit of claim 11, wherein said ignition mechanism is configured such that said actuation is by relative displacement between said ignition implement and said primer.

19. A disposable self-heating-container convenience package for storing, selling, heating, and serving a stored liquid, the convenience package comprising:

(i) a container having a contained volume substantially enclosed by a plurality of walls including at least one side wall, a bottom and a cover, at least one of said walls providing a recessed cavity extending into said contained volume;

(ii) a heating unit disposed within said recessed cavity; and

(iii) at least one serving receptacle associated with said container.

20. The convenience package of claim 19, further comprising a heating unit support element configured so as to support said heating unit in alignment with said recessed cavity.

21. The convenience package of claim 19, wherein said heating unit is the heating unit of claim 11.

22. The convenience package of claim 19, further comprising a spout apparatus associated with said container, said spout apparatus including a pressure-release seal assembly, said spout apparatus being configured so as to inhibit direct oral consumption of contents of said container.

23. The convenience package of claim 19, wherein said serving receptacle is additionally configured for use as a cooling receptacle.

24. The convenience package of claim 19, wherein said at least one serving receptacle is deployed so that together with said container cover there is provided a substantially enclosed storage volume for storage of food items.

25. A method for heating the contents of a container comprising:

(i) providing a housing in thermal communication with the contents of the container, the housing containing a mixture of at least two solid substances which undergo a main chemical reaction which is exothermic but is not kinetically spontaneous at room temperature; and

(ii) activating said main chemical reaction by ignition of a primer which initiates an intermediate exothermic chemical reaction.

26. The method of claim 25 which further comprises a safety device which prevents accidental activation and which can be removed prior to usage.