The present invention concerns a packaging unit (1) for several pipe sections (2) of mineral wool with a packaging material (5), which surrounds the several pipe sections (2) to form the packaging unit (1), with the packaging material (5) arranged around the pipe sections (2) under pressure, the pipe sections (2) are folded within the packaging unit (1) with reduction of the pipe section cavity, and the pipe sections (2) are formed elastically such that, in the folded state, recovery forces for restoring the unfolded initial shape are built up. By means of the packaging unit (1) of the invention, several pipe sections (2) can be transported and stored very economically. In this connection, pipe sections (2) are not restricted in their functionality, but, after removal from packaging unit (1), may be used directly and without restriction, e.g., to insulate chimneys.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

with international search report
Packaging Unit for Pipe Sections

The present invention concerns a packaging unit for pipe sections of mineral wool as defined in the generic term of claim 1.

Such pipe sections are used as so-called insulation sections for insulating pipes, especially in the area of chimney insulation, in shipbuilding or in industrial plant. These pipe sections are generally in the form of whole pipes, that is, not of pipe halves, with a cavity present in their interior that is not used during the transport and storage of the pipe sections. From this results a large space requirement, which manifests itself in increased costs for transport and storage of the pipe sections.

Object of the present invention is to make available a packaging unit for several pipe sections that renders transport and storage of the pipe sections more economical, without the pipe sections suffering loss of functionality, but rather, after having been removed from the packaging unit can be used without restriction, e.g. for insulating chimneys. This object is achieved in this invention with a packaging unit in accordance with claim 1. Preferred embodiments of this packaging unit are the object of the dependent subclaims.

In accordance with the invention, the packaging unit for several pipe sections of mineral wool comprises a packaging material that surrounds the several pipe sections for forming the packaging unit with a pressure such that the pipe sections are accommodated within the packaging unit in a folded state that reduces the pipe section cavity. Essential to the packaging unit of the invention is that the pipe sections are formed so as to be elastic enough to build up recovery forces in the folded state for restoring the unfolded initial shape, with the result that the pipe sections fold out completely to their original state after the pressure has been removed.
With the aid of this packaging unit, several pipe sections can thus be stored and transported in a space-saving manner and thus very economically, as the cavity in their interior can in principle be reduced to zero because of the folding of the pipe sections. Depending on the shape of the pipe sections, the folding process can additionally reduce the external free space, i.e. the cross-sectional free surface generated between the outer circumference of one pipe section and a rectangular, enveloping one touching the outer circumference. The result is that the cavities in a packaging unit of several pipe sections can thus be minimised very efficiently. At the same time, the elastic formation of the pipe sections ensures, however, that the pipe sections fully spring back to their original shape without fibre breakage when the packaging unit has been opened and so may be used directly without any further processing stages, e.g. for insulating chimneys.

This packaging unit is suitable for all kinds of pipe sections that have an interior cavity, especially for those with angular, especially rectangular, oval and circular cross-section. The preferred material for the pipe sections is mineral wool having a composition in accordance with EP 03 02 2609. Such mineral wool has a bulk density between 60 and 130 kg/m³, possesses the requisite elasticity and, in comparison with normal rock wool, has much improved insulating properties for the same bulk density. This mineral advantageously combines the properties of rock wool and glass wool and especially has a melting point exceeding 1000 °C. On the other hand, pipe sections of glass wool or rock wool are suitable, provided it is ensured that the pipe sections build up adequate elastic recovery forces during deformation.

In accordance with a preferred embodiment, the packaging material is a packaging film of plastic, especially a waterproof film, such as polyethylene, polypropylene or polyamide film. This is preferably attached by bonding or is formed as a shrink-fit film. To facilitate transport, provision may be made on the packaging unit for a handle, which especially is formed from a film strip connected to the packaging material.
Advantageously, the packaging unit comprises at least a piece of cardboard, which is at least the size of one side-face of the packaging unit and preferably is surrounded by the packaging material. By virtue of this cardboard, the packaging unit receives a relatively rigid form and additionally is given a quadratic shape, which makes the packaging unit easy to stack. In the simplest manner, provision can be made for the cardboard as a rectangular area on one side of the packaging unit. However, embodiments are expedient which surround several adjacent, e.g. three, sides of the packaging unit, such that dimensionally stable edges and corners are formed. It is especially preferable for both ends of the packaging unit to be boxed, i.e. surrounded on five sides by cardboard, such that the packaging unit has a quadratic structure.

In a further preferred embodiment, the packaging unit may be formed only from box-like cardboard elements arranged on both sides, without further film packaging. This is especially of interest when, given an arrangement of several such packaging units in a large container, individual weathering and transport protection by this film packaging can be eschewed, by, for example, surrounding the large container completely in a film that offers weathering and transport protection.

Alternatively, the packaging material may also be formed in the shape of banderols surrounding the pipe sections, whereby provision has to be made here for an adequate number of banderols in order that undesirable bulging effects of the packaged pipe sections may be limited. Such banderols may, for example, be formed as film strips or as barrel hoops, with these having to have a corresponding width to prevent them from cutting into the pipe sections. Especially preferred here are three banderols, of which two are arranged close to the ends of the packaging unit and the third is in the middle. This packaging form may also be especially suitable if individual weathering and transport protection can be eschewed.

In a further preferred embodiment, the packaging unit is formed such that the pipe section are folded relative to a principal dimension. A principal dimension of this
kind may be the inner diameter of the pipe sections, with the pipe sections assuming an elliptical cross-section in the folded state. In the case of, e.g., pipe sections with a rectangular cross-section, the principal dimension is the shorter side. Accordingly, the principal dimension, irrespective of the cross-sectional shape, is that side which has to be folded the least in order that the same compression of the interior cavity of the pipe section may be obtained.

Preferably, the pipe sections in the packaging unit are folded only to the extent that the mineral wool remains largely uncompressed. This ensures that the mineral fibres themselves do not break and that the elastic properties of the pipe sections are not diminished.

In the event of compression of the mineral wool of the pipe section beyond that of folding, it must be ensured that the elastic properties of the pipe section are not diminished as a result.

In a preferred further development of the packaging unit, the pipe sections are arranged behind each other in respect of the direction of folding, i.e. in a line, such that the packaging unit is as slim as possible, as a result of which handling of the packaging unit is improved.

Preferably, one packaging unit contains three, four or five pipe sections, with each pipe section having a length of 1 m. In this way, the consumer can simply compose various lengths for insulation with the pipe sections, without any appreciable material surplus being generated. These individual contingents of three, four or five pipe sections thus conduce to material-saving and ultimately cost-saving purchasing of required pipe sections. Usually, such pipe sections are used in the insulation of chimneys. Chimneys are for the most part between 6 and 12 m in length. The length of 6 m could thus be covered by two packaging units of three pipe sections each, a chimney length of 7 m could be covered by one packaging unit of 4 pipe sections and a further one of 3 pipe sections, etc.
Of further advantage is to laminate aluminium foil to the exterior and/or interior of the pipe sections. This lamination serves on one hand to protect the pipe sections, e.g. when lying directly against each other, and on the other makes it possible to insert folded pipe sections into unfolded ones and so to make further space savings.

Further characteristics features and advantages of the object of the present invention become clear from the following detailed description of a sample embodiment and the drawing, in which

- Fig. 1 is a packaging unit containing five pipe sections, and
- Fig. 2 is a horizontal section through the packaging unit in accordance with claim 1.

In Fig. 1 may be seen a schematic drawing of a sample embodiment of a packaging unit 1 with five pipe sections 2. Pipe sections 2 have in the unpackaged state a circular cross-section, which, through incorporation into two cardboard covers 3, 4 and the packaging film 5 (only implied in Fig. 1) surrounding these and pipe sections 2, has been reduced to an elliptical shape (see Fig. 2). Packaging film 5 is made from polyethylene, which, after having been slipped over cardboard covers 3, 4 and pipe sections 2, was shrunk by means of the application of heat and thus exerts a pressure on pipe sections 2 and cardboard covers 3, 5 such that pipe sections 2, cardboard covers 3, 4 and packaging film 5 together form packaging unit 1.

Folded pipe sections 2 are arranged directly behind each other in a line (see Fig. 2) in the folding direction and their end faces are each covered jointly by cardboard 3, 4, which also enfolds part of the circumferential sides of the pipe sections. Cardboard covers 3, 4 have a box shape such that, for packaging unit 1, a quadratic shape results, which may be easily stacked on all sides.
In the unfolded state, pipe sections 2 have a length of 1 m, an outside diameter of 17 cm and the wall thickness is 2 cm. In packaging unit 1, pipe sections 2 are folded elliptically, with one axis having an outside dimension of roughly 6 cm, while the other axis has an outside dimension of roughly 25 cm. The volume of packaging unit 1 is 25 cm x (5 x 6 cm) x 1 m = 0.075 m³. Unfolded pipe sections 2 have a volume of 17 cm x (5 x 17 cm) x 1 m = 0.1445 m³. The volume reduction is therefore roughly 48%.

It may be easily seen that pipe sections 2 were not completely folded together, rather an inner cavity of 2 cm width remains. On account of the quality of the employed mineral wool with a composition complying with EP 03 02 2609, pipe sections 2 may be folded even further, without destruction of the mineral fibres setting in at the points of folding. Trials have confirmed that pipe sections 2 of this material build up adequate elastic recovery forces over a long period as well such that, following removal from packaging unit 1, pipe sections 2 return to their original shape and can be used immediately and without further processing stages, such as stretching and shaping, e.g. in a chimney, for insulation.

If maximum folding without compression of the mineral fibres is exploited, i.e. folding without inner cavity, the outside dimension of the one axis in the embodiment presented is accordingly 4 cm, while the outside dimension of the other axis is still practically unchanged at around 25 cm. The volume of packaging unit 1 is then 25 cm x (5 x 4 cm) x 1 m = 0.05 m³ and the volume reduction then amounts to roughly 65%, a figure which corresponds to a total “degree of compression” of 1 : 2.89.

Naturally, other contingents of pipe sections 2 may be combined into a packaging unit 1, e.g. 3 or 4, such that a consumer can acquire suitable lengths of insulation in a non-complicated fashion and without large quantities of surplus material. Furthermore, packaging unit 1 of the invention is also suitable for every other pipe
section dimension and cross-sectional shape if pipe sections 2 are able to form just adequate elastic recovery forces to restore their original shape.

The outcome of the deliberations above is that, with the aid of packaging unit 1 of the invention, several pipe sections 2 can be transported and stored very economically. In this connection, pipe sections 2 are not restricted in their functionality, but, after removal from packaging unit 1, may be used directly and without restriction, e.g., to insulate chimneys.
Patent claims

1. Packaging unit (1) for several pipe sections (2) of mineral wool with a packaging material that at least partially envelopes or surrounds several pipe sections (2) to form packaging unit (1), characterised by the fact that
the packaging material is arranged around pipe sections (2) under pressure, pipe sections (2), as a result of the pressure, are folded within packaging unit (1) with reduction of the pipe section cavity, and pipe sections (2) are formed elastically such that, in the folded state, recovery forces for restoring the unfolded initial shape are built up.

2. Packaging unit (1) as defined by claim 1, characterised by the fact that both ends of packaging unit (1) are surrounded in a container-like manner, i.e. on five sides, by a cardboard box (3, 4), such that packaging unit (1) is held in a quadratic structure.

3. Packaging unit (1) as defined by claim 1, characterised by the fact that packaging unit (1) is held by at least one banderol as packaging material.

4. Packaging unit (1) as defined by claim 3, characterised by the fact that two banderols are arranged close to the end faces of packaging unit (1), and preferably a third is in the middle.

5. Packaging unit (1) as defined by any of the previous claims, characterised by the fact that the packaging material has a packaging film (5) of plastic, especially one that is waterproof.

6. Packaging unit (1) as defined by claim 5, characterised by the fact that packaging film (5) is attached by film bonding.
7. Packaging unit (1) as defined by claim 5, **characterised by the fact that** packaging film (5) is formed as shrink-wrap film.

8. Packaging unit (1) as defined by any of the previous claims, **characterised by the fact that**, for transporting packaging unit (1), provision is made for a handle that is formed especially from a film strip joined to the packaging material.

9. Packaging unit (1) as defined by any of the previous claims, **characterised by the fact that** provision is made for at least one piece of cardboard (3, 4), which is at least the size of one side-face of packaging unit (1) and preferably is surrounded by the packaging material.

10. Packaging unit (1) as defined by any of the previous claims, **characterised by the fact that** pipe sections (2) in the unfolded state have a circular, oval or rectangular cross-sectional shape.

11. Packaging unit (1) as defined by any of the previous claims, **characterised by the fact that** pipe sections (2) are folded relative to a principal dimension.

12. Packaging unit (1) as defined by claim 11, **characterised by the fact that** the principal dimension is the diameter of the pipe sections (2), and the pipe sections (2) assume an elliptical cross-section in the folded state.

13. Packaging unit (1) as defined by any of the previous claims, **characterised by the fact that** pipe sections (2) in packaging unit (1) are folded only to the extent that the mineral wool itself remains largely free of compression.

14. Packaging unit (1) as defined by any of the previous claims, **characterised by the fact that** pipe sections (2), relative to the direction of folding, are arranged behind each other in a line.
15. Packaging unit (1) as defined by claim 2, characterised by the fact that it comprises three, four or five pipe sections (2).

16. Packaging unit (1) as defined by any of the previous claims, characterised by the fact that pipe sections (2) especially are laminated with aluminium film.

17. Packaging unit (1) as defined by any of the previous claims, characterised by the fact that at least one folded pipe section (2) is accommodated or inserted in the cavity of an unfolded pipe section (2).
# INTERNATIONAL SEARCH REPORT

## A. CLASSIFICATION OF SUBJECT MATTER

| INV. | B65D85/08 | B65D75/00 | B65D71/00 |

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>US 3 587 201 A (JOHN JOSEPH STRAYER) 28 June 1971 (1971-06-28) abstract; figures column 1, line 14 - line 45 column 2, line 5 - line 58 column 2, line 74 - column 3, line 18 column 3, line 35 - line 55</td>
<td>1-4, 9-15</td>
</tr>
<tr>
<td>Y</td>
<td>DE 40 05 541 A1 (ROCKWOOL INTERNATIONAL A/S, HEDEHUSENE, DK) 29 August 1991 (1991-08-29) abstract column 4, paragraph 2</td>
<td>5-8, 16</td>
</tr>
<tr>
<td>Y</td>
<td>EP 0 220 980 A (ISOVER SAINT-GOBAIN) 6 May 1987 (1987-05-06) claim 1 figures</td>
<td>5, 7</td>
</tr>
</tbody>
</table>

| X        | Further documents are listed in the continuation of Box C. | X |

Sea patent family annex.

* Special categories of cited documents:
  * "A" document defining the general state of the art which is not considered to be of particular relevance
  * "E" earlier document but published on or after the international filing date
  * "L" document which may throw doubts on priority claims or which is cited to establish the publication date of another citation or other special reason (as specified)
  * "O" document referring to an oral disclosure, use, exhibition or other means prior to the international filing date but later than the priority date claimed
  * "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  * "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  * "Y" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
  * "A" document member of the same patent family

**Date of the actual completion of the international search**

13 July 2006

**Date of mailing of the international search report**

24/07/2006

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patenten 2 NL-2280 HV Hilversum
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax. (+31-73) 040-3016

Authorized officer

Gino, C
<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US 4 909 388 A (WATANABE ET AL) 20 March 1990 (1990-03-20) abstract; figures</td>
<td>1,5</td>
</tr>
<tr>
<td>Y</td>
<td>US 5 080 281 A (SEABOLD ET AL) 14 January 1992 (1992-01-14) column 4, line 16 – line 33; figures</td>
<td>8</td>
</tr>
<tr>
<td>Patent document cited in search report</td>
<td>Publication date</td>
<td>Patent family member(s)</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>DE 4005541 A1</td>
<td>29-08-1991</td>
<td>NONE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FR 2587682 A1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IE 60164 B1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TR 22637 A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DE 19959561 A1</td>
</tr>
<tr>
<td>US 4909388 A</td>
<td>20-03-1990</td>
<td>NONE</td>
</tr>
<tr>
<td>US 5080281 A</td>
<td>14-01-1992</td>
<td>NONE</td>
</tr>
</tbody>
</table>

Form PCT/ISA/210 (patent family annex) (April 2006)