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(54) **A method and moulding implement for manufacture of a body of frozen liquid**

(57) A method for manufacture of a body of frozen liquid in the form of a bucket or a pail with the desired cross-sectional shape, using a moulding implement formed as a negative mould with an outer shell (1) and an inner core (3), which outer shell (1) defines an upper free opening (6) and which core (3) has an upper boundary (4) at a distance below the upper free opening (6), whereby the moulding implement is filled inside the outer shell (1) round the core (3) with liquid to a level above

the core (3), whereby the upper free opening (6) is covered by an insulating cover or lid, whereby the moulding implement is left at a temperature which is so low that the liquid freezes and whereby, when the liquid is frozen, the frozen body is removed from the moulding implement.

A moulding implement for use in the method, having an outer shell (1) and a core (3) which are both conically shaped.

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## Description

**[0001]** The present invention relates to a method for manufacture of a body of frozen liquid such as water or the like, which body is substantially in the form of a bucket or a pail or the like with a closed and an open end, with a cross-sectional shape according to wishes and requirements. The present invention further comprises a moulding implement for manufacture of a body of frozen liquid, which body is substantially in the form of a pail or a bucket or the like, with a closed and an open end with a cross-sectional shape according to wishes and requirements.

**[0002]** The moulding implement according to the present invention is substantially provided for use in connection with the method according to the present invention, but the method and the moulding implement can, of course, also be employed separately since the characterising features are not necessarily of such a nature that they have to be employed simultaneously.

**[0003]** In a number of situations it is desirable to produce a body of frozen liquid, such as ice (frozen water) with a specific cross-sectional shape as a decorative element or as an element for keeping other objects cool. Such a body can also be used as a decorative element together with other objects, giving rise to particularly attractive possibilities when frozen bodies are combined with light. In this connection it may be desirable to combine a body of frozen liquid with, for example, candles, flaming torches or the like.

**[0004]** A specially preferred embodiment of the present invention is also associated with the manufacture of an ice lantern of frozen liquid, in which ice lantern a candle or the like may be placed.

**[0005]** The manufacture of such a decorative body in the form of a bucket with an open and a closed end is associated with some special difficulties with regard to the process in which the liquid freezes, where there are special problems connected with the expansion which takes place when the liquid passes from the liquid phase to the solid phase. Furthermore, there are special problems associated with removing the frozen body from the moulding implement, and when using the decorative body with, e.g., candles, special problems will arise in connection with melting of the body which can result in the interior of the body (if the body is located with the closed end down) being filled with melted liquid.

**[0006]** Thus it is an object of the present invention to provide a method which permits the manufacture of a body of frozen liquid in a moulding implement in such a manner that the body can be extricated from the moulding implement without the moulding implement and/or the body being destroyed in the removal process and without the moulding implement being damaged by the expansion of the liquid during the freezing process.

**[0007]** It is a further object to provide a moulding implement according to the present invention which permits the manufacture of a body in the form of a bucket

which is open at one end and closed at the other end, which moulding implement is designed in such a way that the frozen body can be extricated from the moulding implement without damaging the moulding implement and/or the frozen body.

**[0008]** Furthermore, it is an object of the moulding implement according to the present invention that the implement should be suitable for producing a body with a drainage function for melt liquid from the body during use. This reflects a particularly advantageous embodiment of a body of frozen liquid according to the present invention which can be employed as an ice lantern where a candle or the like is placed on the inside of the open body. The heat from the candle flame will tend to melt the inside of the ice lantern and since the ice in itself has good insulation properties, very little of the heat will be conducted through the ice material and a great deal of the heat therefore contributes to the melting of the inside of the ice lantern. This melt water will collect round the candle and some of the water will evaporate, but to ensure that the candle does not float up or overturn, a drain hole has been provided through the closed end of the frozen body.

**[0009]** The freezing of liquid into a frozen body in a bucket shape entails certain problems which the moulding implement in the present invention is intended to solve. The extent of the problems will vary somewhat according to which material is selected for the moulding implement, but the common feature of most materials such as plastic is that they have an insulating property which, when a mould is filled with liquid, causes the liquid's free surface to first form a film of ice, whereupon the film of ice grows along the inside of the moulding implement, subsequently spreading into the liquid. The result of this is that the expansion which occurs in the liquid when it freezes essentially has to be absorbed by the material of the moulding implement since the free end is already frozen and connected to the frozen liquid along the inside of the moulding implement, thus severely restricting its ability to move. With an expansion in the liquid of approximately 10% (which will occur for example if the liquid is water) this will lead to substantial stresses on the material of the moulding implement, which may be damaged by the expansion while the frozen body will alter the appearance of the moulding implement, thereby itself also acquiring a different appearance in a frozen state from that which was intended.

**[0010]** Furthermore, the moulding implement must be designed in such a way as to facilitate the removal of the frozen body from the moulding implement. In many cases a known method is to place a moulding implement in hot or lukewarm water or to heat up the moulding implement in another manner, thus creating a melt zone in the layer between the moulding implement and the frozen body, whereupon the frozen body is removed from the moulding implement. It is also known to apply such a high pressure to the bottom of the mould for a frozen body that the connection between the frozen

body and the inside of the moulding implement is broken, whereupon the frozen body is extricated. If, however, the body is not a solid block of frozen material, the body may be smashed to pieces with this method of removal.

**[0011]** From previously known technical solutions for manufacturing a frozen body in a moulding implement, which permit the frozen body to be removed from the moulding implement, it is common knowledge to fill an open mould such as a bucket, vessel, pail or the like with a liquid such as water and then put it in a cold place until a frozen body has been formed. This body thereby is in the form of a "lump". If a body has to be produced with an interior cavity which has an opening to the open air, the moulding implement must consist of an outer shell with an inner core where the inner core forms the cavity with the free opening in the frozen body. This entails the frozen body being formed with a "wall" round the inner opening which in turn results in the frozen body being even more vulnerable to mechanical stress when the frozen body has to be removed from the moulding implement. This is further influenced by the fact that both the moulding implement's outer shell and the inner core have to be removed from the frozen body more or less simultaneously.

**[0012]** With regard to freezing of liquid in a mould of this kind there is also the common problem as mentioned above concerning initial freezing of the free surface relative to subsequent expansion of the frozen liquid.

**[0013]** The above-mentioned problems and objects are solved in the present invention by a method according to the present invention as indicated in the introductory part of the following independent claim 1 with characterising features as indicated in the characterising part of claim 1. Further alternative embodiments in connection with the method are indicated in the following claims 2-5. A moulding implement for manufacture of a frozen body according to the present invention is further indicated in the introductory part of following claim 6 with characterising features as stated in the characterising part of claim 6. Further embodiments in connection with the moulding implement are indicated in the dependent patent claims following claim 6.

**[0014]** In the present invention a method is provided for manufacture of a frozen body, especially a frozen body in the form of a pail or bucket with an inner cavity with a free open end. The cross section of the mould may vary according to wishes and requirements. The cross-sectional shape may, for example, be rectangular, square, star-shaped, circular, oval or the like. According to the method a moulding implement consisting of an outer shell with an inner core is placed with the free opening facing upwards; the moulding implement is then filled with a liquid, and in an alternative embodiment decorative elements may be placed in the liquid, these decorative elements subsequently being frozen into the frozen body; the moulding implement is preferably not

completely filled with liquid, thus leaving room for expansion in the upper part of the moulding implement; a lid or other insulating element is then placed over the free opening of the moulding implement. According to the method the lid or the insulating element over the free opening will prevent the formation of a first frozen surface at the free opening, with the result that the freezing will occur in such a manner that the expansion of the liquid moves the free surface up in the moulding implement, whereupon the moulding implement is not noticeably influenced by the forces which are created when the liquid expands in the mould.

**[0015]** The moulding implement according to the present invention is substantially designed with an outer shell in the form of a bucket or pail with the desired cross-sectional shape, such as square, rectangular, star-shaped, cylindrical, oval or the like. In the mould there is further provided a core which forms the open inner part of the frozen body. The core has a smaller area than the surrounding shell and the difference in height between the core and the surrounding shell forms the bottom of the bucket-shaped frozen body. The thickness of the bottom is nevertheless rather variable since the moulding implement is not completely filled with liquid, in addition to which the liquid will expand during freezing. It is important, however, that the moulding implement should be filled in such a way that the core is covered with a sufficient quantity of liquid for the frozen body to have a bottom of the desired thickness. According to the invention, moreover, the outer shell of the moulding implement is designed with conical side walls, with the result that the bottom of the moulding implement has a smaller surface area than the open free end at the top of the moulding implement. The moulding implement is thereby designed with conical side walls, sloping inwards towards the core from the open top of the moulding implement. Furthermore, the core of the moulding implement according to the present invention is also conically shaped in the opposite direction to the conically shaped outer shell. This further contributes to the bottom of the moulding implement having a smaller area than the moulding implement's free upper opening (or the moulding implement's free opening at the upper end of the core).

**[0016]** The angular difference between a straight form and a conical form according to the invention is preferably round 2° but can vary between approximately 0.5 and 8-10°. The conical angle will vary according to which material the moulding implement is made of together with which liquid has to be frozen and which wall thickness (distance between core and outer shell) the finished, frozen body has to have.

**[0017]** An embodiment of a moulding implement for a frozen body according to the present invention is further explained with reference to the attached drawings, in which;

fig. 1 is a sectional view from the side of a moulding

implement according to the present invention;

fig. 2 is a plan view from below of a moulding implement according to the present invention;

fig. 3 is a plan view from above of a moulding implement according to the present invention.

**[0018]** Fig. 1 illustrates a moulding implement according to the present invention which is also suitable for implementation of the method according to the present invention. The moulding implement has an outer shell 1 and a bottom 2 together with a core formed by the walls 3. In the embodiment which is illustrated in fig. 1 the core has an upper boundary with the surface 4 and the frozen body which is produced in the moulding implement will be formed by the cavity 5 round the core, together with the cavity between the core's boundary 4 and the upper free end 6 of the moulding implement. The thickness of the bottom of the frozen body is here determined by the amount of fluid between the upper boundary 4 of the core and the liquid level at the upper free end 6, together with the expansion which takes place when the liquid is frozen in the moulding implement. Furthermore, on the inside (the side of the core which is not filled with liquid) of the core in a preferred embodiment there are provided stiffening elements 8 which will further assist in preventing the core from being compressed due to the expansion forces which occur when the liquid freezes.

**[0019]** Moreover, in the preferred embodiment at the upper boundary 4 of the core there is provided a conical body between the boundary 4 and the upper free opening 6 of the moulding implement, which conical body 7 is intended to provide a drain hole in the bottom of the frozen body.

**[0020]** According to the present invention the outer shell 1 in the moulding implement is conically shaped with an angle  $\alpha$  with the result that the cross-sectional area of the opening in the moulding implement is increasing from the bottom 2 towards the open free end 6. In addition the walls 3 in the core are arranged at an angle  $\beta$  which gives the core a conical shape in the opposite direction of conicity in the outer shell 1. This further contributes to the open cross section increasing from the bottom 2 of the moulding implement towards the upper free end 6.

**[0021]** In fig. 2 there is further illustrated a moulding implement according to the present invention with an outer shell 1 and a core with walls 3. As illustrated in fig. 2 the cross-sectional shape of the core and the outer shell are identical, being star-shaped here, but according to the invention the cross-sectional shape may be varied and different cross-sectional shapes may also be employed externally and internally in the frozen body which has to be produced, i.e. the outer shell and the walls of the core have different cross-sectional shapes. Also illustrated are the stiffening elements 8 which are arranged internally (on the dry side) in the core, the in-

tention of which is to stiffen the upper part of the core to prevent it from being compressed during the expansion which takes place at the upper free end of the moulding implement. During use the space 5 is filled with the liquid which is to form the frozen body and at the upper boundary surface 4 of the core there is further provided a conical body 7 which provides a drain hole in the bottom of the frozen body.

**[0022]** The conical form of the outer shell and the core in the moulding implement are illustrated in fig. 2 by lines 1a and 1b together with 3a and 3b. The conical form of the outer shell 1 is illustrated in figs. 1 and 3 with the lower end 1a and the upper end 1b and the conical form of the core is illustrated by 3a and 3b. At the bottom 2 of the moulding implement the free area will be formed between the lines 1a and 3a and at the upper free opening 6 the free area in the moulding implement will be formed between the points 1b along the shell. Thus the free cross-sectional area which forms the frozen body is gradually increasing from the bottom 2 towards the upper boundary 4 for the core and on from the top of the core towards the free opening 6.

**[0023]** In fig. 3 there is further illustrated from above (from the free open end) a moulding implement according to the present invention where the conical form of the moulding implement's outer shell is shown between the two parallel lines 1a and 1b. The distance between the parallel lines 1b and 1' further constitutes the thickness of the material in the moulding implement. The core is further illustrated with the upper boundary edge 4 and the line 3b marks the outer boundary of the core at the upper boundary edge 4 while the line 3a illustrates the outer boundary edge for the core at the bottom 2 of the moulding implement. According to the preferred embodiment in fig. 3 there is also illustrated a conical body which provides a drain hole in the frozen body and the outer boundary edge for the conical body at the upper boundary 4 for the core is indicated by 7a and the outer boundary for the conical body at the upper free end of the moulding implement is indicated by 7b.

## Claims

1. A method for manufacture of a body of frozen liquid, which body is in the form of a bucket or a pail with the desired cross-sectional shape, where a moulding implement is formed as a negative mould (casting mould) with an outer shell and an inner core, which outer shell defines an upper free opening (6) in the moulding implement, and which core has an upper boundary (4) at a distance below the upper free opening (6) in the moulding implement and where the moulding implement is filled inside the outer shell as well as round and over the core with the desired liquid, to a level above the core, characterized in that ;

- the upper open end of the moulding implement is covered by an insulating cover or lid,
  - the moulding implement is left at a temperature which is so low that the liquid freezes,
  - when the liquid is frozen the frozen body is removed from the moulding implement. 5
- a group consisting of a rectangle, a square, a hexagon, an octagon, a circle, an ellipse and a star.
2. A method according to claim 1, characterized in that when liquid is filled in the moulding implement a space is left in the upper part of the moulding implement which will absorb the expansion of the liquid when it freezes. 10
  3. A method according to claims 1-2, characterized in that the moulding implement is heated in order to remove the frozen body from the moulding implement. 15
  4. A method according to claims 1-3, characterized in that when the moulding implement is filled a space is left which substantially constitutes the expected volumetric expansion of the liquid which is to be frozen. 20
  5. A method according to claims 1-4, characterized in that the space which is left when the moulding implement is filled constitutes approximately 10% of the moulding implement's total volume. 25
  6. A moulding implement for manufacture of a body of frozen liquid, which body is in the form of a bucket or a pail with the desired cross-sectional shape, where the moulding implement is formed as a negative mould (casting mould) with an outer shell and an inner core, where the moulding implement is filled inside the outer shell as well as round and over the core with the desired liquid, to a level above the core, characterized in that the outer shell (1) is conically shaped in the moulding implement's longitudinal direction, with the result that the cross-sectional area of the moulding implement is increasing from the bottom (2) towards the upper free opening (6), and that the core is conically narrowing from the moulding implement's bottom (2) towards the core's (3) upper boundary (4). 30
  7. A moulding implement according to claim 6, characterized in that from the upper boundary (4) of the core there is arranged a conical body (7) narrowing in the same direction as the core (3), which body (7) has an area substantially up to or past the upper free opening (6) of the moulding implement. 35
  8. A moulding implement according to claims 6-7, characterized in that the moulding implement's outer shell has a cross-sectional shape selected from 40

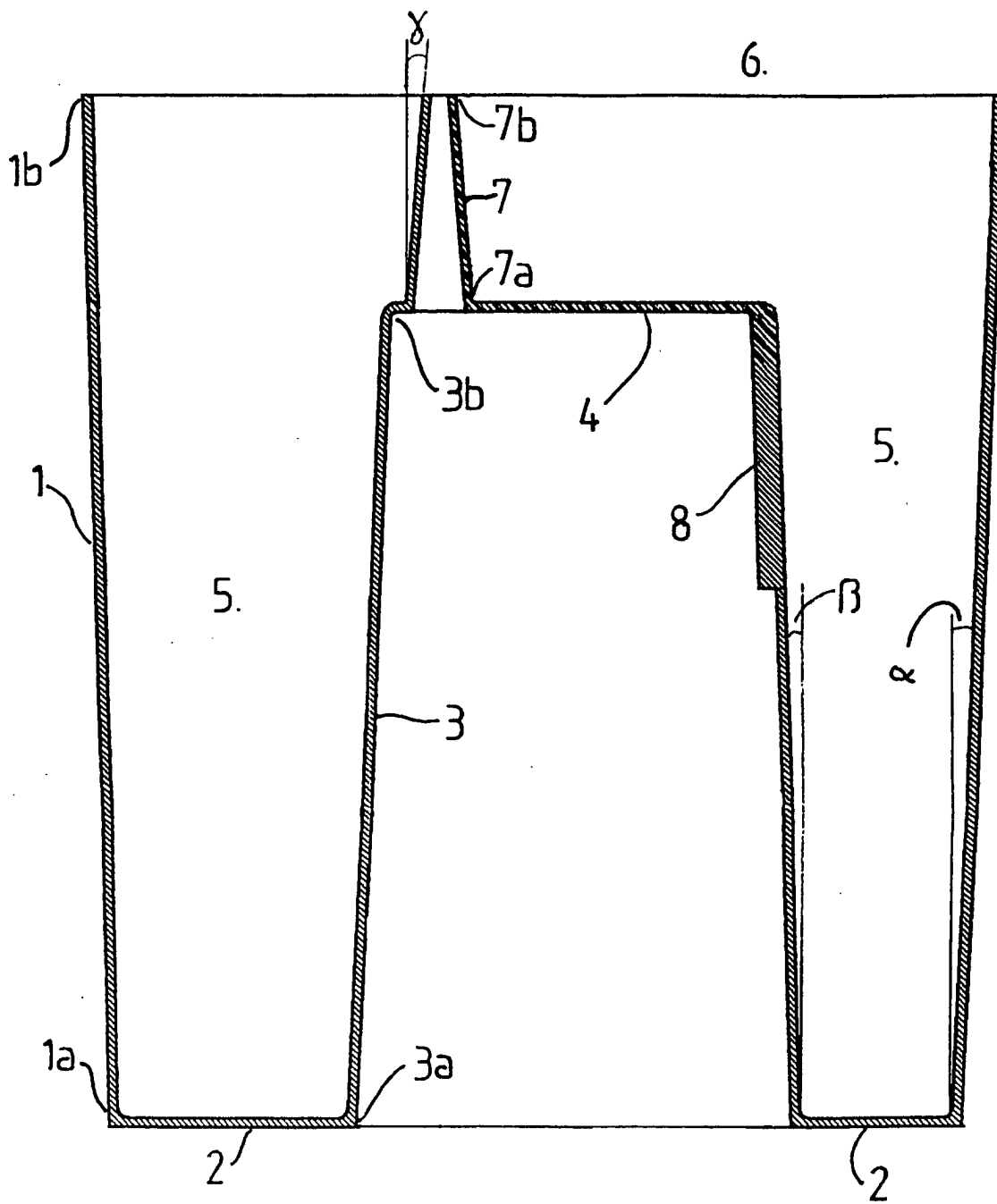


Fig. 1

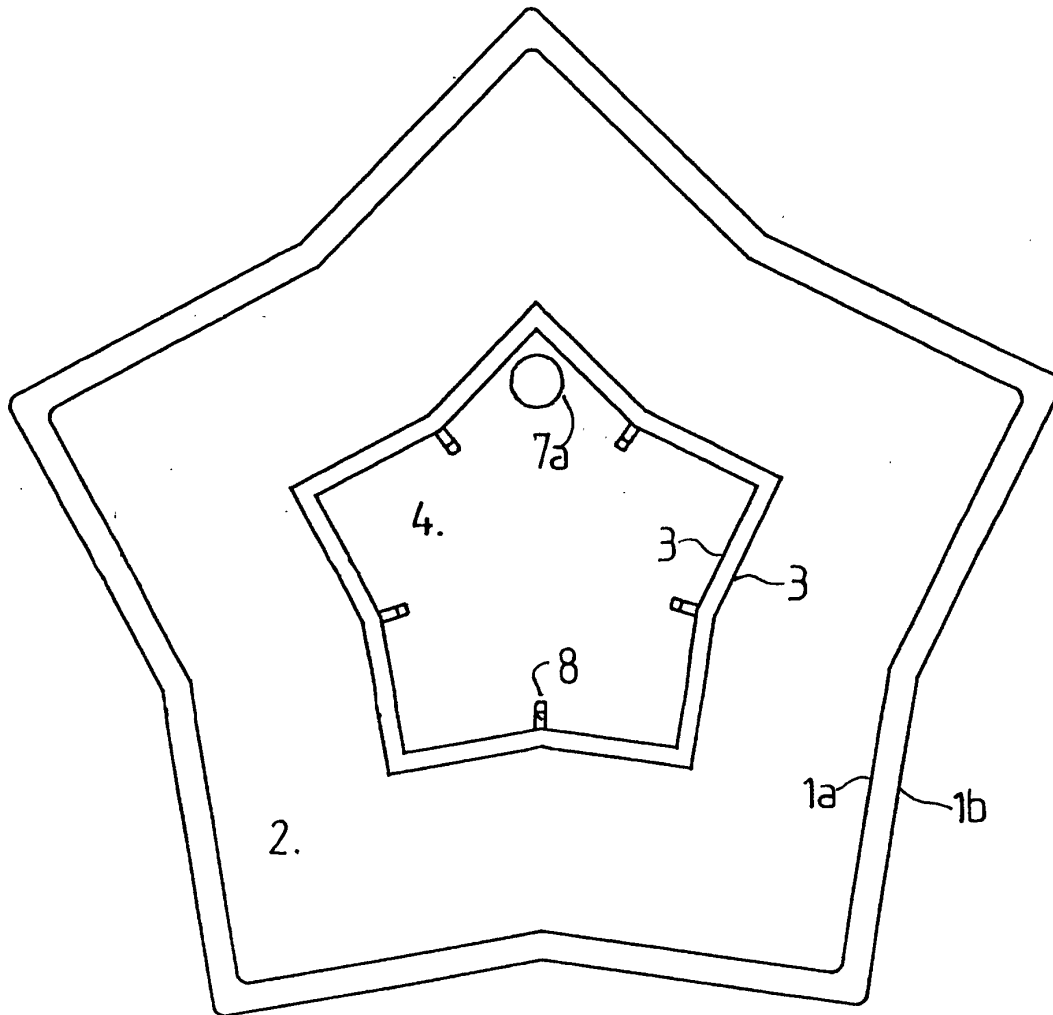


Fig. 2

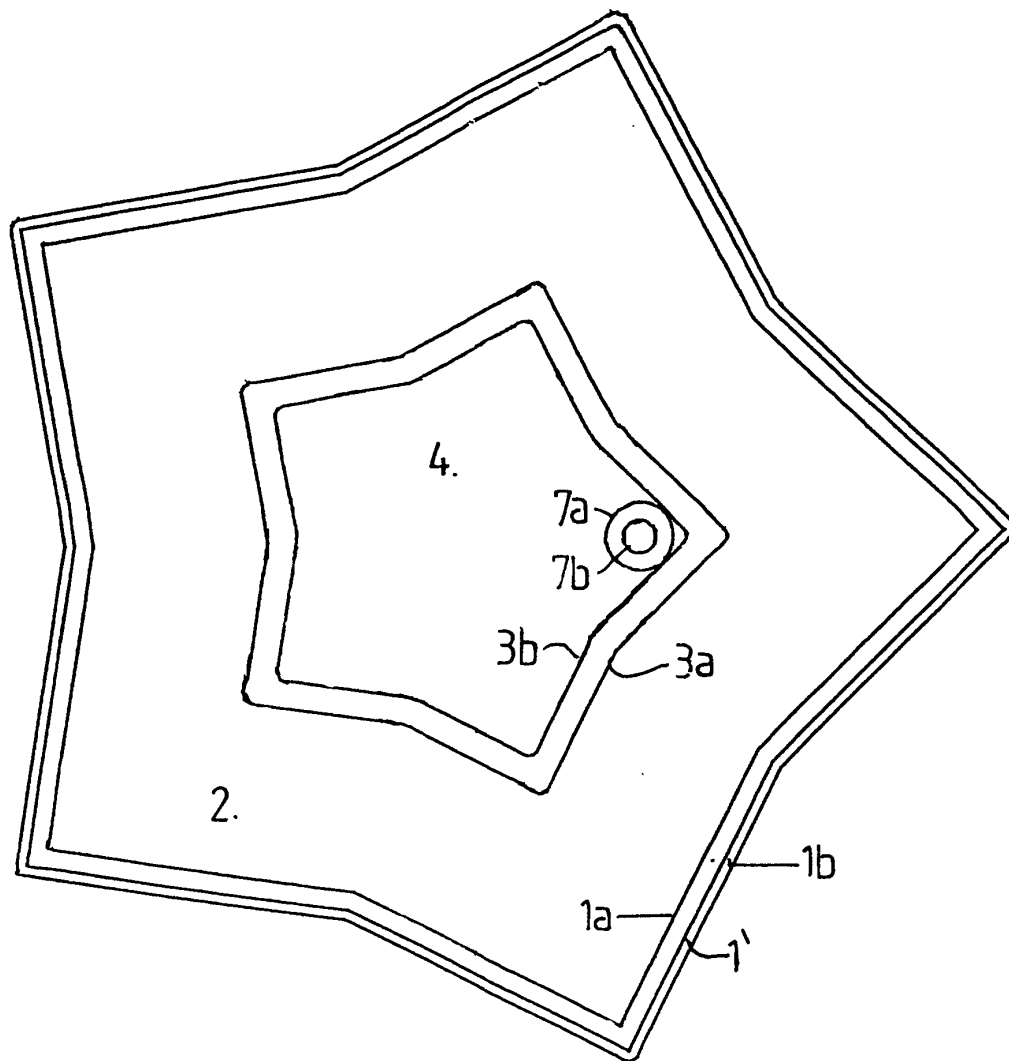


Fig. 3



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# EUROPEAN SEARCH REPORT

Application Number  
EP 01 20 0065

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                               |                                  |                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------|----------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US 5 352 470 A (YANG PING)<br>4 October 1994 (1994-10-04)                     | 1                                | F25C1/22                                     |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | * column 7, line 39 - line 50; figures 1-4 *                                  | 6                                |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ---                                                                           | 3,7                              |                                              |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US 3 684 234 A (CLINEBELL VIRGIL L)<br>15 August 1972 (1972-08-15)            | 1                                |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | * column 3, line 15 - line 62; figures 1-5 *                                  | 2,4                              |                                              |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ---                                                                           | 6                                |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US 5 250 315 A (LOEW JONATHON ET AL)<br>5 October 1993 (1993-10-05)           | 6                                |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | * column 2, line 32 - column 4, line 12; figures 1-4 *                        | 1,8                              |                                              |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ---                                                                           | 6                                |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US 4 625 518 A (FREEDMAN SAUL E)<br>2 December 1986 (1986-12-02)              | 1                                |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US 4 807 844 A (TU CHEN-HUA)<br>28 February 1989 (1989-02-28)                 | 1,3,6,8                          | TECHNICAL FIELDS<br>SEARCHED (Int.Cl.7)      |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | * column 1, line 55 - column 2, line 57; figures 1-6 *                        |                                  | F25C<br>A23G                                 |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ---                                                                           | 1,3                              |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US 5 177 980 A (ICHII AKIHIKI ET AL)<br>12 January 1993 (1993-01-12)          | 2,3,5                            |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | * column 8, line 44 - column 9, line 47; figures 22-28 *                      |                                  |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ---                                                                           |                                  |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US 2 447 170 A (DUNMIRE RUSSELL P)<br>17 August 1948 (1948-08-17)             |                                  |                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | * column 3, line 34 - column 4, line 34; figures 1-10 *                       |                                  |                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ---                                                                           |                                  |                                              |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                               |                                  |                                              |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                               | Date of completion of the search | Examiner                                     |
| THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                               | 21 May 2001                      | Boets, A                                     |
| CATEGORY OF CITED DOCUMENTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                               |                                  |                                              |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                               |                                  |                                              |

EPO FORM 1503 03/82 (P04C01)



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# EUROPEAN SEARCH REPORT

Application Number  
EP 01 20 0065

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                           |                                  |                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Citation of document with indication, where appropriate, of relevant passages                                                             | Relevant to claim                | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US 2 282 544 A (ROSBERG NELS H)<br>12 May 1942 (1942-05-12)<br>* page 1, right-hand column, line 31 - line 49; figure *<br>---            | 2, 4, 5                          |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US 1 753 940 A (REED SADIE B)<br>8 April 1930 (1930-04-08)<br>* page 1, line 57 - line 74; figures 1-4 *<br>---                           | 7                                |                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US 4 905 957 A (STOCKWELL AUBREY E ET AL)<br>6 March 1990 (1990-03-06)<br>* column 3, line 26 - column 4, line 42; figures 1-7 *<br>----- | 8                                |                                              |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                           |                                  | <p>TECHNICAL FIELDS SEARCHED (Int.Cl.7)</p>  |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                           | Date of completion of the search | Examiner                                     |
| THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                           | 21 May 2001                      | Boets, A                                     |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/> Y : particularly relevant if combined with another document of the same category<br/> A : technological background<br/> O : non-written disclosure<br/> P : intermediate document</p> <p>T : theory or principle underlying the invention<br/> E : earlier patent document, but published on, or after the filing date<br/> D : document cited in the application<br/> L : document cited for other reasons<br/> .....<br/> &amp; : member of the same patent family, corresponding document</p> |                                                                                                                                           |                                  |                                              |

EPO FORM 1503 03/82 (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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21-05-2001

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
| US 5352470 A                              | 04-10-1994          | NONE                       |                     |
| US 3684234 A                              | 15-08-1972          | NONE                       |                     |
| US 5250315 A                              | 05-10-1993          | NONE                       |                     |
| US 4625518 A                              | 02-12-1986          | NONE                       |                     |
| US 4807844 A                              | 28-02-1989          | NONE                       |                     |
| US 5177980 A                              | 12-01-1993          | JP 2609741 B               | 14-05-1997          |
|                                           |                     | JP 4009561 A               | 14-01-1992          |
|                                           |                     | DE 4113767 A               | 31-10-1991          |
|                                           |                     | GB 2243676 A,B             | 06-11-1991          |
|                                           |                     | KR 9612324 B               | 18-09-1996          |
| US 2447170 A                              | 17-08-1948          | NONE                       |                     |
| US 2282544 A                              | 12-05-1942          | NONE                       |                     |
| US 1753940 A                              | 08-04-1930          | NONE                       |                     |
| US 4905957 A                              | 06-03-1990          | NONE                       |                     |