An apparatus for preserving a person's body temperature comprises an outer case and an inner case that is inserted inside. The outer case is composed of polyester material and is waterproof, antistatic and radiolucent. It comprises two openings at two adjacent sides, and one of the openings can be closed or fastened using a non-metal zipper. It can be made in different sizes. The inner case comprises transparent polyvinyl chloride (PVC) material divided into a plurality of compartments 1-4, where each compartment is filled with fine granules of soda lime. The inner case further comprises PVC tubes which pass through the periphery of the inner case and has openings 8 corresponding with each compartment. Carbon dioxide 9 is then passed through the compartments, which reacts with the soda lime to produce heat in an exothermic reaction. This device can help warm a patient if the body temperature falls below normal (i.e., when the patient is hypothermic).
NON-ELECTRICAL WARMING MATTRESS

The invention relates to an apparatus used in generating heat without electric power. Warm mattress is a heat source for the prevention and treatment of hypothermic states of patients. The design of the apparatus enables its application almost in all fields of health service, anaesthetic rooms, operating rooms, post-anaesthesia care units (PACU), intensive care units, and in the surgical, neonatal, paediatric, geriatric, emergency, internal medicine, and obstetrics and gynecology departments. The non-electric warm mattress is designed for use on beds and on operating tables during surgical procedures.

Hypothermia is a fall in the core body temperature. Patient's body temperature may fall to a critical level and this has harmful effects on the functions of the different systems of human body and may lead to death. The young, the elderly, the traumatized and the anaesthetized patients are particularly vulnerable to develop hypothermia. Active steps have to be taken to protect against the occurrence of hypothermia such as adjusting ambient temperature of the room/ward, the use of fluid/blood warmer, the availability of warming mattress on the operating table or bed, and the use of surface forced air warming. I have done some search and did not come across documents, previous inventions or any means for warming of patients (without electrical power).

I carried out the necessary search and did not come across documents, previous inventions, or any means of warming patients without the use of electric power.

The aim of this invention is to generate heat from non-electric source to protect patients against the development of hypothermia and treat hypothermia if it happens.

The aim of this invention is to generate heat from non-electric source to be utilized in the protection of patients against the development of hypothermia and to treat hypothermia if it happens.

Warming mattresses in current use depend on the presence of electric current. The heat generated is the result of heating metal or other coils by passing electric current through them. There are different sizes of the warming mattresses to suit patients. However, there are several disadvantages of the use of the electric warming mattress in today's use which include: overheating, fire hazards, and the effect of the presence of electromagnetic field on the human body.

Soda lime is a substance containing the hydroxides of sodium and calcium and is used widely in anaesthetic breathing circuits to absorb carbon dioxide gas (CO₂) which is expired by anaesthetised patients. The main components of soda lime are:
- Calcium hydroxide, Ca(OH)₂ (about 75%)
- Water, H₂O (about 20%)
- Sodium hydroxide, NaOH (about 3%)
- Potassium hydroxide, KOH (about 1%)

A product of the absorption of carbon dioxide by the soda lime is heat as shown in the following chain of reactions:

Carbon dioxide + water form carbonic acid

Carbonic acid + sodium hydroxide result in sodium carbonate + water + heat

Calcium hydroxide + sodium carbonate lead to calcium carbonate + sodium hydroxide + heat

By using chemical symbols the reactions proceed as follow:

\[ \text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3 \]

\[ 2\text{H}_2\text{CO}_3 + 2\text{NaOH} \rightarrow \text{Na}_2\text{CO}_3 + 4\text{H}_2\text{O} + \text{HEAT} \]

\[ 2\text{Ca(OH)}_2 + \text{Na}_2\text{CO}_3 \rightarrow 2\text{CaCO}_3 + 2\text{NaOH} + \text{HEAT} \]

The aim of this invention is to generate heat from non-electric source to protect patients against the development of hypothermia and treat hypothermia if it happens.

The intensity of the heat generated from the chain of reactions is gradual and may eventually reach 55°C. The process continues as long as CO₂ is flowing or the soda lime is exhausted. Signs of exhaustion of soda lime include cessation of heat production or change in the colour of the soda lime from pink to violet. At this stage the soda lime granules should be replaced by fresh ones for the reaction to continue.

The source of the carbon dioxide (CO₂) gas needed for the reaction is from carbon dioxide cylinders.

According to the present invention, this is an apparatus for use in the prevention and treatment of Hypothermia which composed of outer and inner cases. The outer case is available in several sizes made of waterproof, anti-static polyester material which does not hinder the passage of X-ray beams. It has a slot along the upper part and another one in one of the sides equipped with a non-metal zipper capable of closing this side when necessary. The inner case is made of transparent plastic material containing fine granules of soda lime as shown in figures (9-10-11-12).

The material of side tubes may be, polyvinyl chloride, waterproof, antistatic, and radio-lucent.

A preferred embodiment will now be described with reference to the accompanying drawings in which:
FIGURE 1 shows the outer case of the full length warming mattress made of polyester, waterproof, antistatic, and radio-lucent material. Its dimensions are: 1900mm for the length and 590mm for the width. It is open fully from the top (1) and from one side (2) to allow the insertion of the inner case. The edges of the side opening can be brought together and closed by the presence of a non-metal zipper 1.

FIGURE 2 is a side view of the outer case of the full length warming mattress shown in Figure 1. The top and one side of the outer case are open. The opening on the side has a zipper 1 to close it following the insertion of the inner case.

FIGURE 3, FIGURE 5, and FIGURE 7 show the different sizes of the outer case of the warming mattress. They are made of the same material and each has openings at the top and the side for the insertion of the corresponding inner case. FIGURE 4, FIGURE 6, FIGURE 8 are side views of the corresponding drawings.

The dimensions of outer cases are as follow:

FIGURE 3 represents the \( \frac{3}{4} \) length of the outer case of the warming mattress in Fig 1 with dimensions of 1200mm x 590mm. Figure 4 shows its side view.

FIGURE 5 represents the \( \frac{1}{2} \) length of the outer case of the warming mattress in Fig 1 with dimensions of 1070mm x 590mm. Figure 6 shows its side view.

FIGURE 7 represents the neonatal and pediatric version of the outer case of the warming mattress with dimensions of 560mm x 500mm. Figure 8 shows its side view.

FIGURE 9 shows the inner case of the full length of the non-electrical warming mattress made of transparent polyvinyl chloride material. It is 1890mm long and 580mm wide to fit snugly inside the outer case in Fig 1. It is divided transversely into four equal compartments (1, 2, 3 & 4). These compartments are filled with fine granules of soda lime. Passing along the inside of each periphery is a 5mm diameter tube made of polyvinyl chloride material (5). It protrudes 15cm to the outside at the top of the inner case (6), while it ends midway in the inside of the fourth compartment (7). At the middle of each compartment this peripheral tube has a 5mm diameter holes directed towards the lumen of the compartments (8). One tube will deliver carbon dioxide gas (CO2) (9) from its cylinder to the inside of each compartment to react with soda lime thus generating heat, while the other tube drains the waste to the outside by connecting it to a suction apparatus (10).

FIGURE 10, FIGURE 11, and FIGURE 12 represent the different types of the inner case:

FIGURE 10 fits inside the outer case in FIG 3 and measures 1190mm in length and 580mm in width.

FIGURE 11 fits inside the outer case in FIG 5 and measures 1060mm in length and 580mm in width.
FIGURE 12 fits inside outer case in FIG 7 and measures 550mm long and 490mm wide.

These inner cases may be used as long as soda lime is viable and heat is produced. Signs of exhaustion of soda lime can be easily detected by either: 1. change in the colour of the soda lime to violet. This can be detected through the transparent compartments, and 2. if heat is ceased to be produced. In either situation the inner case has to be replaced by a new one.
CLAIMS

1. An apparatus for preserving patient's body temperature or warming the patient if the body temperature falls below the normal, composed of outer case available in different sizes made of polyester, waterproof, antistatic, and radio-lucent material measuring 1900mm in length and 590mm in width and having full length two openings one on the top and the other on the side, the one on the side can be closed by the presence of non-metal zipper.

2. An apparatus as claimed in Claim 1 representing ¾ of the length of outer case described in Claim 1 and measures 1200mm long and 590mm wide.

3. An apparatus as claimed in Claim 1 representing ½ of the length of the outer case described in Claim 1 measuring 1070mm long and 590mm wide.

4. An apparatus as claimed in Claim 1 measuring 560mm in length and 500mm in width representing the neonatal and paediatric version of the outer case described in Claim 1.

5. An apparatus made from transparent polyvinyl chloride material to fit inside the outer case as claimed in Claim 1 measuring 1890mm long and 580mm wide divided transversely into four equal compartments filled with fine granules of soda lime.

6. An apparatus made from transparent polyvinyl chloride material to fit inside the outer case as claimed in Claim 2 measuring 1190mm long and 580mm wide divided transversely into three equal compartments filled with fine granules of soda lime.

7. An apparatus made from transparent polyvinyl chloride material to fit inside the outer case as claimed in Claim 3 measuring 1060mm long and 580mm wide divided transversely into two equal compartments filled with fine granules of soda lime.

8. An apparatus made from transparent polyvinyl chloride material to fit inside the outer case as claimed in Claim 4 measuring 550mm long and 570mm containing two compartments filled with fine granules of soda lime.

9. An apparatus as claimed in Claim 5 attached to the inside periphery of the four compartments consists of two 5mm diameter tubes made of polyvinyl chloride material having 3 holes of 5mm in diameter corresponding to the middle of the first 3 compartments protruding 15cm to the outside at the top while its open end terminates at the middle of the inside of the 4th compartment.

10. An apparatus as claimed in Claim 6 attached to the inside periphery of the three compartments consists of two 5mm diameter tubes made of polyvinyl chloride material having 2 holes of 5mm in diameter corresponding to the
middle of the first 2 compartments protruding 15cm to the outside at the top while its open end terminates at the middle of the inside of the 3rd compartment.

11. An apparatus as claimed in Claim 7 attached to the inside periphery of the two compartments consists of two 5mm diameter tubes made of polyvinyl chloride material having one hole of 5mm in diameter corresponding to the middle of the first compartment protruding 15cm to the outside at the top while its open end terminates at the middle of the inside of the 2nd compartment.

12. An apparatus as claimed in Claim 8 attached to the inside periphery of the two compartments consists of two 5mm diameter tubes made of polyvinyl chloride material having one hole of 5mm in diameter corresponding to the middle of the first compartment protruding 15cm to the outside at the top while its open end terminates at the middle of the inside of the 2nd compartment.
**Patents Act 1977: Search Report under Section 17**

**Documents considered to be relevant:**

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<th>Category</th>
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<th>Identity of document and passage or figure of particular relevance</th>
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<tr>
<td>X</td>
<td>1-4</td>
<td>US 2015/0020309 A1 (PITCHFORTH et al.) See abstract; figs. 2, 5; paragraphs [0051], [0065], [0068]</td>
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<td>A</td>
<td>-</td>
<td>WO 2009/135173 A2 (TEMPRA TECHNOLOGIES) See abstract</td>
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<td>US 4693235 A (VIGNEAU et al.) See abstract</td>
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- **X**: Document indicating lack of novelty or inventive step
- **Y**: Document indicating lack of inventive step if combined with one or more other documents of same category
- **&**: Member of the same patent family

- **A**: Document indicating technological background and/or state of the art.
- **P**: Document published on or after the declared priority date but before the filing date of this invention.
- **E**: Patent document published on or after, but with priority date earlier than, the filing date of this application.

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

- A47G
- A61F
- F24J

Worldwide search of patent documents classified in the following areas of the IPC:

- A47G
- A61F
- F24J

The following online and other databases have been used in the preparation of this search report:

- EPODOC
- WPI
- TXTA

**International Classification:**

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