Munich, 30 September 2025

MOCK - paper M3

A MOCK paper M3 in English is now available for testing and preparation purposes (see annex). Versions in German and French will be made available in due course.

When taking the mock paper, candidates should allow two hours for part 1, two and a half hours for part 2 and three hours for part 3.

A model solution addressing the expected answers for all parts will be provided shortly.

For the Examination Board
The Chairman

Jakob Kofoed

Europäisches Patentamt
European Patent Office
Office européen des brevets

Mock Paper M3-1

E-mail

Dear drafting team,

[001] As you know we have our monthly intellectual property group meeting next week. Set out below is a proposed invention we have received from our advanced cooking group and a published document D1 they believe is relevant. Please draft an independent claim based on the proposed invention which meets all the requirements of the EPC while providing the broadest possible protection and five claims defining good fallback positions. We would also like you to provide us with an introduction to the description defining the subject-matter and explaining in light of the prior art, the differences, the technical problem and its solution. The introduction must contain no more than 2000 characters (ca. 320 words). We intend to discuss your document at the meeting to help us decide whether or not we file a new European patent application based on the invention.

[002] The present proposal relates to cooking using solar radiation ("solar cooking"). Solar cooking is environmentally friendly and suitable for remote areas without a reliable supply of fuel or electricity. Solar cooking functions by concentrating solar radiation on a surface, which heats the surface to a temperature suitable for cooking. This process does not however function on cloudy days or during the night. The surface quickly cools down in the absence of solar radiation, interrupting the cooking. Therefore, there is a need to store heat for the cooking process.

[003] Heat can be stored based on the change of phase of a material. This involves heating the material until it reaches its melting temperature. Additional heat supplied to the material during melting does not increase its temperature but instead induces the change of phase from solid to liquid. The amount of heat necessary to complete the phase change is called “heat of fusion” and is released back by the material upon solidification.

[004] Heat storage based on change of phase is advantageous for solar cooking because, during melting, the temperature of the material is kept constant at the melting

temperature, thereby avoiding exposure of the solar cooker and especially the food to large temperature variations. The invention concerns heat storage based on this principle.

[005] The invention uses phase change materials, which provide an appropriate melting temperature and thermal conductivity. We require the heat storage unit to be able to supply heat at a temperature of between 50°C to 350°C and thus the materials must have a melting point in this temperature range. Metal chlorides, metal nitrates or mixtures of these materials that melt in this temperature range are especially suitable as they have a very good thermal conductivity. Other suitable materials can readily be identified from standard chemical databases.

[006] Brief description of the drawings:
Fig. 1 is a schematic drawing of a solar cooker with a heat storage unit.
Figs. 2 and 3 show embodiments of the heat storage unit.

[007] In Fig. 1, the solar cooker 1 comprises a heat storage unit 3 containing a phase change material 6. Solar radiation 12 concentrated by a parabolic mirror 11 heats the heat storage unit 3, thereby melting the material 6 and cooking the food 8. Should the solar radiation 12 be interrupted by clouds or sunset, the material 6 solidifies, releasing its heat of fusion to the food 8. The food 8 thus continues to cook in the absence of solar radiation.

[008] The heat storage unit 3 is shown in Fig. 2. It includes a box 4, that has to be provided with thermally-insulating walls to minimise heat loss. The box 4 contains the phase change material 6 and has handles 10. The box 4 typically also comprises an empty space 7 dimensioned to allow the material 6 to expand upon melting and reducing stress on the box. A light-absorbing plate 5, e.g. of black anodised aluminium, is fitted in a first opening of the box 4 and is in thermal contact with the material 6. The plate is necessary as the walls of the box only poorly conduct heat. A cooking plate 2 is fitted in a second opening of the box 4 and is also in thermal contact with the material 6, for example using fins 13 extending through the empty space 7. The cooking plate 2 is made of metal or ceramic and provides a cooking surface 9 on which food 8 to be cooked is placed.

[009] Fig. 3 shows another example of the heat storage unit 3. As in the example of Fig. 2, a box 4 with heat-insulating walls contains phase change material 6 and an empty space 7. In this embodiment, the box 4 has only one opening, in which a light-absorbing plate 5 is fitted. In the cooking process, the heat storage unit 3 is first mounted (Fig. 3 (a)) in the solar cooker 1 of Fig. 1 so that solar radiation 12 is concentrated on the light-absorbing plate 5. The temperature of the material 6 rises to the melting temperature, at which point the material 6 melts, storing the heat of fusion. When a sufficient amount of heat is stored, the heat storage unit 3 is detached from the solar cooker 1 and turned upside-down (Fig. 3 (b)). The handles 10 allow this step to be performed with a minimal risk of the cook being burnt. Alternatively oven gloves may be used. Thermal contact between the light-absorbing plate 5 and the melted material 6 is maintained, e.g. by means of fins 13. Food 8 is placed on the surface of the light-absorbing plate 5, which acts as the cooking surface 9 due to the heat of fusion being released from the material 6.

[010] We believe that the heat storage unit could be used to store environmentally friendly solar heat for uses other than solar cooking. A candle maker for example has recently expressed an interest in our solar heating technology. Candle making requires a temperature of 50-120°C.

Kind Regards
Marius Marcellus

Drawings of the Proposal

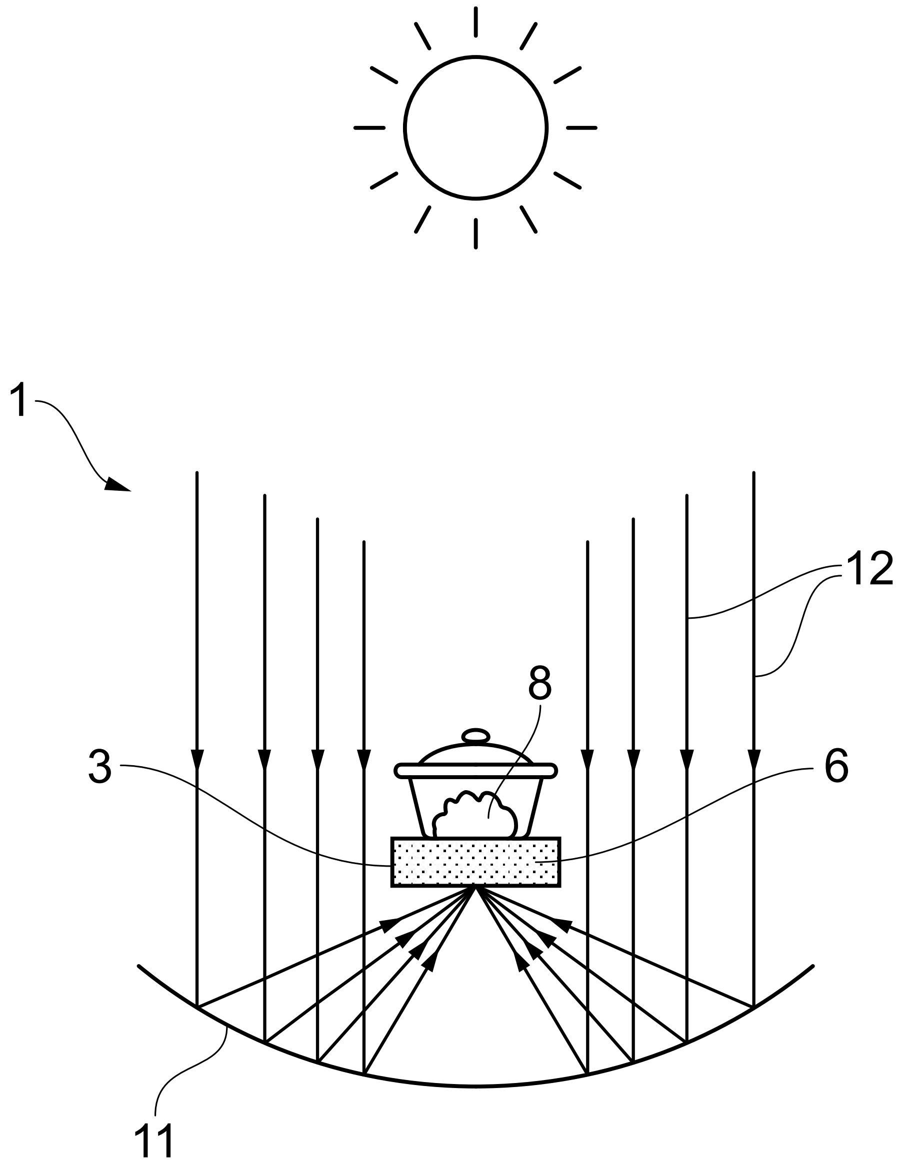


FIG. 1

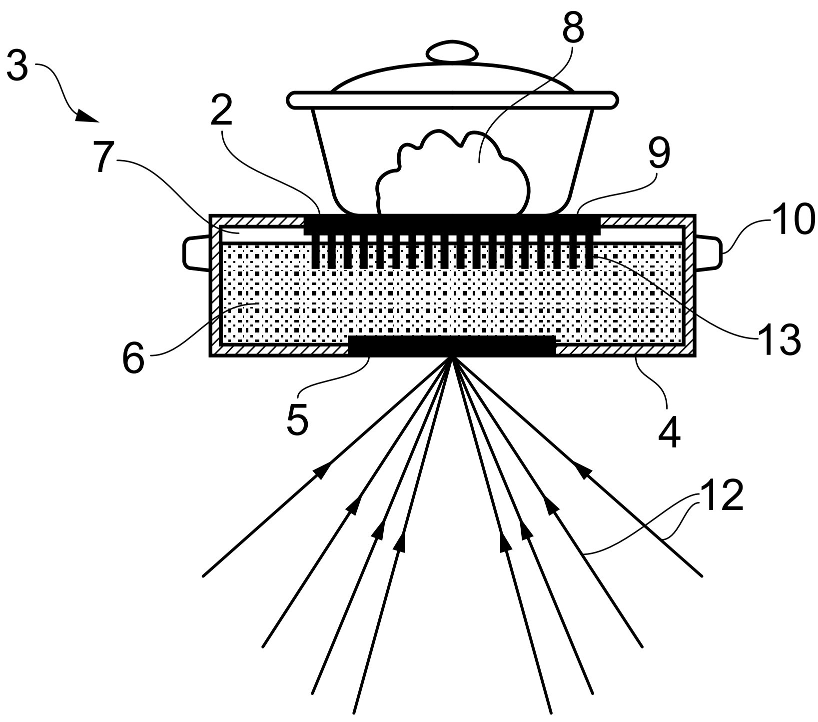


FIG. 2

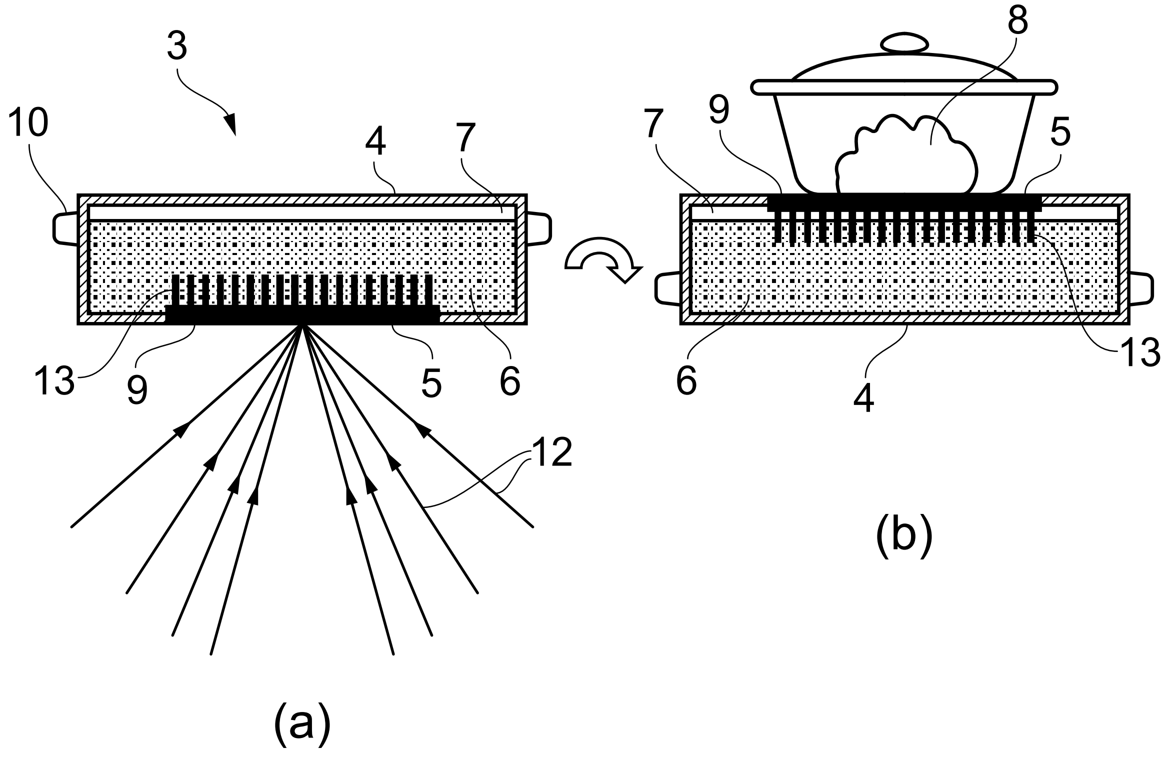


FIG. 3

D1: Solar cooker with parabolic light concentrator

[001] We present a cooker based on solar radiation. It is environmentally friendly and especially useful in remote areas where electricity or fuel is scarce.

[002] Our cooker (Fig. 1) includes a parabolic mirror 1 and a plate 2 located in the focus of the mirror. The aluminium plate 2 is black anodised on its bottom surface 3, in order to absorb light. The top surface of the plate holds the food 4 to be cooked. The food can be placed either directly on the plate for grilling, or in a pot.

[003] In the cooking process, the parabolic mirror is illuminated by solar light and concentrates it at its focal point on the bottom surface of the plate, which absorbs light and heats up, cooking the food 4. Under concentrated solar light, the plate rapidly reaches suitable cooking temperatures in the order of 110-350°C. A solid, single-piece plate without internal gaps provides good heat conduction and distribution. A further advantage of a plate made from black anodised aluminium is that it rapidly cools down as soon as it is no longer being illuminated by solar radiation, minimising the risk of burns when handling the plate.

D1 - Drawing

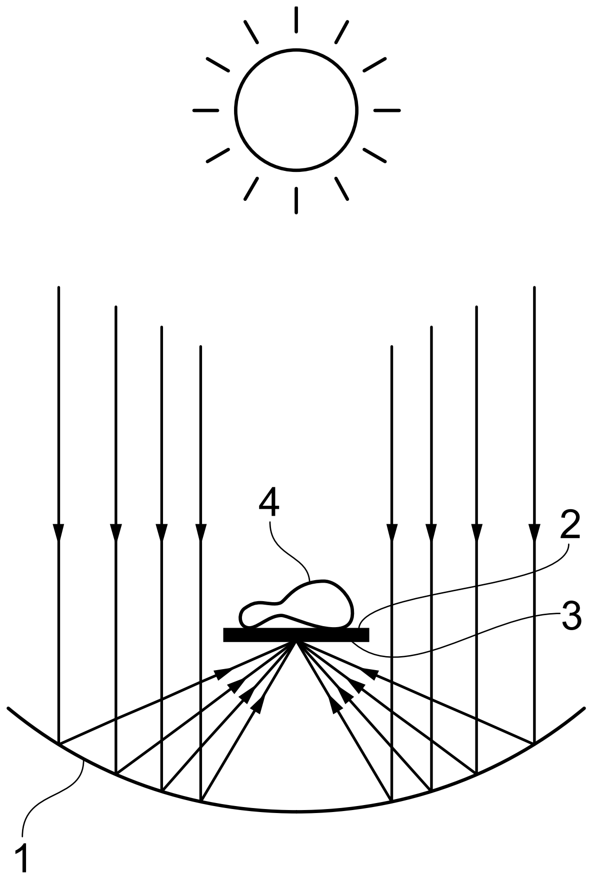


FIG. 1

Mock Paper M3-2

Description of the Application

[001] The present application relates to cooking using solar radiation ("solar cooking"). Solar cooking is environmentally friendly and suitable for remote areas without a reliable supply of fuel or electricity.

[002] The document D1 discloses a conventional cooking process wherein solar radiation is concentrated by a parabolic mirror onto a light-absorbing plate (see Fig. 1 of D1). Said plate heats up upon absorption of solar radiation, cooking the food placed on top of it. Said process does not however function on cloudy days or during the night. The plate quickly cools down in the absence of solar radiation, interrupting the cooking process. Therefore, there is a need to store heat for the cooking process.

[003] Heat is normally stored by raising the temperature of a material. To increase the amount of heat stored, the material thus has to reach high temperatures, with the disadvantage that the system has to sustain a wide temperature range.

[004] An alternative way of storing heat is based on the change of phase of a material. This involves heating the material until it reaches its melting temperature. Additional heat supplied to the material during melting does not increase its temperature but instead induces the change of phase from solid to liquid. The amount of heat necessary to complete the phase change is called “heat of fusion” and is released back by the material upon solidification.

[005] Heat storage based on change of phase is advantageous for solar cooking because, during melting, the temperature of the material is kept constant at the melting temperature, thereby avoiding exposure of the solar cooker and especially the food to large temperature variations. The invention concerns solar cooking with heat storage based on this principle.

[006] The invention uses salt compositions, which provide an appropriate melting temperature and good thermal conductivity, as the material subject to the change of phase. Salt compositions suitable for cooking in accordance with the invention have a melting temperature in the range of temperatures normally used for cooking, for example from 110°C, sufficiently above the boiling temperature of water, to 350°C. Examples of suitable salt compositions may be found in standard chemical databases.

[007] The invention is defined by the cooking process of claim 1.

[008] Brief description of the drawings:
Fig. 1 is a schematic drawing of a solar cooker with a heat storage unit as employed in the cooking process of the present invention.

[009] In Fig. 1, the solar cooker 1 comprises a heat storage unit 3 containing a salt composition 6. In the cooking process of the invention, the solar radiation 12 concentrated by a parabolic mirror 11 heats the heat storage unit 3, thereby melting the salt composition 6 and cooking the food 8. Should the solar radiation 12 be interrupted by clouds or sunset, the salt composition 6 solidifies, releasing its heat of fusion to the food 8. The food 8 thus continues to cook in the absence of solar radiation.

[011] In the cooking process, the solar radiation 12 is concentrated on the light-absorbing plate 5. The heat generated by the light-absorbing plate 5 is conducted to the salt composition 6 and to the cooking plate 2. The temperature of the salt composition 6 rises to the melting temperature, at which point the salt composition melts, storing the heat of fusion. At the same time, the food 8 on the cooking surface 9 cooks. When the solar radiation 12 is interrupted, no more heat is generated by the light-absorbing plate 5. However, the salt composition 6 does not cool down rapidly but instead solidifies, releasing the heat of fusion to the cooking plate 2 so that the cooking process continues.

Claims forming basis for refusal

1. A cooking process including the steps:
providing a heat storage unit (3);
concentrating solar radiation (12) onto the heat storage unit (3) to heat it; and
cooking food (8) placed on the heat storage unit (3).

2. A cooking process according to claim 1, wherein solar radiation is concentrated using a parabolic mirror for melting a material contained in the heat storage unit.[1]

3. A cooking process according to any of claim 1 or 2, wherein the heat storage unit (3) contains a salt composition, preferably having a melting temperature in the range of temperatures normally used for cooking.

[1] The changes are indicated with respect to the original claims

Drawings of the Application

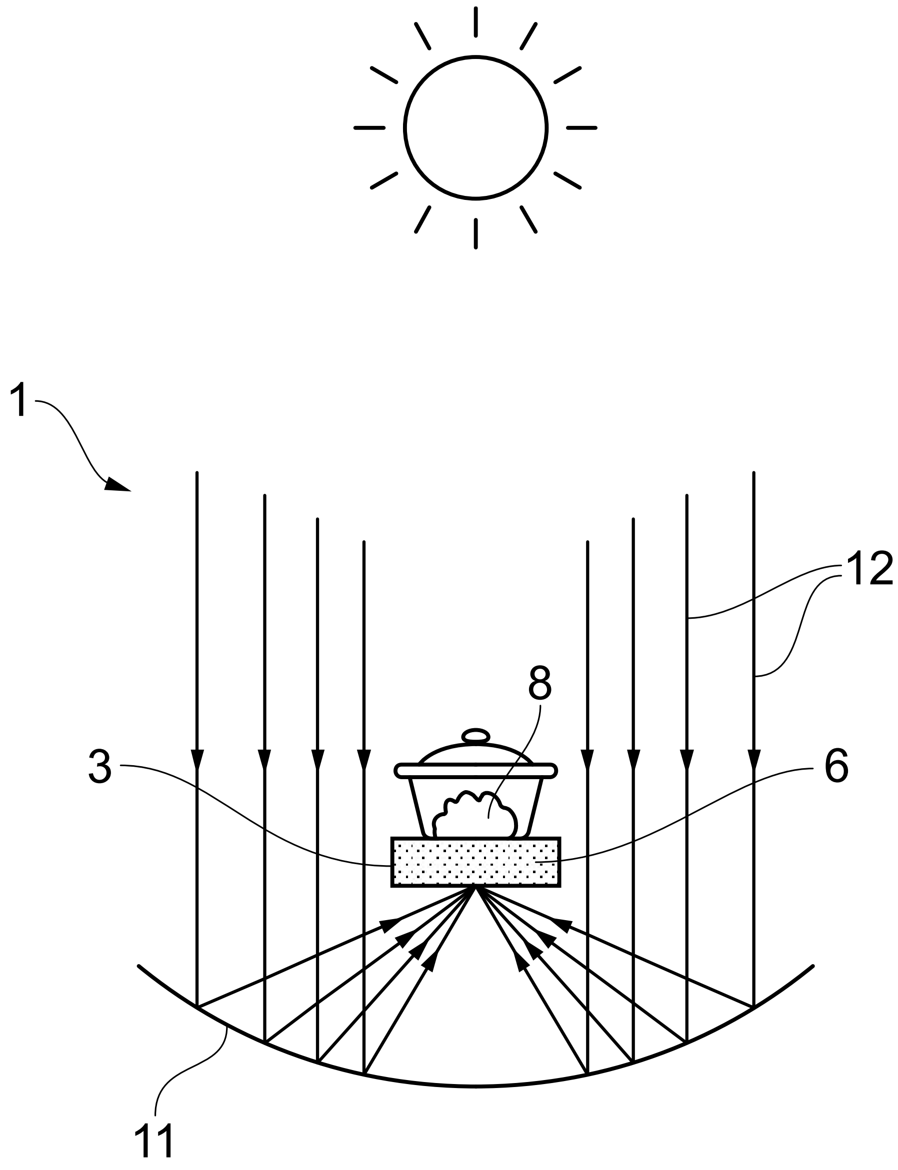


FIG. 1

Extract of the Decision from the Examining Division

1. The subject-matter of claim 1 is not new in the sense of Art. 54(1) and (2) EPC:
   D1 discloses:
      A cooking process ([003]), including the steps:
      providing a heat storage unit (the heated aluminium plate 2 stores a certain amount of heat when heated);
      concentrating solar radiation onto the heat storage unit to heat it; and
      cooking food placed on the heat storage unit ([003]).
   D1 thus discloses all the features of claim 1.

2. Claim 2 was amended so that its subject-matter extends beyond the scope of the original application, contrary to the requirements of Art. 123(2) EPC.
   The wording:
      "melting a material contained in the heat storage unit"
   was added to original claim 2 by amendment. However, the original application discloses only a salt composition being melted during the cooking process (see par. [006], [011]), not any material as in the amended claim.

3. The subject-matter of claim 3 does not involve an inventive step in the sense of Art. 56 EPC. It would be obvious for the skilled person to use, in the solar cooker of D1 (Fig. 2), a heat-storing pot as in D2 to obtain the advantages mentioned by D2. The optional feature of claim 3 is not clear (Art. 84 EPC). The range of temperatures normally used for cooking is not a well-recognized limit on the melting temperature, in view of the many different cooking processes and corresponding great variation of the cooking temperatures.

D1: Solar cooker with parabolic light concentrator

[001] We present a cooker based on solar radiation. It is environmentally friendly and especially useful in remote areas where electricity or fuel is scarce.

[002] Our cooker (Fig. 1) includes a parabolic mirror 1 and a plate 2 located in the focus of the mirror. The aluminium plate 2 is black anodised on its bottom surface 3, in order to absorb light. The top surface of the plate holds the food 4 to be cooked. The food can be placed either directly on the plate for grilling, or in a pot.

[003] In the cooking process, the parabolic mirror is illuminated by solar light and concentrates it at its focal point on the bottom surface of the plate, which absorbs light and heats up, cooking the food 4. Under concentrated solar light, the plate rapidly reaches suitable cooking temperatures in the order of 120°C and higher. A solid, single-piece plate without internal gaps provides good heat conduction and distribution.

[004] In the version shown in Fig. 2, the plate 2 was substituted with a stand 5 for mounting a pot 4´. The stand 5 has a hole in the centre so that the bottom surface of the pot is at the focal point of the parabolic mirror. In this cooker, the pot is heated directly by the concentrated solar light. Any pot can be used, provided that the bottom surface is light-absorbing, as is the case with a black or matt surface.

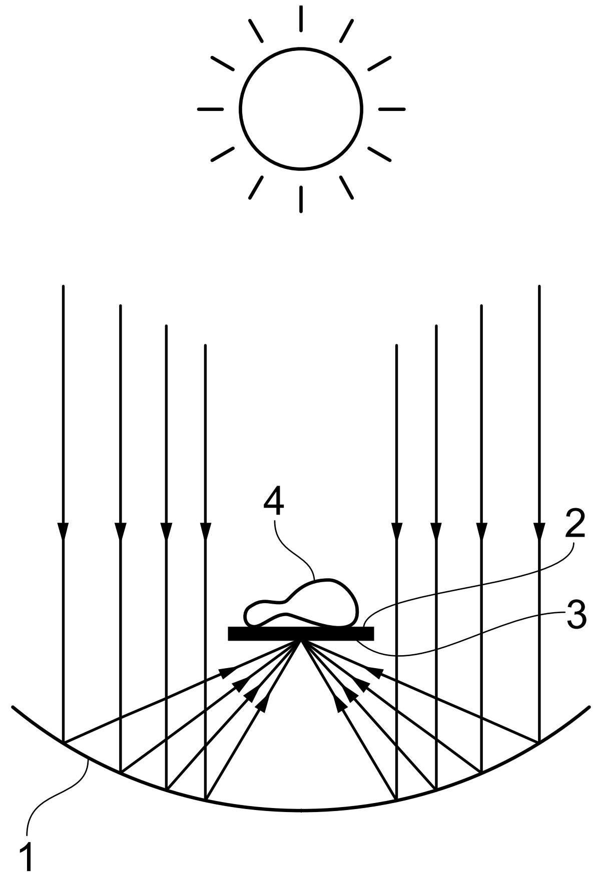


FIG. 1

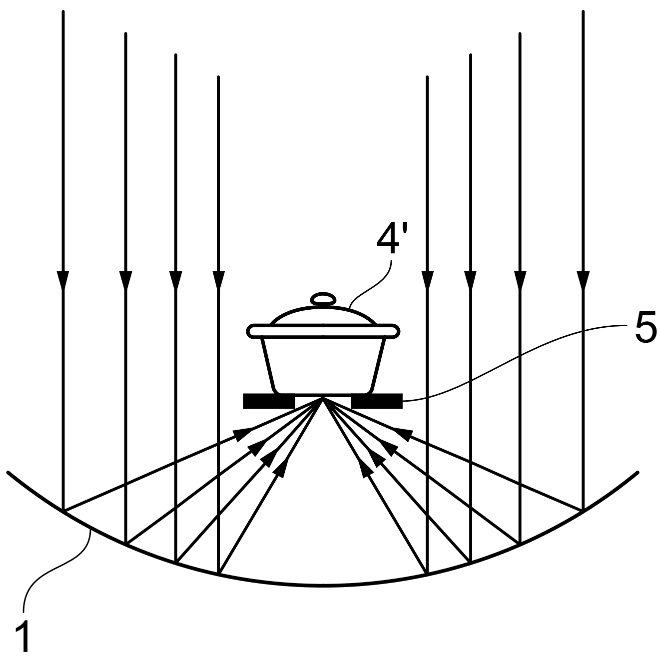
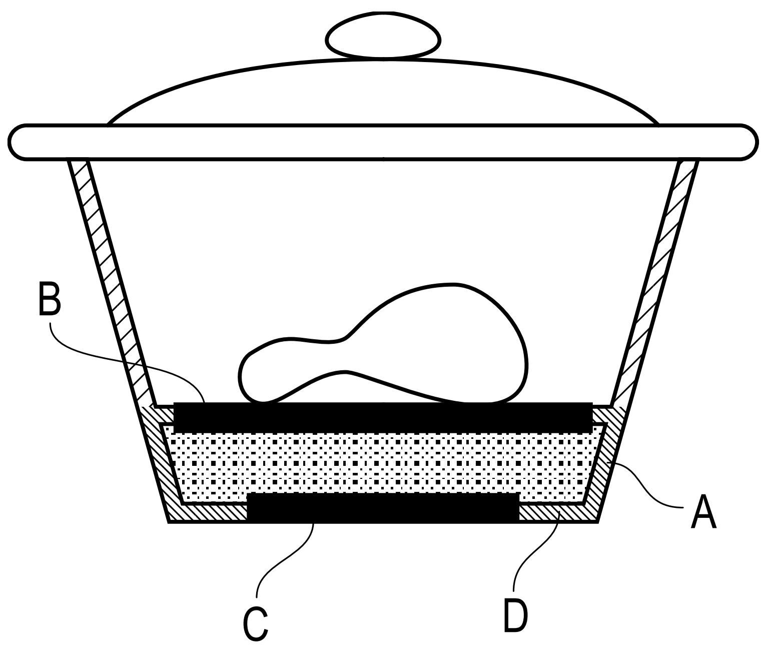


FIG. 2

D2: Cooking pot with salt box

[001] It is common to cook food, especially meat and fish, on a salt bed. Kitchen salt (sodium chloride) provides excellent thermal conductivity and stores a high quantity of heat when it is brought to high temperatures, so the food is cooked evenly and gently. Unfortunately, large amounts of salt have to be thrown away after cooking is completed. We produce cooking pots or pans having a permanent reserve of salt in a sealed container (A), as illustrated in the figure. The top of the container (A) contains a plate providing the cooking surface (B). The bottom of the container (A) is sealed by a disk (C) of black-anodised aluminium , for collecting heat from a cooker (e.g. a gas flame). The salt ensures good thermal flow from the disk (C) to the cooking surface (B). The rest (D) of the container (A) is thermally insulated.

[002] The salt is in granular form. The gaps between the grains allow air circulation inside the container, thereby distributing heat more uniformly. Advantageously, sodium chloride is non-toxic, very stable and maintains this granular state up to its melting temperature of around 800°C, far higher than normal cooking temperatures.



<u>Client's letter</u>

Dear Mr. Marcellus,

The attached application was refused from the European Patent Office. The relevant part of refusal and the cited prior art are also enclosed.

We intend to file an appeal against this decision. In our view, the idea of the invention of storing the heat of fusion by melting a salt composition was not duly considered.

Please draft a set of claims that could overcome the objections basing the refusal and prepare an accompanying argumentation to be submitted with the statements of grounds of appeal. The intention is that the examining division will grant interlocutory revision.

Kind regards,
Dr. Archimedes

Mock Paper M3-3

Client's letter

Dear Mr. Marcellus,

We are following our competitor's patent strategy on solar cookers. The annexed European patent application is in examination phase and currently has five claims (see attached description, claims and figures). We do not want this application to proceed to grant in its current state.

Please file anonymous third party observations which hopefully will be taken up by the EPO and push our competitor to delete part or all of the claims. Forcing the competitor to file an further application is also part of our policy. However we do not wish to object to the application on the ground of insufficient disclosure.

The application was filed on 17 June 2022 and has a priority date of 15 April 2022. The application as originally filed is identical to the priority document, except that claim 5 and [011] of the description are not present in the priority document and were added on filing.

Claim 2 has been amended during examination. It originally read:

"The heat storage unit of claim 1, wherein the salt composition is a nitrate composition."

We have found document D1-D4 which might be of use for the third party observations. We have contacted Y who has sent us the leaflet delivered together with the Allday cooker that he bought in 2022. The leaflet is annexed as document D2.

Kind regards,

Dr. Archimedes

Annexes: D1, D2, D3, D4

Description of the Application

[001] The present application relates to cooking using solar radiation ("solar cooking"). Solar cooking is environmentally friendly and suitable for remote areas without a reliable supply of fuel or electricity.

[002] In a conventional solar cooking process, solar radiation is concentrated by a parabolic mirror onto a light-absorbing plate. Said plate heats up upon absorption of solar radiation, cooking the food placed on top of it. Said process does not however function on cloudy days or during the night. The plate quickly cools down in the absence of solar radiation, interrupting the cooking process. Therefore, there is a need to store heat for the cooking process.

[003] Heat is normally stored by raising the temperature of a material. To increase the amount of heat stored, the material thus has to reach high temperatures, with the disadvantage that the system has to sustain a wide temperature range.

[004] An alternative way of storing heat is based on the change of phase of a material. This involves heating the material until it reaches its melting temperature. Additional heat supplied to the material during melting does not increase its temperature but instead induces the change of phase from solid to liquid. The amount of heat necessary to complete the phase change is called “heat of fusion” and is released back by the material upon solidification.

[005] Heat storage based on change of phase is advantageous for solar cooking because, during melting, the temperature of the material is kept constant at the melting temperature, thereby avoiding exposure of the solar cooker and especially the food to large temperature variations. The invention concerns solar cooking with heat storage based on this principle. The invention is defined in the appended claims.

[006] The invention uses salt compositions, which provide an appropriate melting temperature and good thermal conductivity, as the material subject to the change of phase. Salt compositions particularly suitable for cooking in accordance with the invention have a melting temperature from 110°C, sufficiently above the boiling temperature of water, to 350°C.

[007] Examples of suitable salt compositions are listed in Table 1. Referring to standard chemical databases, other suitable salt compositions can be found that have melting temperatures identical or close to those indicated in Table 1. Nitrate salt compositions have proved to be particularly useful.

Table 1

	Chemical formula	*Name*	*Melting temp. (°C)*
A	$MgCl_2 \cdot 6H_2O$	Magnesium chloride hexahydrate	115
B	$LiNO_3$ (33%) - KNO_3 (67%)	Lithium nitrate (33%) - Potassium nitrate (67%)	130
C	$AlCl_3$	Aluminium chloride(1)	192
D	$LiNO_3$	Lithium nitrate	252
E	$NaNO_3$	Sodium nitrate	307
F	KNO_3	Potassium nitrate	334
G	LiCl (58%) - KCl (42%)	Lithium chloride (58%) - Potassium chloride (42%)	348

(1) Sometimes sold under the name MagicHeat.

[008] Brief description of the drawings:
Fig. 1 is a schematic drawing of a solar cooker with a heat storage unit according to the present invention.
Figs. 2 and 3 show embodiments of the heat storage unit of the present invention.

[009] In Fig. 1, the solar cooker 1 comprises a heat storage unit 3 containing a salt composition 6. In the cooking process of the invention, the solar radiation 12 concentrated by a parabolic mirror 11 heats the heat storage unit 3, thereby melting the salt composition 6 and cooking the food 8. Should the solar radiation 12 be interrupted by clouds or sunset, the salt composition 6 solidifies, releasing its heat of fusion to the food 8. The food 8 thus continues to cook in the absence of solar radiation.

[010] An example of the heat storage unit 3 is shown in Fig. 2. It includes a box 4, provided with heat-insulating walls to avoid heat loss. The box 4 contains a salt composition 6, which can be chosen from Table 1. The box 4 also comprises an empty space 7 dimensioned to allow the salt composition 6 to expand upon melting. A light-absorbing plate 5, e.g. of black anodised aluminium, is fitted in a first opening of the box 4 and is in physical contact, hence in thermal contact with the salt composition 6. A cooking plate 2 is fitted in a second opening of the box 4 and is also in thermal contact with the salt composition 6, for example using fins 13 extending through the empty space 7. It is generally known that other solid items may be used instead of fins to ensure thermal contact between the salt and the cooking plate or between the salt and the light-absorbing plate. The cooking plate 2 provides a cooking surface 9 on which food 8 to be cooked is placed.

[011] The cooking plate 2 can be made of metal or ceramic. Metal is more resistant to breakage, for example when heavy or sharp objects accidentally hit the plate. Among metals, steel is particularly suitable as it does not easily deform. Thus the cooking surface 9 remains flat.

[012] In the cooking process, the solar radiation 12 is concentrated on the light-absorbing plate 5. The heat generated by the light-absorbing plate 5 is conducted to the salt composition 6 and to the cooking plate 2. The temperature of the salt composition 6 rises to the melting temperature, at which point the salt composition melts, storing the heat of fusion. At the same time, the food 8 on the cooking surface 9 cooks. When the solar radiation 12 is interrupted, no more heat is generated by the light-absorbing plate 5. However, the salt composition 6 does not cool down rapidly but instead solidifies, releasing the heat of fusion to the cooking plate 2 so that the cooking process continues.

[013] The heat storage unit 3 of Fig. 2 may be detachable from the solar cooker 1 of Fig. 1 and portable. Therefore, the solar cooker 1 can also be used in two steps: in the first step the heat storage unit 3 is mounted in the solar cooker under solar radiation 12 to store heat; in the second step the heat storage unit 3 is detached from the solar cooker and transported elsewhere, e.g. indoors, where food 8 is placed on the cooking plate 2 for cooking. One or more handles 10 may facilitate the transport of the heat storage unit 3. The handles remain relatively cold even after long exposure of the heating plate to solar radiation 12, thanks to the heat-insulating walls of the heat storage unit 3. The walls typically include an outer layer and an inner, as well as a layer of heat-insulating material placed between the outer and inner layers. The heat-insulating material can be for instance polymer foam, mineral fibre blanket or a natural material like straw. The use of straw advantageously reduces the environmental footprint of the heat storage unit 3.

[014] Fig. 3 shows another example of the heat storage unit 3, especially suitable for the aforementioned two-step operation. As in the example of Fig. 2, a box 4 with heat-insulating walls contains a salt composition 6, which can be chosen from Table 1. The empty space 7 is dimensioned to allow the salt composition 6 to expand upon melting. In this embodiment, the box 4 has only one opening, in which a light-absorbing plate 5 is fitted. In the cooking process, the heat storage unit 3 is first mounted (Fig. 3 (a)) in the solar cooker 1 of Fig. 1 so that solar radiation 12 is concentrated on the light-absorbing plate 5. The temperature of the salt composition 6 rises to the melting temperature, at which point the salt composition 6 melts, storing the heat of fusion. When a sufficient amount of heat is stored, the heat storage unit 3 is detached from the solar cooker 1 and turned upside-down (Fig. 3 (b)) by means of one or more handles 10. Thermal contact between the light-absorbing plate 5 and the melted salt composition 6 is maintained, e.g. by means of fins 13. Food 8 is placed on the surface of the light-absorbing plate 5, which acts as the cooking surface 9 due to the heat of fusion being released from the salt composition 6. When food 8 is placed in a cooking pan, it is desirable to use cooking pans having a diameter which is larger than the diameter of the cooking surface 9.

Claims of the application

1. A heat storage unit (3) for use in a solar cooker (1), comprising:
a box (4) having heat-insulating walls and an opening, the box (4) containing a salt composition (6) and comprising an empty space (7) dimensioned to allow the salt composition (6) to expand upon melting,
a light-absorbing plate (5) fitted in the opening and in thermal contact with the salt composition (6), and
a cooking surface (9) having a diameter which is smaller than the diameter of cooking pans, the cooking surface (9) being in thermal contact with the salt composition (6), wherein the salt composition (6) has a melting temperature of 115°C to 350°C.

2. The heat storage unit of claim 1, wherein the salt composition is selected from the list consisting of lithium nitrate, sodium nitrate, potassium nitrate and their mixtures.

3. A solar cooker (1) comprising:
a heat storage unit (3) comprising: a box (4) having heat-insulating walls and an opening, the box (4) containing a salt composition (6) and comprising an empty space (7) dimensioned to allow the salt composition (6) to expand upon melting, a light-absorbing plate (5) fitted in the opening and in thermal contact with the salt composition (6) and a cooking surface (9) in thermal contact with the salt composition (6), the salt composition having a melting temperature of 110°C to 350°C; and
a parabolic mirror (11) for concentrating solar radiation (12) on the light-absorbing plate (5) of the heat storage unit (3).

4. The solar cooker (1) of claim 3, wherein the heat-insulating walls of the box (4) include in this order: an outer layer, a thick layer of straw as heat insulation and an inner layer.

5. The solar cooker (1) of claim 3, wherein the cooking surface (9) is a surface of a cooking plate (2) fitted in a second opening of the box (4) and in thermal contact with the salt composition (6), the cooking plate (9) being made of steel.

Drawings of the Application

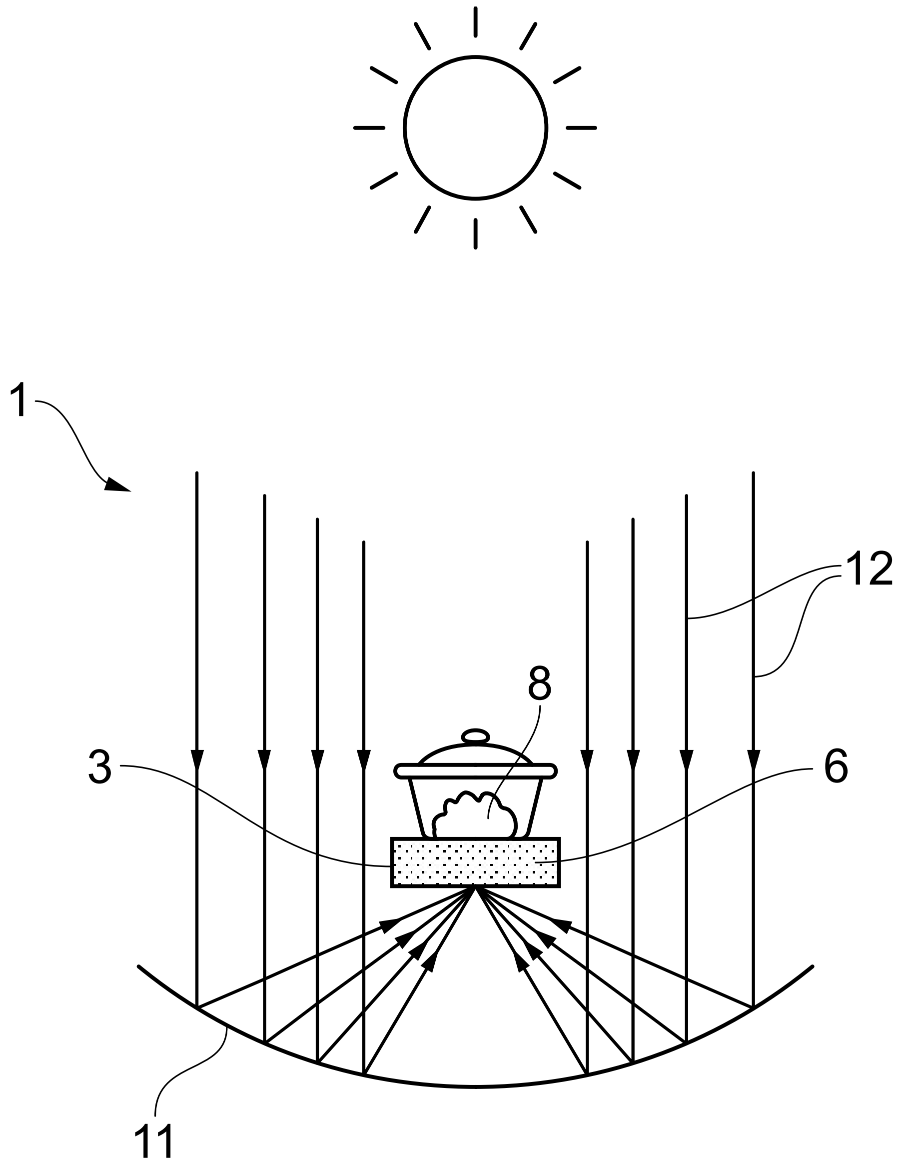


FIG. 1

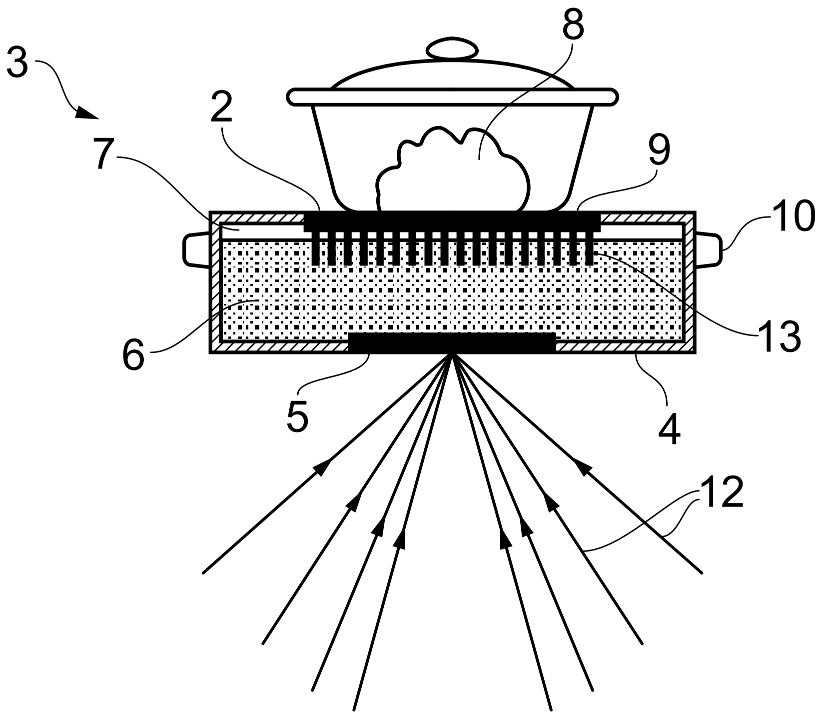


FIG. 2

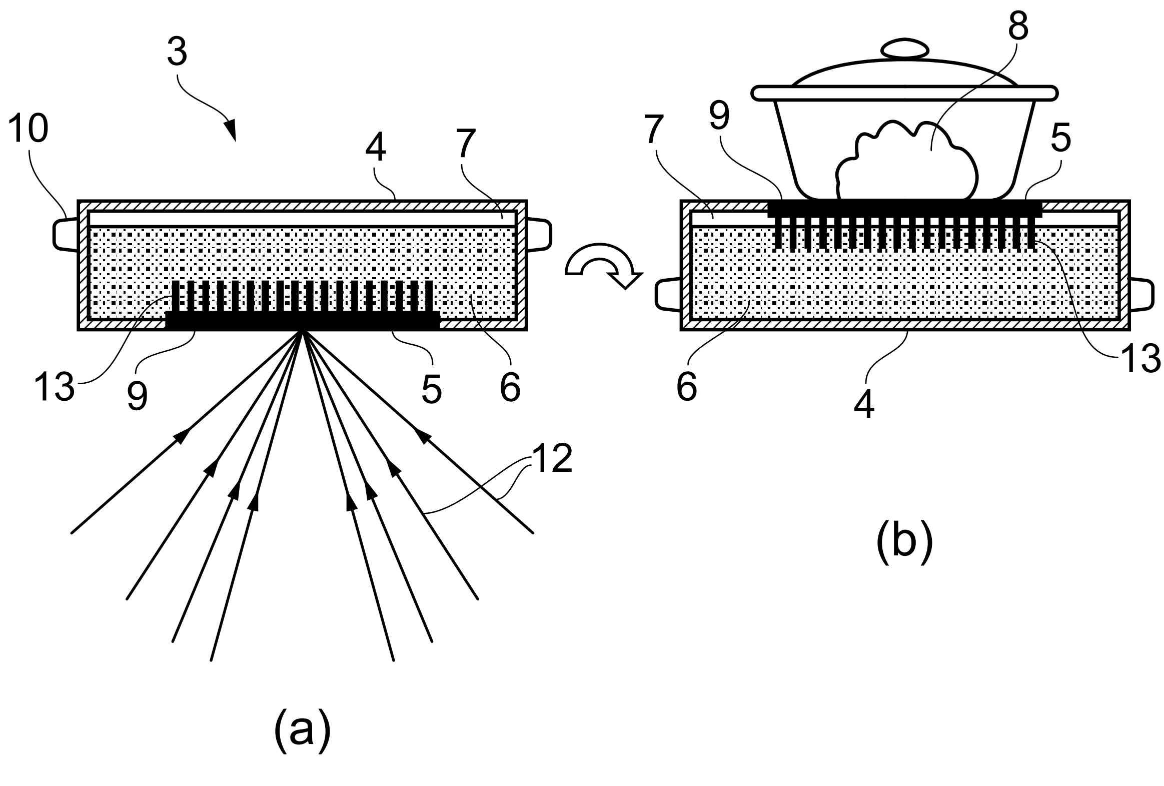


FIG. 3

D1 : Transcript of a show live broadcasted on 21 June 2022 on RadioGreen

[001] X: Hi, welcome to our show "Life in Nature".
Good morning Y, what are the new devices for camping that you discovered at the Outdoor Spring Fair held on 10-13 April 2022 in Utrecht?
[002] Y: I was impressed by the new solar cooker Allday of Company B, like many other visitors who could see a demonstration of how the cooker works.
[003] X: Well, as everyone familiar with solar cooking knows, most solar cookers are made of two parts, first a box having heat-insulating walls andone opening closed with a heating plate; second a parabolic mirror for concentrating solar light onto the heating plate. So what is new?
[004] Y: Indeed, the Allday solar cooker has the box and parabolic mirror which you have just described. The trick is that the cooker can be used also in the absence of sun, because it stores heat and releases it to the food up to several hours after sunset.
[005] X: Very interested, indeed!
[006] Y: When demonstrating the Allday cooker Company B mentioned that the box was only partially filled, with a composition called MagicHeat. They explained that MagicHeat melts when light reflected by the mirror hits the heating plate at the bottom of the box, and solidifies when the sun disappears. The box releases heat to the cooking plate which is inserted in another opening at the top of the box when MagicHeat solidifies during cooling.
[007] X: It really seems to be magic…
[008] Y: A visitor asked to see inside the box but Company B did not allow for that. They mentioned though that metallic bars were attached to the cooking plate and partially dipping into MagicHeat.
[009] X: Ah, great! I am still curious about how MagicHeat melts. Is the heating plate transparent?
[010] Y: No need for that, the heating plate absorbs sunlight and is in direct contact with MagicHeat, as explained by Company B at the fair.
[011] X: Well, it would be interesting to test it under real conditions. So perhaps something to use in you next trip to France?
[012] Y: You are right.The cooker was not available for sale at the fair so I ordered it later.. I received it a week ago together with the leaflet for security and care instructions and I am eager to test it in my next holidays.

D1: Screenshot from https//www.radiogreen.com/lifeinnature

Life in Nature, presented by X
Episode 73 – Tuesday 14 June 2022
How to secure drinkable water?

Episode 74 - Tuesday 21 June 2022
News from the Outdoor Spring Fair

D2: Leaflet sent by Y

Allday solar cooker – outdoor cooking made easy

Security

[001] The box has a round, black cooking surface (see figure). This surface gets hot when heated by sunlight.

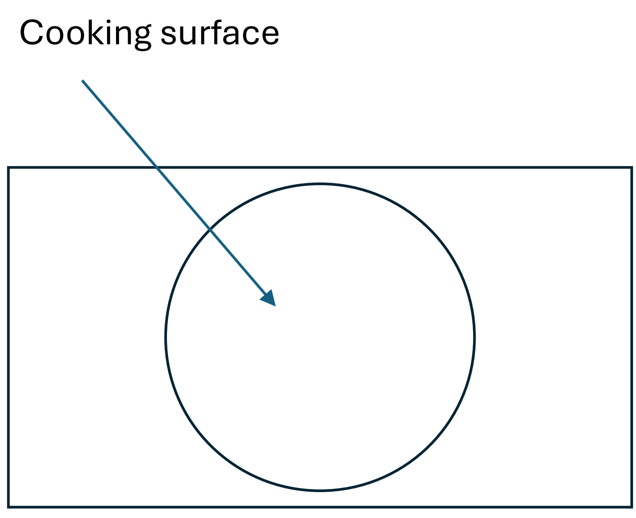
[002] Place a cooking pan, or directly food onto the cooking surface. It is recommended to use pans with a bottom diameter slightly larger than the diameter of the cooking surface.

Care instructions for Allday solar cooker

[003] The walls of the Allday cooker can be cleaned with soft detergent.

[004] The metal cooking plate has a surface which is easy to clean. Removing food leftover with a fabric after the surface has sufficiently cooled is recommended. Removing food with a knife is not recommended as it can scratch the cooking plate surface.

[005] The surface of the parabolic mirror should only be cleaned with soft detergent. Never use abrasive powder which could damage the surface.



Top view of the Allday

[006] We have been awarded the GreenFuture label for our solar cooker not only in the category “Smart energy” but also in the category “Bio-sourced materials” thanks to the use of straw as insulation material.

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D3: "Portable radiator with storage of solar heat", Journal of Camping Science, Summer 2016

[001] We have developed a portable heat radiator which stores solar heat during the daytime and releases it in the evening. It does not rely on gas or electricity, it is safe and it is especially useful for holiday homes or camping. The heat storage is based on the properties of a phase-change material (PCM), which stores and releases the heat of fusion upon melting and solidification respectively.

[002] The portable radiator 9 (see Fig. 1) consists of a box 1 containing a PCM 2 and a space to allow the thermal expansion of the PCM. The box has heat-insulating walls. A light-absorbing plate 3 of black ceramic is fitted in an opening of a side of the box., in thermal contact with the PCM 2. Thermal contact is a well-established concept, see e.g. the Handbook of Energy Transfers. It requires physical contact via a thermally conductive material, here plate 3.

[003] The box 1 also has two hinged covers 4 of insulating material, which can be closed against the plate 3 or opened to expose the plate 3 to sunlight 8, as in Fig. 1. On the side opposite the plate 3, the PCM 2 is in thermal contact with a metal block 5 (shown in the cut-away view of Fig. 1 under the insulating layer 11), including air conduits 6. These conduits are open to the outside at both ends through openings 10 in the insulating layer 11.

[004] To store heat, the hinged covers 4 are opened, exposing the light-absorbing plate 3 to sunlight (see Fig. 1). The plate 3 heats up and melts the PCM 2. The covers 4 are then closed and the radiator 9 is transported to the space to be heated, where it is put in an upright position (see Fig. 2). Upon solidification, the heat of fusion is released by the PCM 2 to the air in the conduits 6. Heated air 7 flows by convection through the openings 10 to the surrounding environment.

[005] Organic materials such as fatty acids having a melting temperature between 40 and 80°C provide suitable PCMs for this radiator. These temperatures correspond to the conventional internal temperatures of domestic heaters and are rapidly reached by the light-absorbing plate 3 when exposed to sunlight 8. The quantity of PCM determines the amount of heat stored and is thus calculated depending on the space to be heated. A radiator having external dimensions of 30 x 40 x 15 cm, containing 1200 cm^3 of stearic acid (a non-toxic fatty acid having a melting temperature of 70°C), was found sufficient to heat a two-person tent to a comfortable temperature for several hours.

[006] The hydrated salt $MgCl_2 \cdot 6H_2O$, normally used to prevent ice on roads, was also tested as a PCM in this radiator. This composition has however the disadvantage of a high melting temperature of 115°C. Reaching this temperature under average sunlight and melting the material takes a long time. Furthermore, such a high temperature is not only unnecessary for our radiator but also dangerous, since burns or fires could result from accidental opening of the covers 4 and contact with the plate 3.

D3 - Drawings

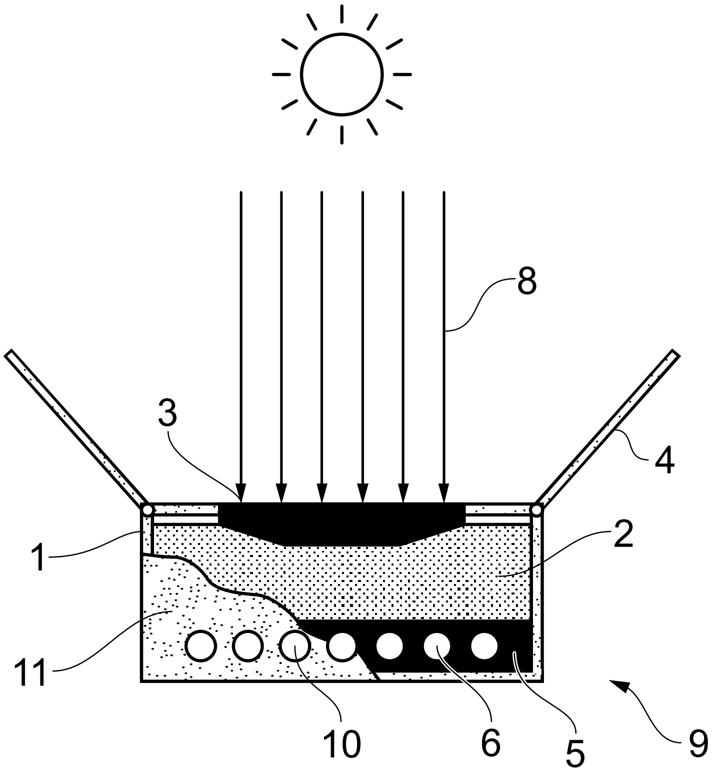

FIG. 1

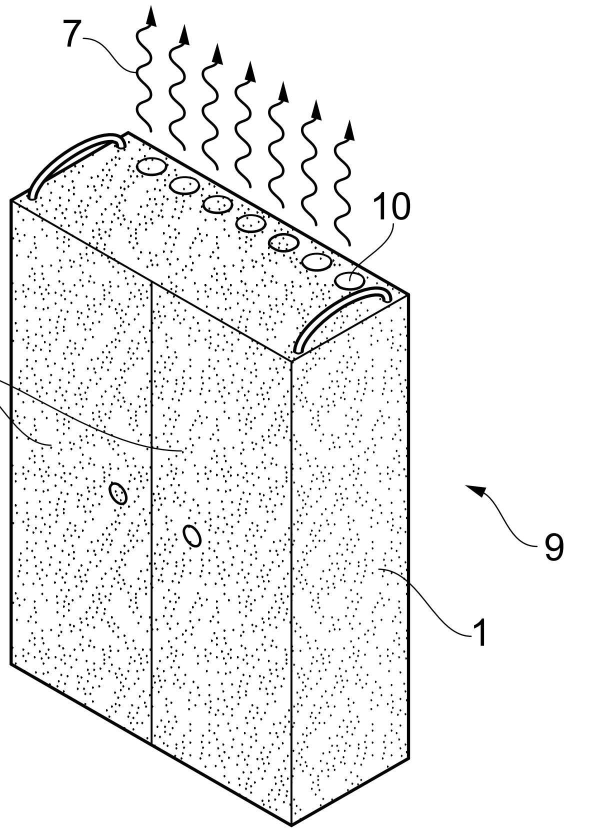

FIG. 2

D4 - Extract from the magazine "Tips from our grandparents for the XXIth century", November 2017

Build a fireless cooker and save electricity!

[001] Fireless cookers, also called Norwegian cookers, are boxes with a lid and heat-insulation material on the walls of the box. Food placed in a pot is heated to a boil. The pot with the food is then put in the box and the box is closed with the lid. Heat remains within the box and further cooks the food. The use of energy is then greatly reduced. Natural insulation materials are used, for instance wood chips or straw. In rural areas, these are largely available materials. As by-products of agriculture or wood industry they do not require much energy or resources for their production.

[002] In some variations, granite blocks which have been previously heated can be placed in the box. A pot with the food is then placed on the granite blocks and the box is again closed with the lid. The heat stored in the blocks is slowly released and further contributes to cooking the food. Both versions, with or without heated blocks, have been used for centuries.

[003] Some companies have changed this traditional tool into a trendy kitchen appliance. I have recently seen in a shop a Norwegian cooker with perfectly flat stainless steel walls. As we all know, stainless steel has excellent resistance to breakage and deformation, which makes it also difficult to shape if you do not have the right tools. The use of such material is more for professionals.

[004] Follow our instructions if you want to make your own traditional Norwegian cooker.

- Take a wooden box with enough space for your cooking pot. If the box does not have a lid, cut a wooden plank to the desired size for the lid. Optionally choose or make a cushion of the same size.

- Add insulation material. It is well-known that in traditional construction, insulation material fills a gap between two walls. Such a construction is not necessary for a Norwegian cooker, it is even preferred to have the insulation material come into contact with the pot.

- When the pot with hot food is ready, place it carefully in the box, add further insulation material if needed and the cushion on top. Close with the lid and wait until the food is ready.