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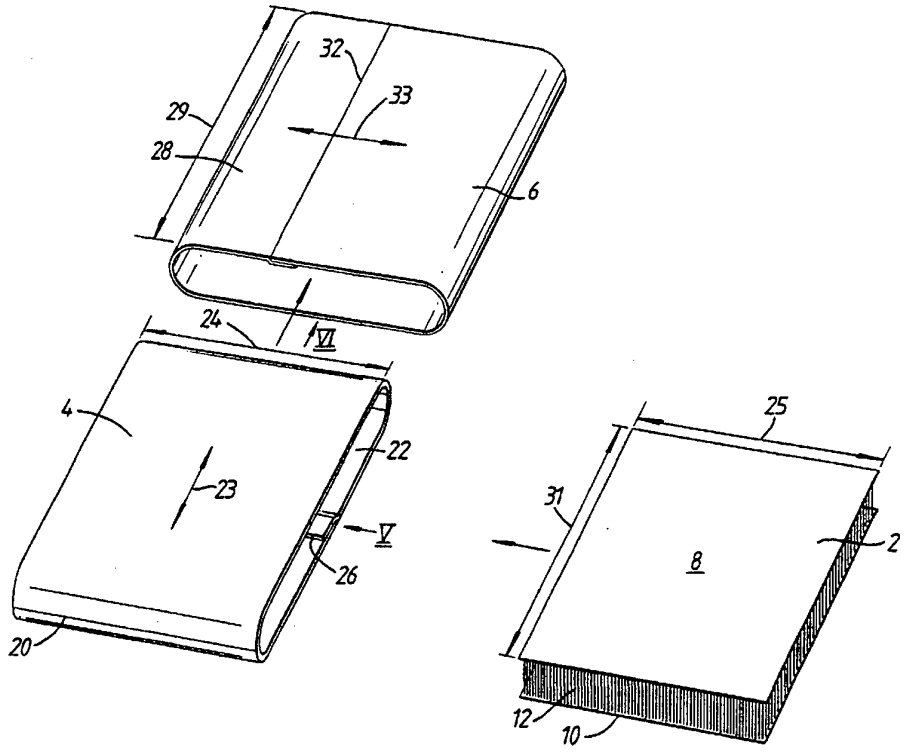
(54) Title: A LIFTING CUSHION

(57) Abstract

A lifting cushion includes an inflatable envelope (2), a first layer (4) and a second layer (6). The envelope (2) includes two rectangular sheets (8 and 10) of woven polyaramid cloth. The sheets (8 and 10) are connected either by a very large number of closely adjacent polyaramid filaments (12) or a series of cell structures (58) made of polyaramid or polyester sheet. The first layer (4) is wrapped around the envelope (2) with the direction of reinforcement (20) extending in the direction (23). The second layer (6) is wrapped around the first layer (4) with the direction of reinforcement (33) running perpendicularly to the direction of reinforcement (23) of the sheet (20). The first and second layers are made of polyaramid and coated with a neoprene layer on both their upper and lower surfaces. An air valve is inserted in one corner of the envelope (2). The envelope (2) and first and second layers (4 and 6) are heated, compressed and hot vulcanised to secure these components to one another during manufacture of the lifting cushion.



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A LIFTING CUSHION

The present invention relates to a lifting cushion for supporting, raising or moving objects.

Lifting cushions of the invention may for example be used for rescuing people who are trapped by collapsible walls, girders, concrete slabs or heavy road vehicles. This lifting cushion can also be used for prising steering columns, removing windscreens and for forcing doors. Industrial uses of these lifting cushions include lifting heavy machinery, rail locomotives and pipelines, supporting tensioning in mining, splitting slabs in quarries, and use as compression or spreader elements.

In operation, the lifting cushion in placed in its flattened condition beneath the object to be raised. The cushion is then inflated thereby raising the object. If further lift is required one or more additional lifting cushions may be inserted one above the other and subsequently inflated to provide a required degree of lift of the object.

In order to provide a maximum lifting force the lifting cushions are generally of rectangular form. With the previously known lifting cushions the problem arises that when the cushion is inflated the cushion changes from its non-inflated flat rectangular form to a form having a generally oval vertical cross-section. This change in shape of the cushion considerably reduces the contact area between the cushion and the object to be raised thereby producing a corresponding reduction in the lifting force that can be applied by the cushion to the object. There is also a significant risk arising from the difficulty of calculating the force required to lift

the object from the trapped person or to gain clearance to insert cribbage. It will be appreciated that this change of shape in the cushions makes it extremely difficult to provide sufficient stability to be able to use a plurality of cushions one on top of the other.

It is an aim of the invention to alleviate the above-mentioned disadvantages, and according to the present invention there is provided a lifting cushion comprising an air-tight inflatable envelope having two major opposed faces, a first layer extending around the envelope, and means for retaining said two major faces of the envelope at a preselected attitude to one another when the envelope is inflated.

The said means may comprise a plurality of closely adjacent filaments extending between and connected to the two major opposed faces of the envelope. In a preferred embodiment of the invention the filaments may be polyaramid filaments but the invention is not restricted to filaments made of polyaramid material. The length of the filaments will define the preselected relative attitude of the two major faces of the envelope, and also the spacing of these major faces when the envelope is fully inflated. In one example of the invention the polyaramid filaments may be 100mm in length but the invention is not restricted to filaments of any specific length.

The said means may also comprise a plurality of cell structures extending between and connected to the two major opposed faces of the envelope. In a preferred embodiment of the invention the cell structure may be constructed from a Polyaramid material, but the invention is not restricted to cells made from Polyaramid.

The vertical height of the cell structure will define the pre-selected relative attitude of the two major faces of the envelope, and also the spacing of these major faces when the envelope is fully inflated.

In one example of the invention the vertical height of the cell structure may be 100mm in length but the invention is not restricted to cells of any specific height or width.

The first layer may extend in a first direction, and be folded around the envelope.

The invention may include a second layer extending in a second direction and being folded around the said first layer. The folded over regions of this second layer may be on the opposite side of the lifting cushion to the folded over regions of the first layer, and in a preferred embodiment the said first and second directions are at 90^0 to one another.

In a construction in which the envelope is rectangular, the said first and second directions of the layers extend parallel to first and second sides of the rectangular envelope.

In another embodiment of the invention the first layer comprises two sheet portions which are laid one on each of the associates major surfaces of the envelope, and folded over the sides of the envelope.

The major opposed faces of the envelope may be made of woven polyaramid cloth or polyaramid cord superimposed with a steel tyre cord. The exterior upper and lower surfaces of the envelope may be coated with an air

holding rubber compound to enable the envelope to be vulcanised and secured to the first and second layers in the construction of the lifting cushion.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of an envelope of a lifting cushion of the invention,

Figure 2 is a perspective view of a first and second layer of the cushion of Figure 1,

Figure 3 is a perspective view of a nipple for an air valve,

Figure 4 is a perspective view of a metallic fitting for the nipple,

Figure 5 is a diagrammatic side elevation of a double unit lifting cushion of the invention before folding the second layer,

Figure 6 is a side elevation of the lifting cushion of Figure 5 when the layers are folded,

Figure 7 is a diagrammatic side elevation of another lifting cushion envelope of the invention, and

Figure 8 is a diagrammatic side elevation of a further lifting cushion envelope of the invention.

Referring to the drawings, the lifting cushion comprises an inflatable envelope 2, a first layer 4 and a second

layer 6. The lifting cushion is manufactured in a press using hot vulcanisation, and the material of the components of the cushion is unvulcanised before hot vulcanisation takes place.

Alternatively, the lifting cushion may be hand assembled prior to hot vulcanisation.

The envelope 2 includes two rectangular sheets 8 and 10 of woven polyaramid cloth or polyaramid cord superimposed with steel tyre cord. The sheets 8 and 10 are connected by a very large number of closely adjacent polyaramid filaments 12, and the length of these filaments defines the maximum separation distance of the sheets 8 and 10. In the illustrated embodiment all the filaments are of equal length to ensure that the sheets 8 and 10 are parallel to one another when the envelope 2 is fully inflated. However, different filaments may have different lengths to enable the sheets 8 and 10 to be inclined to one another at a required angle when the envelope 2 is fully inflated. The filaments 12 may have any desired length in order to provide the required attitude and spacing of the sheets 8 and 10.

The outer surfaces of the envelope sheets 8 and 10 are coated with an air retaining rubber compound such as neoprene thereby enabling the envelope 2 to be vulcanised to the other components of the lifting cushion. This coating is spread on the sheets 8 and 10 with rollers.

An air valve for the envelope 2 includes a rubber nipple 14 attached to a nozzle 16, and a metal fitting 18 which is located in the nozzle 16.

Referring to Figure 8 another envelope of the invention

includes the two rectangular sheets 8 and 10 of woven polyaramid cloth or polyaramid cord superimposed with steel tyre cord. The sheets 8 and 10 are connected by a plurality of cell structures 58 which extend the length of the envelope 2 in the direction perpendicular to the plane of Figure 8. Each cell structure is of rectangular cross-section, and is formed from polyaramid or polyester sheet material. The end portions 60 and 62 of the sheet material overlap at the upper regions of each cell 58. The vertical height of these cells defines the maximum separation distance of the sheets 8 and 10, and in the illustrated embodiment all the cell structures are of equal height to ensure that the sheets 8 and 10 remain parallel to one another when the envelope is fully inflated.

However, different cells 58 may have different vertical heights enabling the sheets 8 and 10 to be inclined to one another when the envelope 2 is fully inflated. The cell structures 58 may have any desired height in order to provide the required attitude and spacing of the sheets 8 and 10.

In another cell structure, the height of the cells may be adjustable so as to vary the separation distance of the sheets 8 and 10.

The outer surfaces of the envelope sheets 8 and 10 are coated with an air retaining rubber compound such as neoprene thereby enabling the envelope 2 to be vulcanised to the other components of the lifting cushion. This coating is spread on the sheets 8 and 10 with rollers.

The first layer 4 consists of a rectangular sheet 20 of polyaramid which is coated with a neoprene layer on both

the upper and lower surfaces. This sheet 20 has the same width 24 as the width 25 of the envelope 2, and the length of the sheet 20 is chosen so that it can be wrapped round the envelope 2 with the sheet edges 26 overlapping one another in the centre of the lifting cushion. The direction of reinforcement of the sheet 20 extends in the direction 23.

The second layer 6 consists of a second rectangular sheet 28 which is made of the same material as, and neoprene coated the same as, the first sheet 20 except that all its directions and dimensions are rotated through 90^0. The sheet 28 has the same width 29 as the length 31 of the envelope 2, and the length of the sheet 28 is chosen so that it can be wrapped round the first layer 4 with its edges 32 overlapping in the centre of the lifting cushion. The direction of reinforcement 33 of the sheet 28 runs perpendicularly to the direction of reinforcement 23 of the sheet 20.

During manufacture, the first and second layers 4 and 6 are carefully pressed by a roller in order to prevent air from being trapped in the two layers. Any such trapped air would breathe during inflation and evacuation of the lifting cushion thereby producing unwanted separation of the components of the cushion.

The envelope 2 is placed in the centre portion of the laid out first sheet 20. The two outer portions of the sheet 20 are folded over the envelope 2 so that the two sheet edges 26 overlap one another. The rubber nipple 14 of the air valve is inserted in one corner of the envelope 2 with the attached nozzle 16 extending from the envelope 2.

The sheet 20, envelope 2 and nipple 14 are then heated and compressed by a platen, and hot vulcanised to secure these components to one another. The attached sheet 20 and envelope 2 are then placed on the centre portion of the laid out second sheet 28 which is located at 90^0 to the first sheet 20. The two outer portions of the sheet 28 are then folded over the first sheet 20 so that the two sheet edges 32 overlap one another on the opposite face of the lifting cushion to the edges 26 of the first sheet 20. The direction of reinforcement 33 of the sheet 28 runs perpendicularly to the direction of reinforcement 23 of the first sheet 20.

The folded sheet 28 is heated and compressed by a platen and hot vulcanised to secure the sheet 28 to the sheet 20 and envelope 2. The sheets 20 and 28 are preferably folded over suitable templates which can be manufactured from a metal sheet.

Figures 1 to 4 illustrate the components of a single unit lifting cushion. The invention includes within its scope a lifting cushion having two or more units. Referring to Figures 5 and 6, a two unit lifting cushion includes two units 34 and 36 with each unit constructed as previously described herein with reference to Figures 1 to 4. This double unit lifting cushion includes a central hinge strip 38 extending around a space 40 located between the two units 34 and 36. This hinge strip is made of a polyaramid sheet coated on both its surfaces with neoprene. This strip 38 is folded centrally to form a V cross-section and each arm of the V is vulcanised to the adjacent opposed sheets 20 and 28 of the upper and lower cushion units 34 and 36 which define the upper and lower surfaces of the space 40. This two unit assembly requires only a single air valve which is located in

either one of the units. Coaxial central orifices are made in the envelope sheets 20 and 28 of the first and second layers 4 and 6 adjacent to the space 40 between the two units to enable air from the air valve to enter both these units.

A lifting cushion of three or more units can be assembled in the same way by connecting all adjacent units by a hinge strip and providing coaxial central orifices between the sheets of adjacent units.

The lifting cushion of the invention may have any convenient dimensions. One embodiment of the invention may have the following dimensions:-

The envelope 2:-
The sheets 8 and 10 are each 510 x 510mm and the filaments 12 are 100mm in length.

The first layer 4 is 610 x 610mm when folded, and 610 x 1220mm when laid out flat. 50mm is added to the length for the edge overlap.

The second layer 6 is 610 x 610mm when folded and 610 x 1220 when laid out flat. 50mm is added to the length for the edge overlap.

In one example of a double unit lifting cushion of the invention each unit will have the above dimensions. The above-mentioned first and second layers 4 and 6 are larger than the envelope sheets 8 and 10 to allow for the 100mm length of the filaments. When the lifting cushion is inflated the surface areas of the first and second layers contract to 510 x 510mm to allow for the fully stretched filaments 12.

When manufacturing a lifting cushion having two or more units, each unit may be vulcanised separately and adjacent units and the connecting hinge assembly then vulcanised to one another. Alternatively, all the units and their connecting hinge strips may be secured together in a single vulcanising operation.

The above-described and illustrated lifting cushion is designed for an internal working pressure of 800 Kpa when the filaments 12 are fully extended to their operational length of 100mm. This enables the lifting cushion to lift and support a weight of 20,714 kg.

Although the described embodiment includes filaments 12 of polyaramid, the invention includes within its scope a lifting cushion having filaments of any suitable material such as, for example, a polyaramid/nylon mixture. The advantage of polyaramid is that it can sustain a working pressure greater than some other materials.

The described and illustrated embodiment includes within its scope a filament density in the range from 230 to 40,000 filaments 12 per square metre.

The important feature of the filaments 12 is that they retain the envelope sheets 8 and 10 in a preselected required relative attitude and spacing. It will be appreciated that the most common relative attitude will be when the sheets 8 and 10 are parallel to one another but the invention is not restricted to this configuration.

Figures 1 to 4 illustrate the components of a single lifting cushion in which the first layer 4 consists of a first single rectangular sheet 20, and the second layer 6

consists of a second single rectangular sheet 28. In another embodiment of the invention the second layer 6 is not used, and the single sheet 20 of the first layer 4 is replaced by two half sheets as illustrated in Figure 7.

Referring to Figure 7, another single unit lifting cushion of the invention includes the inflatable envelope 2 previously described herein and illustrated in Figure 1. The illustrated dimension L of the envelope 2 will be referred to herein as its length, and the breadth is the dimension perpendicular to the length.

The first layer 42 of the lifting cushion includes upper and lower half sheets 44 and 46 of polyaramid which are coated with a neoprene layer on both their upper and lower surfaces. Both sheets are rectangular, the same as the envelope sheets 8 and 10, but the half sheets 44 and 46 have a greater length and breadth than the sheets 8 and 10 in order that these sheets can cover the sides of the envelope 2. For example, if the envelope sheets 8 and 10 are held 100 mm apart when the envelope 2 is fully inflated, then the upper and lower half sheets 44 and 46 would each need to have a length and breadth 100 mm greater than the length and breadth of the envelope sheets 8 and 10. As an example, if the envelope sheets 8 and 10 are each 510 mm x 510 mm, then the upper and lower half sheets 44 and 46 will each be 610 mm x 610 mm.

During manufacture, the upper and lower half sheets 44 and 46 are carefully pressed by a roller in order to prevent air from being trapped in the two layers.

The envelope 2 is placed centrally on the lower half sheet 46, and the envelope 2 and half sheet 46 are then heated and compressed by a platen, and hot vulcanised to

secure these components to one another. The upper half sheet 44 is then placed centrally on the envelope upper sheet 8, and the envelope 2 and upper half sheet 44 are then heated and compressed by a platen and hot vulcanised to secure the components to one another. A strip 50 is made of a polyaramid sheet coated on both its surfaces with neoprene. This strip 50 is folded centrally to form a V cross-section with the arms of the V extending inwardly towards the envelope filaments 12 when the V is in its folded configuration. The strip 50 extends completely around the sides of the envelope 2, and the inner surfaces of the V arms are coated with mellamex.

The peripheral portions of the upper and lower half sheets 44 and 46 are folded over the envelope sides to form side sheets 52 and 54 which extend around the envelope 2. A small central gap 56 is left between the inner edges of the side sheets 52 and 54 which are each connected to the outer surface of the V strip 50. The rubber nipple 14 of the air valve is inserted in one corner of the envelope 2 with the attached nozzle 16 extending from the envelope 2.

The assembly is then hot vulcanised to secure the side sheets 52 and 54 to their respective arms of the V strip 50. The mellamex coating prevents the V strip 50 from being vulcanised into the permanently closed position. When the lifting cushion is inflated the V strip 50 and the side sheets 52 and 54 adopt the generally straight configuration illustrated in Figure 7. When the lifting cushion is deflated the V strip 50 closes inwardly causing the side sheets 52 and 54 to adopt a V shape with the point of the V extending outwardly along the generally central plane of the envelope 2.

Figure 7 illustrates the components of another single unit lifting cushion. The invention includes within its scope a lifting cushion having two or more units in which all or some of the units are as described herein and illustrated in Figure 7. Such a lifting cushion having two or more units will be constructed as described on pages 6 to 9 and the construction of a two unit lifting cushion is illustrated in Figures 5 and 6.

CLAIMS

1. A lifting cushion comprising an air-tight inflatable envelope (2) having two major opposed faces (8) and (10), a first layer (4) extending around the envelope, and means for retaining said two major faces of the envelope at a preselected attitude to one another when the envelope is inflated.

2. A lifting cushion as claimed in claim 1 in which the said means comprises a plurality of closely adjacent filaments (12) extending between and connected to the two major opposed faces of the envelope.

3. A lifting cushion as claimed in claim 2 in which the filaments are made of polyaramid material.

4. A lifting cushion as claimed in claim 2 or claim 3 in which the filaments are all of substantially the same length.

5. A lifting cushion as claimed in claim 1 in which the said means comprises a plurality of cell structures 58 extending between the two major faces 8 and 10 of the envelope 2.

6. A lifting cushion as claimed in claim 5, in which each cell structure 58 is of rectangular cross-section.

7. A lifting cushion as claimed in claim 6 in which each cell structure is formed from sheet material folded to have two overlapping end portions (60) and (62).

8. A lifting cushion as claimed in claim 5, 6 or 7, in which each cell structure is made from a polyaramid material.

9. A lifting cushion as claimed in any preceding claim, in which the first layer (4) extends in a first direction and is folded around the envelope (2).

10. A lifting cushion as claimed in any preceding claim, including a second layer (6) extending in a second direction and being folded around the said first layer (4).

11. A lifting cushion as claimed in claim 10 in which the folded over regions of the second layer (6) are on the opposite side of the lifting cushion to the folded over regions of the first layer (4).

12. A lifting cushion as claimed in claim 9 or claim 10 in which said first and second directions are at 90° to one another.

13. A lifting cushion as claimed in any one of claims 1 to 8, and in which the first layer (4) comprises two sheet portions which are laid one on each of the associated major faces (8) and (10) of the envelope (2), and folded over the sides of the envelope.

14. A lifting cushion as claimed in any preceding claim in which the major opposed faces of the envelope (2) are made of woven polyaramid cloth.

15. A lifting cushion as claimed any one of claims 1 to 13, in which the major opposed faces of the envelope are made of polyaramid cord superimposed with a steel

tyre cord.

16. A lifting cushion as claimed in any preceding claim in which the exterior upper and lower surfaces of the envelope (2) are coated with an air holding rubber compound.

17. A lifting cushion comprising a plurality of units in which each unit is as claimed in any one of claims 1 to 16.

18. A lifting cushion substantially as herein described and shown in the accompanying drawings.

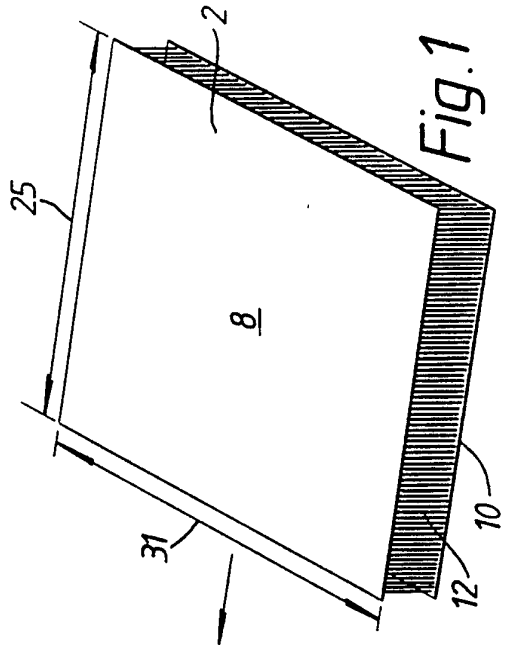

Fig.1

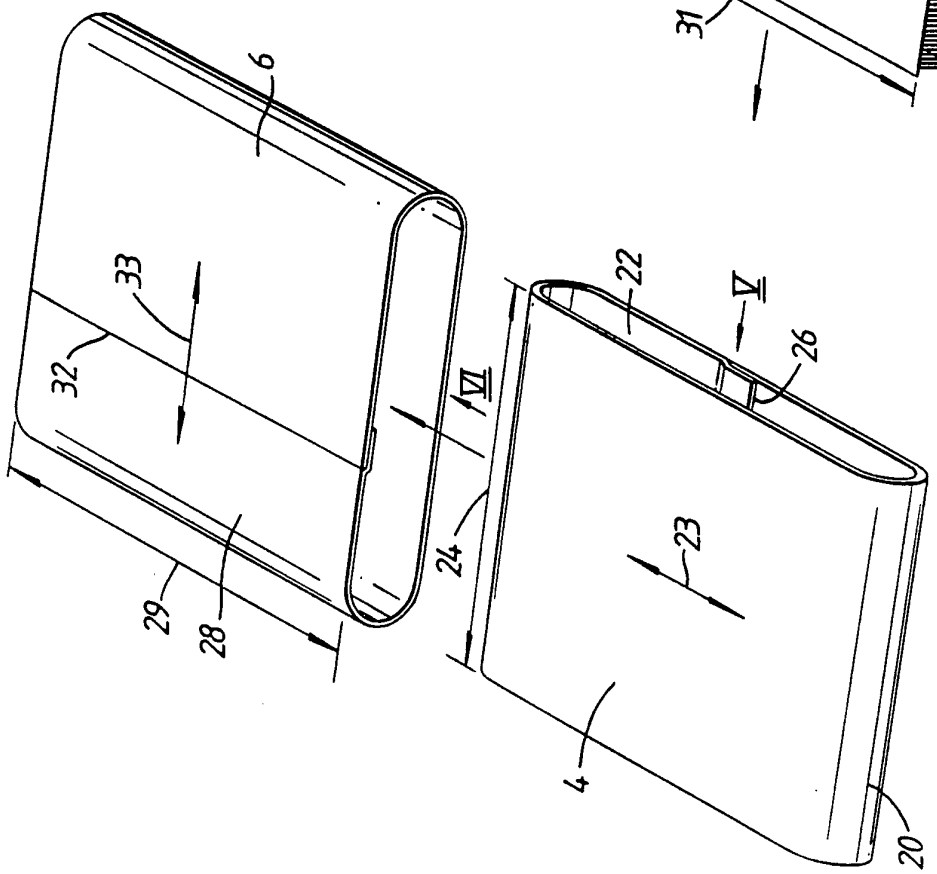

Fig.2

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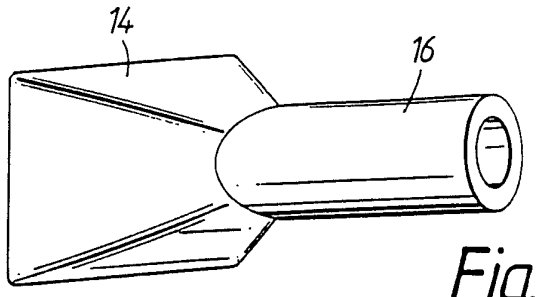

Fig.3

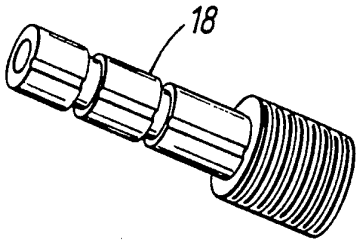

Fig.4

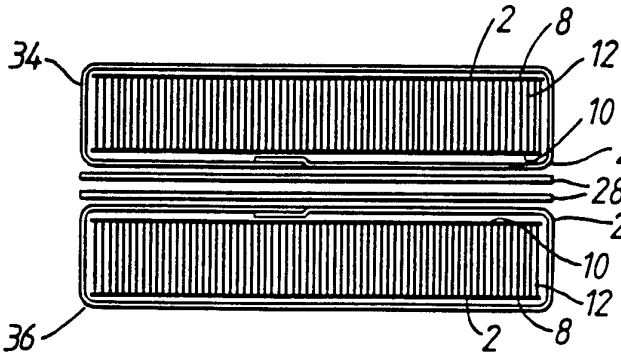

Fig.5

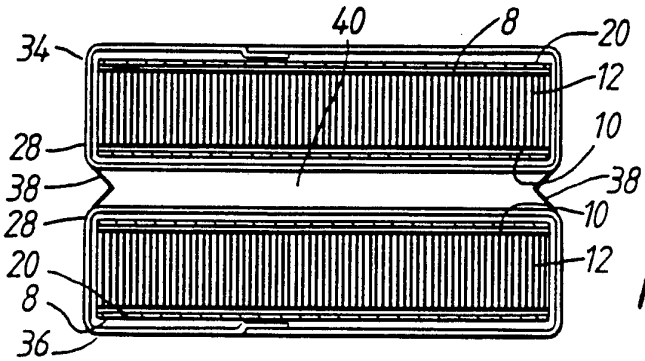

Fig.6

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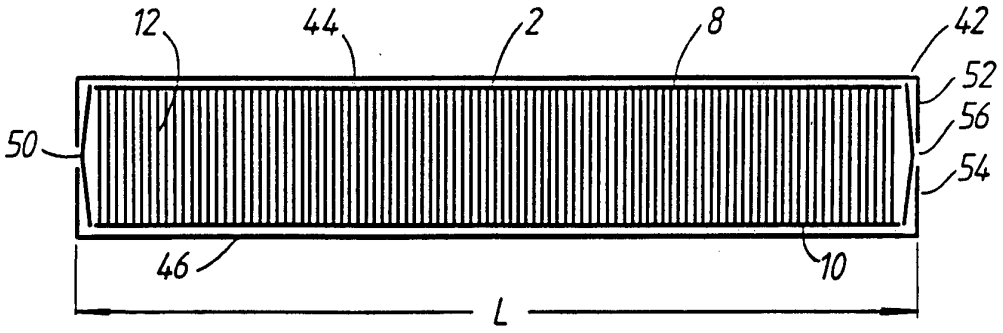

Fig.7

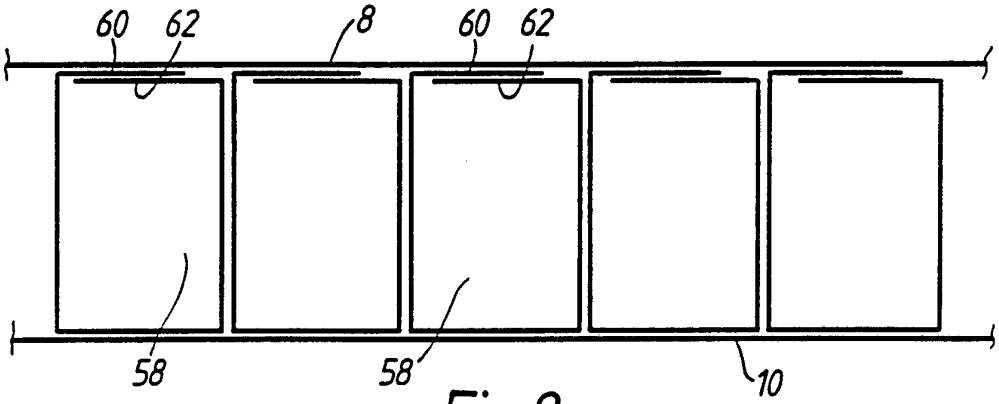

Fig.8

INTERNATIONAL SEARCH REPORT

Interr al Application No
PCT/GB 94/01012

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 B66F3/35

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)
IPC 5 B66F

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP,A,0 157 947 (VETTER) 16 October 1985 see page 8, line 27 - page 9, line 8 see page 10, line 1 - page 11, line 24 see page 12, line 18 - line 22 see figure 1 ---	1,2,4, 9-12,16, 17
Y	DE,U,85 06 736 (VETTER) 5 June 1985 see page 7, line 22 - page 8, line 15 see page 10, line 1 - line 5 see figures 1,3 --- -/--	1,2,4, 9-12,16, 17

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
11 August 1994	25.08.94

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Guthmuller, J

Form PCT/ISA/210 (second sheet) (July 1992)

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Interr. al Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,5 083 361 (RUDY) 28 January 1992 see figures 2,2A,2B see figures 23A,23B see column 19, line 61 - column 20, line 25	1,2,4,9, 13
A	EP,A,0 040 578 (GOODYEAR AEROSPACE CORPORATION) 25 November 1981 see page 3, line 29 - page 4, line 1 see figure 5	12,14,15
A	FR,A,1 035 755 (SOYER) 31 August 1953 see page 2, left column, line 7 - line 47 see page 2, right column, line 12 - line 28 see figures 1,2,4	1,5-7
A	DE,U,73 03 940 (VETTER) see figure 1	1,5,6
A	DE,A,37 43 551 (METZELER G.M.B.H.) 20 July 1989	

INTERNATIONAL SEARCH REPORT

Information on patent family members

Interr al Application No
PCT/GB 94/01012

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-0157947	16-10-85	CA-A-	1237419	31-05-88
		US-A-	4643398	17-02-87
DE-U-8506736	05-06-85	NONE		
US-A-5083361	28-01-92	US-A-	4906502	06-03-90
		AU-B-	615022	19-09-91
		AU-B-	2896289	10-08-89
		BE-A-	1003892	07-07-92
		CH-A-	680828	30-11-92
		DE-A-	3903242	17-08-89
		FR-A-	2627356	25-08-89
		GB-A,B	2217576	01-11-89
		GB-A,B	2251367	08-07-92
		GB-A,B	2251368	08-07-92
		JP-A-	3068303	25-03-91
		NL-A-	8900273	01-09-89
		PT-B-	89634	31-01-94
		SE-B-	469590	02-08-93
		SE-A-	8900363	02-02-89
EP-A-0040578	25-11-81	AU-B-	540387	15-11-84
		AU-A-	7051081	26-11-81
		CA-A-	1153358	06-09-83
		JP-A-	57009698	19-01-82
		US-A-	4372533	08-02-83
FR-A-1035755		NONE		
DE-U-7303940		NONE		
DE-A-3743551	20-07-89	NONE		