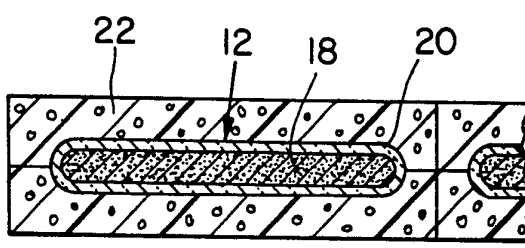




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification <sup>5</sup> : E04B 1/80, F25D 23/06</p>	<p>A1</p>	<p>(11) International Publication Number: <b>WO 91/02856</b> (43) International Publication Date: 7 March 1991 (07.03.91)</p>
<p>(21) International Application Number: PCT/US90/04864 (22) International Filing Date: 27 August 1990 (27.08.90) (30) Priority data: 398,788 25 August 1989 (25.08.89) US (71) Applicant: MASSACHUSETTS INSTITUTE OF TECHNOLOGY [US/US]; 77 Massachusetts Avenue, Cambridge, MA 02139 (US). (72) Inventors: GLICKSMAN, Leon, R. ; 8 Maiden Lane, Lynnfield, MA 01940 (US). BURKE, Melissa, S. ; 473 Chapel Court, Pittsburgh, PA 15237 (US). (74) Agents: REYNOLDS, Leo, R. et al.; Hamilton, Brook, Smith &amp; Reynolds, Two Militia Drive, Lexington, MA 02173 (US).</p>		<p>(81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent)*, DK (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).</p> <p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
<p>(54) Title: THERMAL INSULATIONS USING VACUUM PANELS</p>		
		
<p>(57) Abstract</p> <p>Thermal insulation vacuum panels are formed of an inner core (18) of compressed low thermal conductivity powders enclosed by a ceramic/glass envelope (20) evacuated to a low pressure.</p>		

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THERMAL INSULATIONS USING VACUUM PANELSDescriptionBackground of the Invention

5 The most efficient insulation used in buildings  
and appliances is closed cell foam polyurethane,  
polyisocyanurate or phenolic insulation. When new,  
this insulation has over twice the insulating value  
per inch of thickness as does fiberglass insulation.  
Substantially, all commercial refrigerators made  
10 today in the U.S. use closed cell foam for the  
surfaces; save the doors. About seven million  
refrigerators are sold in the U.S. every year.  
One-third of the interior volume of a refrigerator is  
foam insulation. Industry representatives estimate  
15 that reducing insulation volume by one cubic foot  
would be worth \$50.

About one-half of the buildings constructed in  
the U.S. use closed cell foam for roof or wall  
insulation. Use of boards made of foam as exterior  
20 sheathing is the most practical way 2 x 4 framed  
construction can meet the current energy standards.

Closed cell foam has excellent insulating  
characteristics because it contains chlorofluoro-  
carbon (CFC) vapor within the cells. The CFC vapor  
25 has a thermal conductivity which is one-third that of  
air. Unfortunately, it has been found that this CFC  
causes depletion of the stratospheric ozone layer.  
The U.S. and other developed nations have agreed to  
phase out the use of CFC over the next decade.

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Replacement refrigerant vapors are not available at present. Replacements being considered have not completed toxicity tests, have higher projected costs and higher thermal conductivity, and there is little  
5 manufacturing capability in place for these replacements.

All of the above factors favor the development of alternate insulations which are inexpensive and have insulating values per unit thickness equal to or  
10 exceeding that of present day closed cell foams. One such concept is vacuum thermal insulation. Vacuum insulations have been used for thermos-type containers and for vessels containing cryogenic fluids. These are vacuums made with rigid wall  
15 containers which have a high reflectivity surface to reduce radiation heat transfer. These insulations are expensive and fragile.

Recent interest has centered on vacuum panels made with flexible surfaces. In Uekado et al., U.S.  
20 4,668,555, the panel is formed of evacuated foam insulation within a metal-plastics laminate film envelope. In another system, the panels are filled with lightly compressed blocks of fine powder. The powder is covered with a flexible plastic skin or  
25 packaging coated with thin metallic layers which prevent air diffusion. When the interior of the panel is evacuated to a modest vacuum, e.g., one mm Hg pressure, the effective conductivity of the powder is found to have one-third to one-fifth the  
30 conductivity of the best closed cell foam insulation.

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The powder also supports the skin so that it does not collapse when it is evacuated.

#### Summary of the Invention

The problem with such systems is the presence of  
5 pin holes, or gaps, in the metallic-plastic layers  
which allow air to enter the panel. As the air  
pressure in the panel rises, the insulating  
performance drops off dramatically.

Use of thicker metal foils to prevent pin holes  
10 causes a secondary problem. Since the metal is a  
good conductor of heat, appreciable heat is  
transferred around the foil surface, bypassing the  
vacuum space.

The deficiencies summarized above may be  
15 overcome by the present invention. In accordance  
with the present invention, evacuated insulation  
panels are formed by enclosing in an evacuated  
envelope lightly compressed fine powder formed of low  
thermal conductivity materials. The envelope is also  
20 comprised of low thermal conductivity, low gas  
permeable ceramic material, such as glass or other  
ceramics in continuous layers. Optionally, the  
panels thus formed may be enclosed in an outer  
protective enclosure of low thermal conductivity  
25 lightweight material, such as open-cell foam.

The low-thermal conductivity envelope reduces  
the opportunity for heat to bypass the evacuated  
envelope and the foam enclosure protects the envelope  
surface from abrasion or sharp objects.

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The ceramic envelope can be preformed in the shape of the powder as it is manufactured, or it can initially be in continuous sheet form, powder or non-woven fiber form, or it can be placed over the  
5 compressed powder, heated to softening, and formed around the powder by evacuating the powder while the hot film envelope is being formed in place around the powder.

An array of N rows and M columns of such panels  
10 can be formed so that damage to one does not substantially degrade overall performance.

#### Brief Description of the Drawings

Fig. 1 is a front view of a panel array of the invention.

15 Fig. 2 is a sectional view taken along lines II-II of Fig. 1 of the overall panel array performance.

Fig. 3 is a schematic view of a first method for forming panel envelopes in accordance with the  
20 invention.

Fig. 4 is a schematic view of a method for forming panels in accordance with the invention.

Fig. 5 is a partial sectional view of a panel.

Fig. 6 is a perspective view of a portion of a  
25 panel array made in accordance with the Fig. 4 method.

Fig. 7 is a sectional side view of a first step in an alternate method for making the panels of the invention.

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Fig. 8 is a sectional side view of a last step in the process of Fig. 7.

Fig. 9 is a sectional view of a first step in another method embodiment for making the panels of the invention.

Fig. 10 shows the panel as processed in Fig. 9.

Fig. 11 shows a step in a glass blowing embodiment of the invention.

Fig. 12 shows the panel envelope as made per Fig. 11.

#### Detailed Description of the Invention

Referring now to Figs. 1 and 2, the invention will now be described in detail in connection therewith. An array 10 of evacuated insulation panels 12 is shown in Fig. 1 which consists of N rows and M columns. In the embodiment of Fig. 1, N = M = 5. Each panel consists of an inner core of low thermal conductivity powder, such as fumed silica (Minileit<sup>TM</sup>, Gruenzweig and Hartmann AG) (Aerosil 380<sup>®</sup> or Cab-O-Sil<sup>®</sup>, Cabot Corporation) silica dust (Selma Gray<sup>TM</sup>, Alabama Met. Corp. or Beverly Fume<sup>TM</sup>, Interlake, Inc.), fine perlite (Chemrock Corp.), fiberglass and alumina, precipitated silica (FK500LS, Degussa Corp.) or precipitated silica/fly ash mixtures. Each of these materials is considered to be a low conductivity powder. Preferably, such material should have a high thermal resistivity of about 15 or more (h ft<sup>2</sup>·F/Btu in) at pressure levels in the range of 1/10-10 mm Hg.

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[See Advanced Evacuated Thermal Insulators: The State of the Art, H. Alan Fine (1988)] An outer envelope 20 of low thermal conductivity material which has a low permeability to atmospheric gases encloses the powder. Preferably, this material is glass, such as pyrex<sup>®</sup>, C-Glass, Corning low melting point solder glass, or an Owens-Corning Glass fiber mat combined with solder glass or ceramic glaze.

The envelope is evacuated down to a pressure of about 5 mm Hg.

Glass has a thermal conductivity which is 200 times less than aluminum, 40 times less than mild steel and only 3-5 times greater than polymers. In addition, glass has a very low permeability to all gases, except helium.

In the embodiment of Fig. 1, a glass envelope 20 is formed of a glass film 5-15 thousands of an inch thick. Each panel envelope 20 is 5 inches wide and 1 inch thick. This will have an insulating value equivalent to 3.5 - 4 inch thick closed cell foam. The vacuum elements of this width are preferably enclosed in open cell air filled foam protection covering 22. The foam 22 protects the glass surface from abrasion or sharp objects. If a 5 inch wide envelope 20 is punctured, neighboring vacuum panels will continue to function and the overall impact on the appliance or the building energy efficiency will be minimal.



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Thin glass sheets for the envelope can be manufactured by continuous extrusion and drawing, as shown in the schematic diagram of Fig. 3. Softened or molten glass 30 is forced through die 32 yielding flattened oval- or elliptical-shaped cylindrical extended glass panel envelopes 34. Alternatively, glass in tubular form may be heated and drawn to the requisite envelope shape 34. Suitable low thermal conductivity powder (not shown) may be co-extruded into the center of the envelope 34, or added later in the process. The extended envelope 34 is cut to the desired length (about 18 inches) and evacuated and sealed at the ends. Molded glass or metallic end caps may be used to seal the ends. Optical clarity and uniform thickness are not necessary, so the sheets should be relatively inexpensive.

The thin glass envelope has some degree of flexibility; the tightly compacted powder can support the glass without breakage if the glass has the same shape as the powder. The glass can be preformed as it is manufactured, as shown in Fig. 4. In Fig. 4, a hot glass sheet is conveyed past a die 42 in the direction of arrow 44. Die 42 rotates about its axis in the counterclockwise direction indicated by arrow 46. Male molds 48 disposed about the latitude and periphery of cylindrical die 42 create dimples 50, or depressions, in sheet 40 as it passes beneath the die 42. These dimples may be several inches in width or diameter, with a depth up to one or several inches. Surrounding each depression 50 is a flat portion 52

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of the sheet, as shown in Fig. 6. The depressions are filled with powder 60, either in loose form, or compressed lightly into the shape of the depression 50. If in loose form, the powder should be  
5 compressed after it enters the depression to eliminate any large voids. A second flat sheet of glass 54 is placed over the dimpled sheet 90 forming a cover for the depressions. The resulting sandwich 60 (Fig. 5) is placed in a vacuum oven (not shown) to  
10 evacuate the air from the powder 60 and the two glass sheets 54 and 50 are sealed by fusing the adjacent flat surfaces 52 and 62 at elevated temperatures (Fig. 5).

Alternatively, an upper glass sheet 70 can be  
15 placed over pellets of compressed powder 72 disposed on a lower glass sheet 74, as shown in Fig. 7. Each pill or pellet 72 may be three or four inches wide and one-half to one inch thick. The sandwich is placed in a vacuum oven (not shown) and the  
20 temperature elevated above the glass softening temperature. The glass sheet 72 on top flows around the surface of the pill 72, optionally, with the aid of a mold or fixture 76 applying pressure from above, and joins the sheet 74 on the bottom to form a series  
25 of closed surfaces around each individual pill 72, as shown in Fig. 8.

In another embodiment, shown in Fig. 9, the compressed insulating powder shapes or pills 80 may be coated with a ceramic or glass powder 82, such as  
30 C-Glass or Corning low melting point solder glass,

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whose melting point is lower than the softening point of the insulating powder forming the pill 80. The coated shape is heated in a vacuum until the powder on the surface forms a liquid which flows together to form a continuous surface film or glaze 82' to encapsulate the evacuated pill 80' (Fig. 10).

As shown in Fig. 11, the glass envelope can be blown into the desired shape much the same way as glass containers are blown by blowing a hot gob of glass 90 into a mold 92 of the desired shape. Possible shapes include flat cylinders 94 four inches in diameter and one inch high with an open filling tube 96 on the top. Another shape is the flattened cylinder described in connection with Fig. 3. Powder (not shown) is added to the container 94 and the container is evacuated with a filter in the neck 96 to retain the particles. The powder compacts as it is evacuated, or can be compacted by vibration. Several successive fillings will achieve complete filling of the glass shape. The filling tube can be sealed by heating and pinching off the tube 96, or by the use of an end cap similar to the base of an incandescent light bulb.

The evacuated panels can be placed in a foam matrix 22 (Fig. 2), or used by themselves. They can be used to insulate appliances or to form part of an insulated building panel. Another possible use of the vacuum panel is as a night insulation for windows. Strips 2.5 inches wide and 1/4 inch thick may have an R value of 7 (BTU hrft<sup>2</sup>·F)<sup>-1</sup> when

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evacuated to a level of 10 mm Hg, or less, and sealed by a glass envelope. These strips could be used in the form of jalousies, or in a flexible roll which can be deployed at night.

5       The inorganic ceramic envelope evacuated powder panels of the present invention can be made with small widths without causing substantial degradation of thermal performance.

10       In another embodiment, the powder is enclosed in a five to 10 mil thick nonwoven glass fiber mat, which is porous to air, such as that made by Owens Corning Fiberglas. The powder element enclosed in the mat can be used in the aforementioned processes. Alternatively, the mat can be impregnated with  
15 powdered glass, such as Corning low melting point solder glass or powdered C glass, so that when the mat is heated, the powdered glass melts to form with the mat a strong impermeable envelope. The mat and the powdered glass can be combined together before  
20 applying around the low conductivity powder, or the low conductivity powder can be encapsulated within the mat, the glass powder applied to the mat surface and the resulting elements placed in a vacuum furnace to evacuate the low conductivity powder and melt the  
25 glass powder on the surface of the glass mat. In this process, the glass powder must have a lower melting point than the softening point of the low conductivity powder.

To automate the process, it may be desirable to  
30 first heat the powder in loose or compressed form

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and/or evacuate the powder for enough time to drive off water, gas or vapor-forming materials which are physically trapped or chemically bonded to the particles before the particles are encapsulated in the glass layer. Typically, heating at 212°F for 24 hours is used for the powder.

If low temperature means are used to seal the glass around the low conductivity powder, it may be advantageous to first evacuate and seal the powder in an inexpensive conventional food packaging which will retain an adequate vacuum, of the order of 1 to 10 mm Hg for a period of several hours to several weeks. This process can be carried out using processes similar to the vacuum packing of foods, such as coffee. This package could be subsequently sealed in a thin glass envelope within hours or days of its manufacture. In sealing this package in glass film, the evacuation could be carried out very quickly.

This completes the description of the preferred embodiments of the invention.

#### Equivalents

Those skilled in the art will recognize, or be able to ascertain employing no more than routine experimentation, many equivalents to the specific structures, steps, functions and materials described specifiially herein, and such equivalents are intended to be encompassed within the scope of the following claims.

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CLAIMS

1. An evacuated insulation panel comprising:
  - a) an inner core of low thermal conductivity material;
  - 5 b) an outer envelope of thin low thermal conductivity, low gas permeable material enclosing the core in an evacuated volume.
  
2. An insulation panel comprising an inner core of low thermal conductivity material contained in  
10 an evacuated envelope formed of low thermal conductivity, low gas permeable material.
  
3. The panel of Claim 2 wherein the envelope is formed of glass.
  
4. The panel of Claim 2 wherein the envelope is  
15 formed of ceramic.
  
5. The panel of Claim 1 wherein the envelope is formed of glass.
  
6. An evacuated insulation system comprising:
  - a) a plurality of panels each comprising:
    - 20 (i) an inner core of low thermal conductivity powder;
    - (ii) an outer envelope of thin low thermal conductivity, low gas permeable

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material enclosing the powder in an evacuated volume; and

b) a protection covering of closed cell foam enclosing the panels.

- 5 7. The system of Claim 6 wherein the panels form an array of N rows and M columns of evacuated panels.
8. The system of Claim 6 wherein the envelope is formed of glass.
- 10 9. The system of Claim 6 wherein the envelope is formed of ceramic.
10. The system of Claim 7 wherein N and M are greater than one.
11. The method of forming an insulation panel  
15 comprising the steps of:  
a) forming an inner core of low thermal conductivity material;  
b) forming an outer envelope of thin low thermal conductivity, low gas permeable  
20 material enclosing the core;  
c) evacuating the envelope.
12. The method of Claim 11 wherein the panel is formed by placing a glass sheet under the core

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and a glass sheet over the core and sealing the two sheets about the periphery of the core.

13. The method of Claim 11 wherein the envelope is formed by extruding glass through a die.
- 5 14. The method of Claim 11 wherein the envelope is formed of glass which is blown in a mold shaped like the envelope.
15. The method of forming an insulation panel comprising:
- 10 a) forming an inner core of low thermal conductivity powder;
- b) forming an outer envelope of thin low thermal conductivity, low gas permeable material enclosing the powder; and
- 15 c) evacuating the envelope.
16. An evacuated insulation panel comprising:
- a) an inner core of high thermal resistivity material;
- 20 b) an outer envelope of thin low thermal conductivity, low gas permeable material enclosing the core in an evacuated volume.
17. The panel of Claim 16 wherein the thermal resistivity is in the range above 15 (hrft<sup>2</sup>·F/BTU-in) at pressure levels of 1/10-10 mm of Hg.
- 25



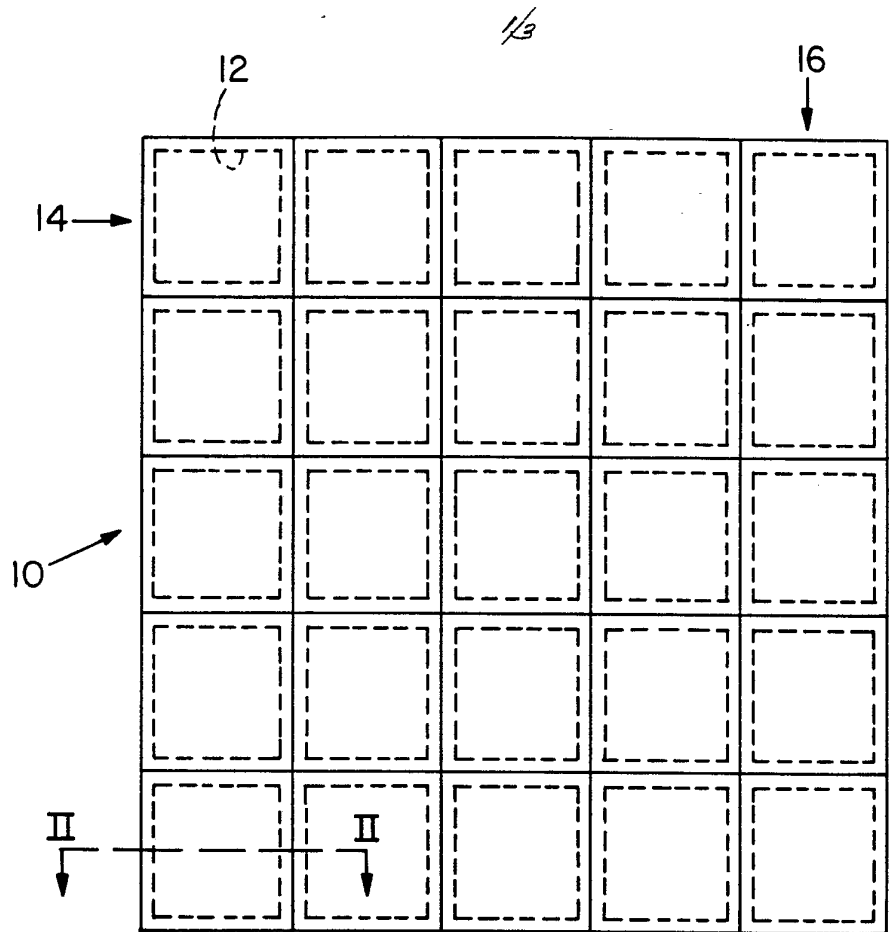


Fig. 1

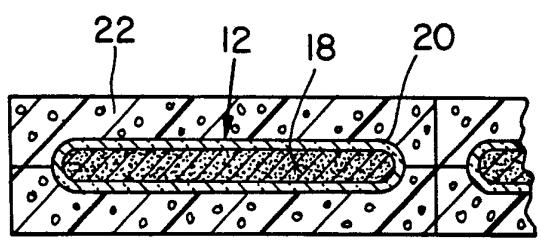


Fig. 2

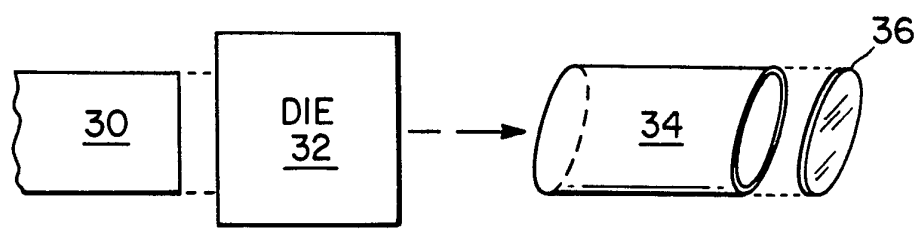


Fig. 3

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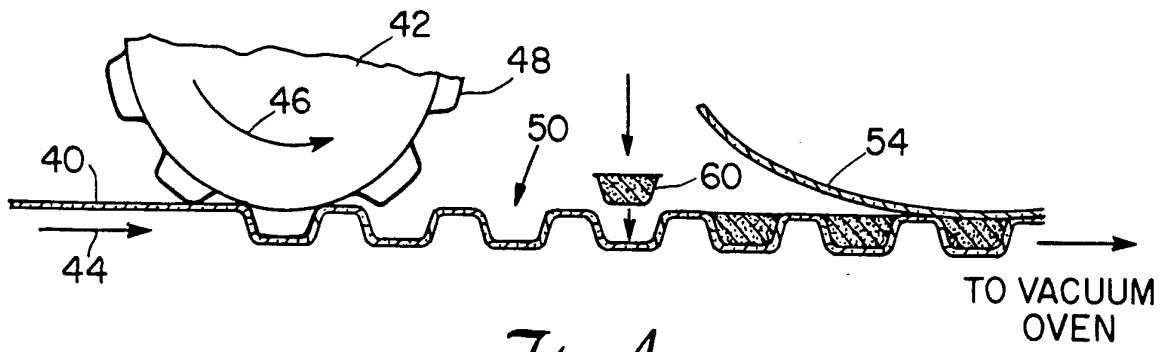


Fig. 4

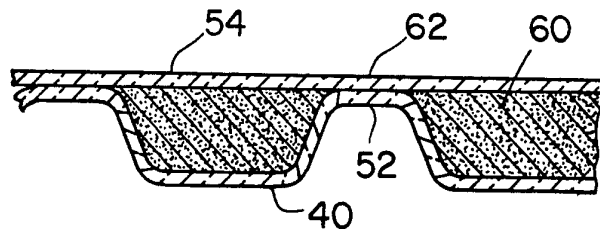


Fig. 5

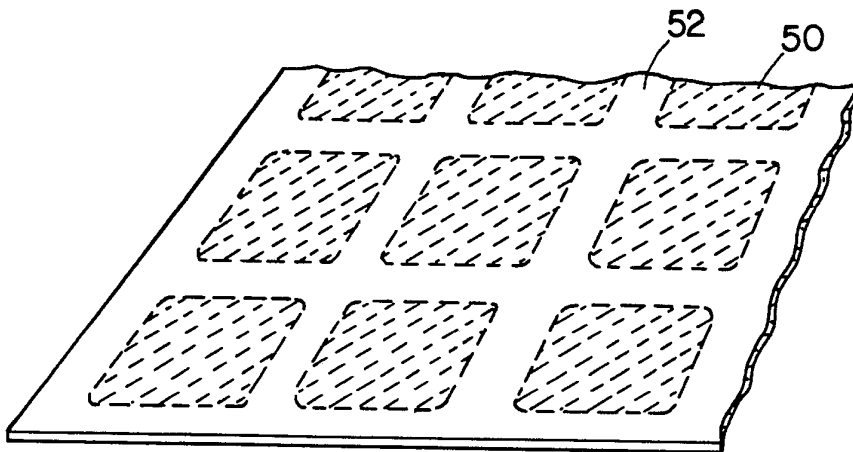


Fig. 6

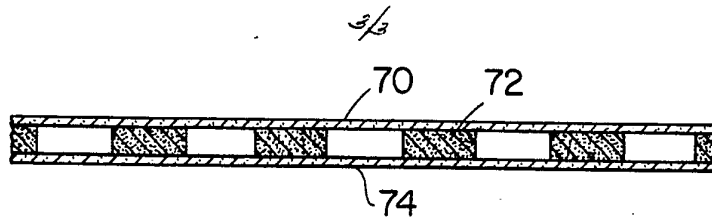


Fig. 7

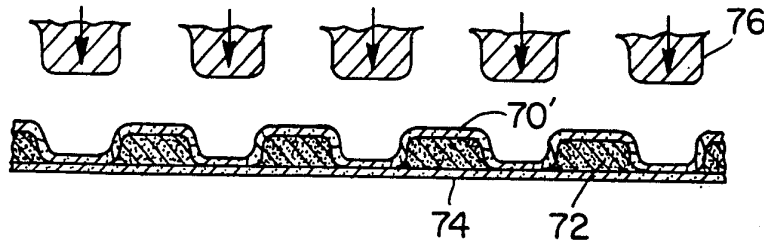


Fig. 8

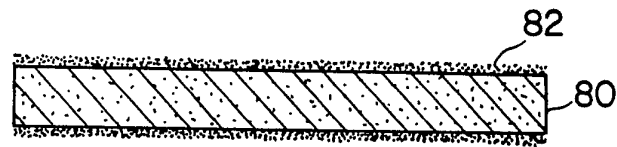


Fig. 9

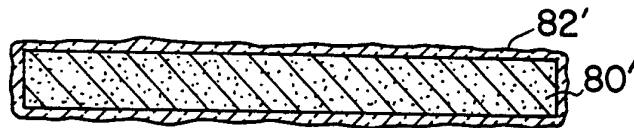


Fig. 10

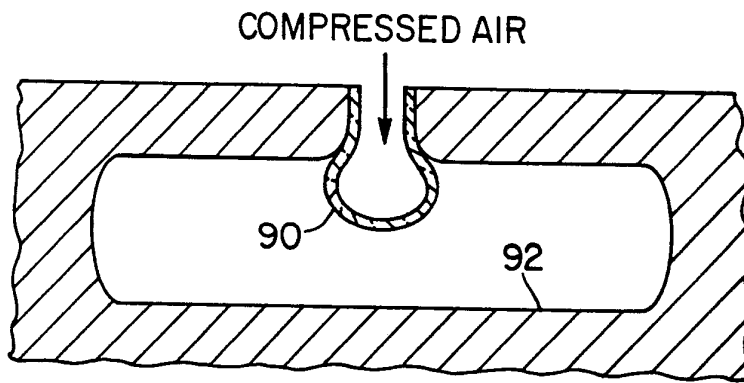


Fig. 11

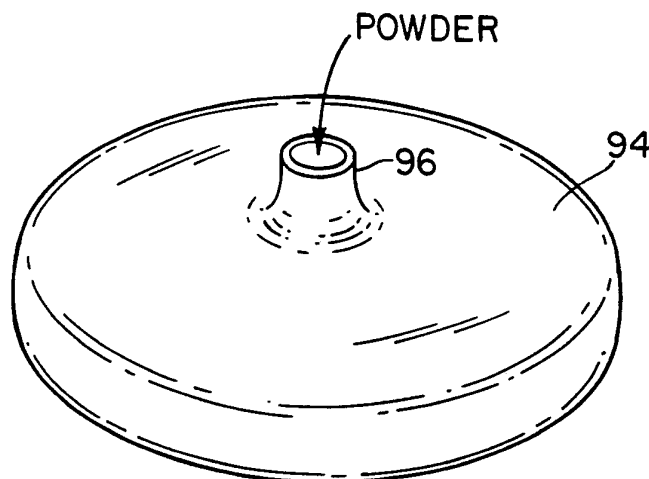


Fig. 12

# INTERNATIONAL SEARCH REPORT

International Application No PCT/US 90/04864

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC IPC <sup>5</sup> : E 04 B 1/80, F 25 D 23/06				
<b>II. FIELDS SEARCHED</b> Minimum Documentation Searched <sup>7</sup>				
Classification System	Classification Symbols			
IPC <sup>5</sup>	E 04 B			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>				
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>				
Category <sup>9</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>		
X	US, A, 4529638 (YAMAMOTO) 16 July 1985 see column 2, lines 1-67; figures 1,2 --	1,2,6,16		
X	US, A, 4798753 (ABUAF) 17 January 1989 see column 3, lines 62-68; column 4, lines 1-68; column 5, lines 1-4; column 7, lines 19-40; figures 1,2 --	1,2,6,16		
A	GB, A, 1271070 (ACCESSAIR) 19 April 1972 see page 2, lines 78-116; figures 1,2 -- ./	1,3,5		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <ul style="list-style-type: none"> <li>* Special categories of cited documents: <sup>10</sup></li> <li>"A" document defining the general state of the art which is not considered to be of particular relevance</li> <li>"E" earlier document but published on or after the international filing date</li> <li>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</li> <li>"O" document referring to an oral disclosure, use, exhibition or other means</li> <li>"P" document published prior to the international filing date but later than the priority date claimed</li> </ul> </td> <td style="width: 50%; border: none; vertical-align: top;"> <ul style="list-style-type: none"> <li>"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</li> <li>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</li> <li>"Y" document of particular relevance; the claimed invention 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.</li> <li>"Z" document member of the same patent family</li> </ul> </td> </tr> </table>			<ul style="list-style-type: none"> <li>* Special categories of cited documents: <sup>10</sup></li> <li>"A" document defining the general state of the art which is not considered to be of particular relevance</li> <li>"E" earlier document but published on or after the international filing date</li> <li>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</li> <li>"O" document referring to an oral disclosure, use, exhibition or other means</li> <li>"P" document published prior to the international filing date but later than the priority date claimed</li> </ul>	<ul style="list-style-type: none"> <li>"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</li> <li>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</li> <li>"Y" document of particular relevance; the claimed invention 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.</li> <li>"Z" document member of the same patent family</li> </ul>
<ul style="list-style-type: none"> <li>* Special categories of cited documents: <sup>10</sup></li> <li>"A" document defining the general state of the art which is not considered to be of particular relevance</li> <li>"E" earlier document but published on or after the international filing date</li> <li>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</li> <li>"O" document referring to an oral disclosure, use, exhibition or other means</li> <li>"P" document published prior to the international filing date but later than the priority date claimed</li> </ul>	<ul style="list-style-type: none"> <li>"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</li> <li>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</li> <li>"Y" document of particular relevance; the claimed invention 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.</li> <li>"Z" document member of the same patent family</li> </ul>			
<b>IV. CERTIFICATION</b>				
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report			
21st December 1990	24. 01. 91			
International Searching Authority	Signature of Authorized Officer			
EUROPEAN PATENT OFFICE	miss T. MORTENSEN			

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US, A, 4579756 (EDGE) 1 April 1986 see column 3, lines 58-68; column 4, lines 1-51; figures 1,9,10  --	1,7,10
A	US, A, 3991531 (BECKER) 16 November 1976 see column 5, lines 24-36; column 7, lines 50-68; column 8, lines 1-68; column 9, lines 1-7; figures 1-6  -----	1,2,3,5

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

US 9004864

SA 40292

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 16/01/91. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4529638	16-07-85	JP-A, B, C57096852	16-06-82
US-A- 4798753	17-01-89	JP-A- 63190999	08-08-88
GB-A- 1271070	19-04-72	None	
US-A- 4579756	01-04-86	None	
US-A- 3991531	16-11-76	US-A- 3803784	16-04-74
		BE-A- 769025	03-11-71
		CA-A- 984118	24-02-76
		CA-A- 995868	31-08-76
		CH-A- 579189	31-08-76
		DE-A- 2031394	30-12-71
		DE-A- 2036013	23-03-72
		DE-A- 2043461	15-06-72
		DE-A- 2044378	23-03-72
		DE-A- 2126352	14-12-72
		FR-A- 2104764	21-04-72
		GB-A- 1366503	11-09-74
		NL-A- 7108750	28-12-71
		SE-B- 387684	13-09-76
		US-E- RE29517	17-01-78