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(72) Inventors:
 • **Baeteman, Jan**
9270 Kalken (BE)
 • **Van Haute, Renaat**
9200 Dendermonde (BE)

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(74) Representative: **Van Reet, Joseph et al**
Gevers & Vander Haeghen,
Patent Attorneys,
Rue de Livourne 7
1060 Brussels (BE)

(71) Applicant: **RECTICEL**
1200 Brussels (BE)

(54) **Mattress with air cushion**

(57) The mattress according to the invention comprises an upper (1) and a lower foam plate (2), at least one air cushion (4) applied there between, and means to pressurize this air cushion for adjusting the hardness of the mattress at the site of the air cushion. The air cushion (4) extends at least from the shoulder area (5), over the lumbar area (6) to the pelvis area (7) of the mattress, and consists of at least two separately pres-

surizable parts, a first one of which extends in the shoulder area. In each of these parts, oblong aeration compartments (17) are delimited, which are hermetically sealed from the remainder of the respective part of the air cushion, and wherein at the top and at the bottom aeration openings are provided. In this way, condensation and fungal growth at the surface of the air cushion is avoided.

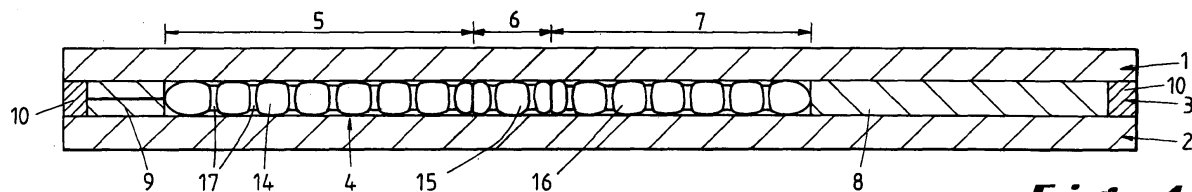


Fig. 4

Description

[0001] The present invention relates to a mattress comprising an upper and a lower plate of a flexible material, in particular of a foam material, at least one air cushion provided there between, and means to pressurize this air cushion in order to adjust the hardness of the mattress at the site of the air cushion.

[0002] Such a mattress is known from FR-A-2 743 995. This known mattress consists of a frame of foam material, onto which a foam plate is attached at the top and at the bottom, and in which, at the location of the legs, a foam core is provided, and at the location of the pelvis and of the shoulders each time a separate air cushion. Both the air cushions are connected through a pressure regulating valve to a source of compressed air, in such a way that the pressure within the air cushions can be controlled in order to adjust the hardness of the mattress in the pelvis and shoulder areas. Between the air cushions, another soft area with flexible foam is provided.

[0003] A disadvantage of this known mattress is, that the support of the lumbar region is of special importance in practice, but that precisely the support of the lumbar region cannot be controlled in the known mattress. Moreover, the lumbar region should normally be supported extra firmly, which is not the case in the known mattress, since it is located in the soft area between both air cushions. A further disadvantage of the mattress known from FR-A-2 743 995 is, that the air cushions do not allow air to pass, and thus do not allow any ventilation of the mattress, which leads to condensation at the surface of the air cushion. In practice, it was found that in such non ventilated areas, fungal growth quickly occurs, which of course is not hygienic and more particularly may lead to allergies.

[0004] From DE-A-39 37 214 further a mattress is known in which no air cushions are applied, but instead separate, flexible air bags, which are fitted into cylindrical transverse channels in the mattress. By means of a source of compressed air, the pressure in each of the air bags may be adjusted. In this way, it is possible, in the area of the shoulders and the pelvis, to provide for a smaller resistance to compression, and in the lumbar area for a larger one.

[0005] A disadvantage of the mattress known from DE-A-39 37 214 however is, that the compression characteristics of the mattress, to a large extent, are still determined by the characteristics of the foam that is between the air bags. Moreover, the application of the different air bags and their connection to the source of compressed air is labour intensive. Further, notwithstanding the air cushions which are to be applied additionally, almost no saving of foam is realised, due to the fact that the channels for the air bags have to be cut out and produce only waste foam. A last important disadvantage is finally, that notwithstanding the foam strips between the cylindrical air bags, the surface of these air

bags is almost not ventilated, and that in practice condensation and consequently relatively quick fungal growth occurs also in this case at the level of the air bags.

[0006] An object of the invention is therefore to offer a solution to the above described problems, by proposing a new mattress with a hardness adjustable by air pressure, in which fungal growth occurs less rapidly, in which further also the area of the lumbar region can be supported in a sufficiently firm way, and in which, through the presence of the air cushion, an important saving of foam material can be realised.

[0007] To this effect, the mattress according to the invention is characterised in that the air cushion extends at least from the shoulder area, over the lumbar area to the pelvis area of the mattress, and consists of at least two parts that can be pressurized separately, a first one of which extends in the shoulder area, whereby in each of both these parts, longitudinal aeration compartments are delimited, which are hermetically sealed from the remainder of the respective part of the air cushion, and wherein at the top and at the bottom aeration openings are provided.

[0008] By the presence of the aeration compartments provided with aeration openings in the air cushions, upon movements of the user, an air flow is created at the surface of the air cushion, more specifically due to a kind of bellows effect, in such a way that condensation at the surface of the air cushion is prevented. Because the air cushion can be applied as a whole beneath the shoulder, lumbar and pelvis areas, this is considerably less labour intensive than the application of several air cushions or air bags, which have to be separated from each other by foam material. Moreover, the hardness in the whole of these three areas may be regulated. Since a separate, pressurizable part of the air cushion is located in the shoulder area, not only the hardness of the mattress in the shoulder area can be regulated separately, but it is also prevented that the mattress would rise in the pelvis area when extra pressure is exerted in the shoulder area, e.g. when turning around, or vice versa. There is however a pressure distribution in the shoulder area itself, by which the shoulder weight may provide an extra support of the neck and head. In the lumbar and pelvis areas, the air cushion may possibly also consist of one separately pressurizable part. In that case, a sufficiently firm support of the pelvis may be obtained by the pressure distribution in this part and by the weight of the pelvis. To this effect, the air cushion in the pelvis area may possibly be made somewhat thicker.

[0009] An air cushion with aeration compartments is already known per se from W095/32649. As to the application of this known air cushion, it is mentioned that it may be put either underneath, or on top of an existing mattress to obtain an additional pressure distribution. The application of such a pressure distribution cushion within a new mattress, however, is nowhere indicated in this international patent application.

[0010] In a preferred embodiment of the mattress according to the invention, the air cushion consists of at least three separately pressurizable parts, a first of which extends in the shoulder area, a second in the lumbar area and a third in the pelvis area. In this way, the hardness of the mattress can thus also be adjusted separately in the lumbar and in the pelvis areas.

[0011] Further advantages and details of the invention will become apparent from the following description of a preferred embodiment of a mattress according to the invention. However, this description is only given as an example and is not intended to limit the scope of protection, as defined by the claims. The reference numbers indicated in the description refer to the attached drawings, wherein:

Figure 1 shows a top plan view of a non-inflated air cushion from a mattress according to the invention; Figures 2 and 3 show a longitudinal section and respectively a cross section, along the lines II-II and III-III through the air cushion shown in figure 1, but now in an inflated state and on a larger scale; Figure 4 shows, on a smaller scale, a longitudinal section through the mattress provided with an air cushion within it, according to figures 1 to 3; and Figure 5 shows a perspective view on the middle foam layer of the mattress according to figure 4, in which a free area is provided for the air cushion shown in figures 1 to 3.

[0012] The mattress according to the invention shown in figure 4 in longitudinal section is a foam mattress with an upper 1 and a lower foam plate 2, and a middle layer 3 there between, in which an inflatable air cushion 4 is provided. This air cushion 4 extends from the shoulder area 5, over the lumbar area 6 to the pelvis area 7 of the mattress. In the embodiment shown, the remainder of the middle layer 3 of the mattress is formed by foam material. As it appears from figure 5, which shows the middle layer 3 of the mattress without the air cushion 4, this middle layer 3 may simply be manufactured from rectangular pieces of foam material that are glued together, whereby the space required for the air cushion 4 is left free, without necessarily having to apply cut outs. In the legs and feet area of the mattress, the middle layer is in particular formed by a foam block 8, and at the head end of the mattress by a double foam plate 9. The whole is surrounded by a frame 10 of foam material.

[0013] Instead of the foam block 8 in the legs and feet area of the mattress, also a spring core could be provided. Alternatively, one could also make a longer air cushion 4, which would then extend further to into the legs and feet area. As to the foam plates 1 and 2, it may further be considered to manufacture these plates of another flexible material, in particular of coconut material or of a combination of foam and other materials. As a foam material, both synthetic foams, such as polyurethane foam, and natural foam materials, such as nat-

ural latex, are suitable.

[0014] The air cushion 4 in the mattress is intended on the one hand to adjust the hardness of the mattress at the site of this cushion, and on the other hand to allow pressure distributions in the mattress. To this effect, means to pressurize the air cushion 4 are provided. These means may consist of an electrical air pump and by control valves to adjust the pressure in the air cushion, but in the embodiment of this air cushion shown in figure 1, these means consist of small hand pumps, in particular of bulb pumps 11, each of which is connected to the air cushion 4 through a flexible hose 12. On the hoses 12 are provided further valves 13 to release the pressure of the air cushion 4. To store the bulb pumps, cavities 29 are provided in the foam frame 10 of the middle layer 3 of the mattress.

[0015] According to the invention, the air cushion 4 consists of at least two separately pressurizable parts, a first of which extends in the shoulder area 5. In the preferred embodiment according to figure 1, which shows a top view on the non-inflated air cushion 4, the air cushion consists of three separately inflatable parts, i.e. a first part 14 in the shoulder area of the mattress, a second part 15 in the lumbar area and a third part 16 in the pelvis area. In these different areas, the pressure or hardness of the mattress can thus be adjusted individually by means of the bulb pumps 11.

[0016] An important aspect of the invention is, that in each of the parts 14, 15, 16 of the air cushion, oblong aeration compartments 17 are delimited, which are hermetically sealed from the remainder of the respective part of the air cushion 4, and wherein at the top and at the bottom aeration openings 18 are provided. In this way, by a bellows effect of the aeration compartments 17, when a user moves on the mattress, an air flow is generated at the surface of the air cushion 4, and thus condensation at this surface can be avoided. The aeration compartments 17 preferably extend in the transverse direction of the mattress. Their number may for example vary from five to nine in the part 14 beneath the shoulder area, from one to three in the part 15 beneath the lumbar area and from four to seven in the part 16 of the air cushion 4 beneath the pelvis area.

[0017] In the preferred embodiment according to the figures, the air cushion 4 is formed by a lower 19 and an upper foil 20, preferably of a thermoplastic synthetic material, such as TPU (thermoplastic polyurethane) or a polyolefine, which are welded together along the circumference of the cushion 4, according to a weld 21. As thermoplastic material, TPU is particularly preferred, owing to its high gas tightness and large tear resistance. At the sides and at the head end of the air cushion 4, both foils 19, 20 form flaps 22 and 23, which are glued between the foam layers of the frame 10 and of the foam block 9 to keep the air cushion 4 in its place. If desired, perforations may of course further be made in the flaps to allow an extra aeration of the sides of the mattress. Between the three separately inflatable parts 14, 15, 16

of the air cushion 4, the lower 19 and the upper foil 20 are further connected to each other respectively by partitions 24, 25, in such a way that an hermetic sealing between the different parts is achieved. Instead of applying partitions between the foils, they could also be welded or glued together or still be hermetically connected to each other in other ways.

[0018] To obtain the aeration compartments 17, hermetically sealed pockets 26 are welded between the lower 19 and the upper foil 20, more particularly with their top against the upper foil 20 and with their bottom against the lower foil. This welding is each time carried out according to a weld 27 that forms a closed line, whereby on the upper and lower side of the air cushion 4, oblong surfaces 28 are delimited. In these surfaces 28 the aeration openings 18 are then applied. These openings 18 communicate only with the interior of the pockets 26, which are hermetically sealed from the remainder of the interior of the air cushion 4, so that through these openings no pressure can escape from the cushion. Through these openings, there is however generated an air flow into and out of the aeration compartments 17 of the air cushion formed by the pockets 26 when the person lying on the mattress is moving. According to figure 1, seven pockets 26 are provided beneath the shoulder area of the mattress, two beneath the lumbar area and six beneath the pelvis area.

[0019] In figure 2, a longitudinal section through the air cushion 4 according to figure 1 is shown, but now in the inflated state. From this figure, it appears that the thickness of the air cushion is determined by the partitions which are formed by the pockets. This can also be seen in the cross section according to figure 3. It will be clear, that the thickness of the air cushion 4 can be modified locally by using wider pockets or by narrowing the width of the surfaces 28 with the aeration openings 18. In particular in the lumbar area, and also at the location of the head and neck, one could thus consider to make the cushion thicker in order to allow an extra support in this way.

[0020] At the edges of the air cushion, the thickness of the cushion does not only depend on the width of the pockets, but mainly also on the distance between the weld 27 and the weld 21 of the edge of the cushion. In figure 2 this resulted in a thicker cushion edge at the head end of the air cushion, while at the longitudinal edges of the cushion, which are visible in figure 3, the welds 27 between the pockets 26 and the foils 19 and 20 extend over such a short distance from the side edges of the cushion, that the cushion has there substantially the same thickness as in the middle part. If desired, however, raised side edges could also be obtained.

[0021] In the embodiment according to figure 1, the pockets have for example a width of 67 mm, and in the flattened state, they are at a mutual distance of about 3 mm, except between the different parts 14, 15 and 16, where they are at a mutual distance of about 3 cm. In this way, in the inflated state, the air cushion 4 has a

thickness of about 6 cm, and in the flattened state, a length of about 122 cm. By providing foam plates 1, 2 with a thickness of about 6 cm above and beneath the cushion 4, a total mattress thickness of about 18 cm is obtained. As desired, the different thicknesses may of course be varied within wide limits. The air cushion may for example have a thickness of 2 to 10 cm, and particularly a thickness of 4 to 8 cm, whereas the cover plates 1, 2 may have a thickness of 2 to 8 cm, and in particular a thickness of 4 to 6 cm.

[0022] The foil of which the air cushion is made, is further preferably as flexible as possible and shows to this effect for example only a thickness of 150 to 300 μ , and in particular a thickness of 200 to 250 μ .

[0023] From the above given description of a preferred embodiment of a mattress with air cushion according to the invention, it will be clear that numerous modifications may yet be applied thereto, without departing from the scope of the present invention as defined by the attached claims.

[0024] Thus the air cushion may be made longer to cover almost the entire length of the mattress. Thereby, it is preferred to carry out the part beneath the legs and feet symmetrically to the above described air cushion, in such a way that the mattress can be turned, without losing the comfort characteristics thereof, at least if the different parts of the cushion are inflated at the right pressure.

Claims

1. Mattress comprising an upper and a lower plate of a flexible material, in particular of a foam material, at least one air cushion applied there between, and means to pressurize this air cushion for adjusting the hardness of the mattress at the site of the air cushion, characterised in that the air cushion extends at least from the shoulder area, over the lumbar area to the pelvis area of the mattress, and consists of at least two separately pressurizable parts, a first one of which extends in the shoulder area, whereby in each of both these parts oblong aeration compartments are delimited, which are hermetically sealed from the remainder of the respective part of the air cushion, and wherein at the top and at the bottom aeration openings are provided.
2. Mattress according to claim 1, characterised in that the air cushion consists of at least three separately pressurizable parts, a first one of which extends in the shoulder area, a second one in the lumbar area and a third one in the pelvis area.
3. Mattress according to claim 1 or 2, characterised in that said aeration compartments extend in the transverse direction of the mattress.

4. Mattress according to claim 2 and 3, characterised in that the part of the air cushion that extends in the shoulder area comprises five to nine, in particular seven aeration compartments, the part of the air cushion that extends in the lumbar area one to three, in particular two, and the part of the air cushion that extends in the pelvis area four to seven, in particular six. 5

5. Mattress according to any one of claims 1 to 4, characterised in that the air cushion is mainly formed by a lower and an upper foil which are hermetically connected to each other, in particular welded to each other along the edges of the cushion and between the separately pressurizable parts, and by oblong pockets of a same foil material that are closed off at their ends, which, in order to form said aeration compartments, are applied transversely with respect to the longitudinal direction of the mattress, between said upper and lower foils, in the air cushion, and connected, in particular welded hermetically with their upper, respectively lower side to the upper and the lower foil of the air cushion, to the joints between the upper side of the pockets and the upper foil and the joints between the lower side of the pockets and the lower foil, forming each a closed line, which on the upper, respectively lower side of the air cushion delimit oblong surfaces wherein said aeration openings, which extend into the interior of said pockets, are applied. 10
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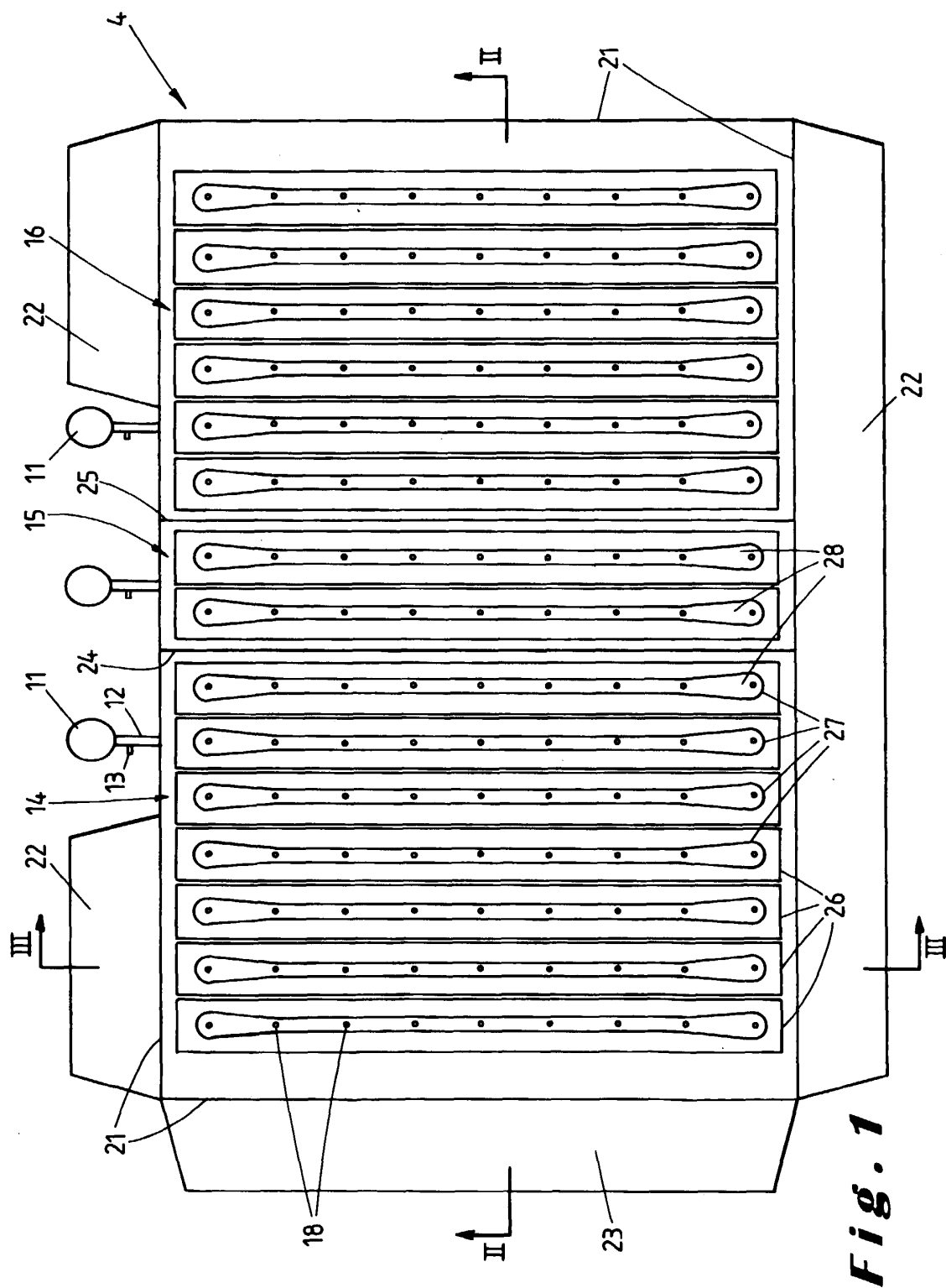
6. Mattress according to claim 5, characterised in that the joints between the upper side of the pockets and the upper foil and the joints between the lower side of the pockets and the lower foil each extend until a short distance from the side edges of the air cushion. 35

7. Mattress according to claim 5 or 6, characterised in that said upper and lower foils and the foil of said pockets have a thickness of 150 to 300 μ , in particular a thickness of 200 to 250 μ . 40

8. Mattress according to any one of claims 1 to 7, characterised in that the air cushion has a thickness of 2 to 10 cm, and in particular a thickness of 4 to 8 cm. 45

9. Mattress according to any one of claims 1 to 8, characterised in that the upper and lower foam plates have a thickness of 2 to 8 cm, and in particular a thickness of 4 to 6 cm. 50

10. Mattress according to any one of claims 1 to 9, characterised in that the separately pressurizable parts of the mattress are each provided with a pump, in particular with a bulb pump. 55



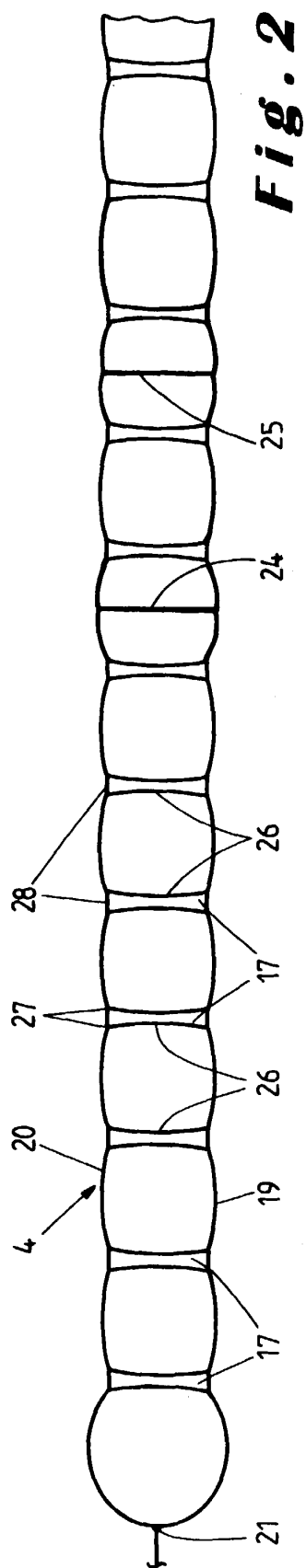


Fig. 2

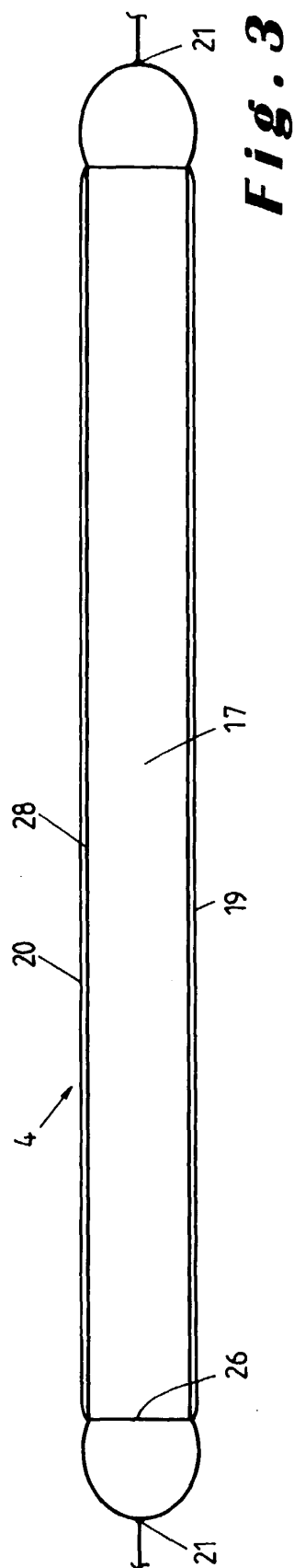


Fig. 3

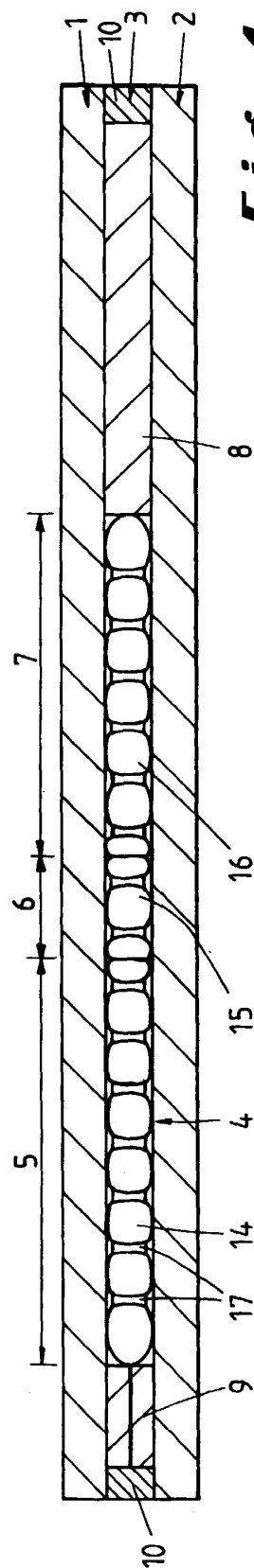


Fig. 4

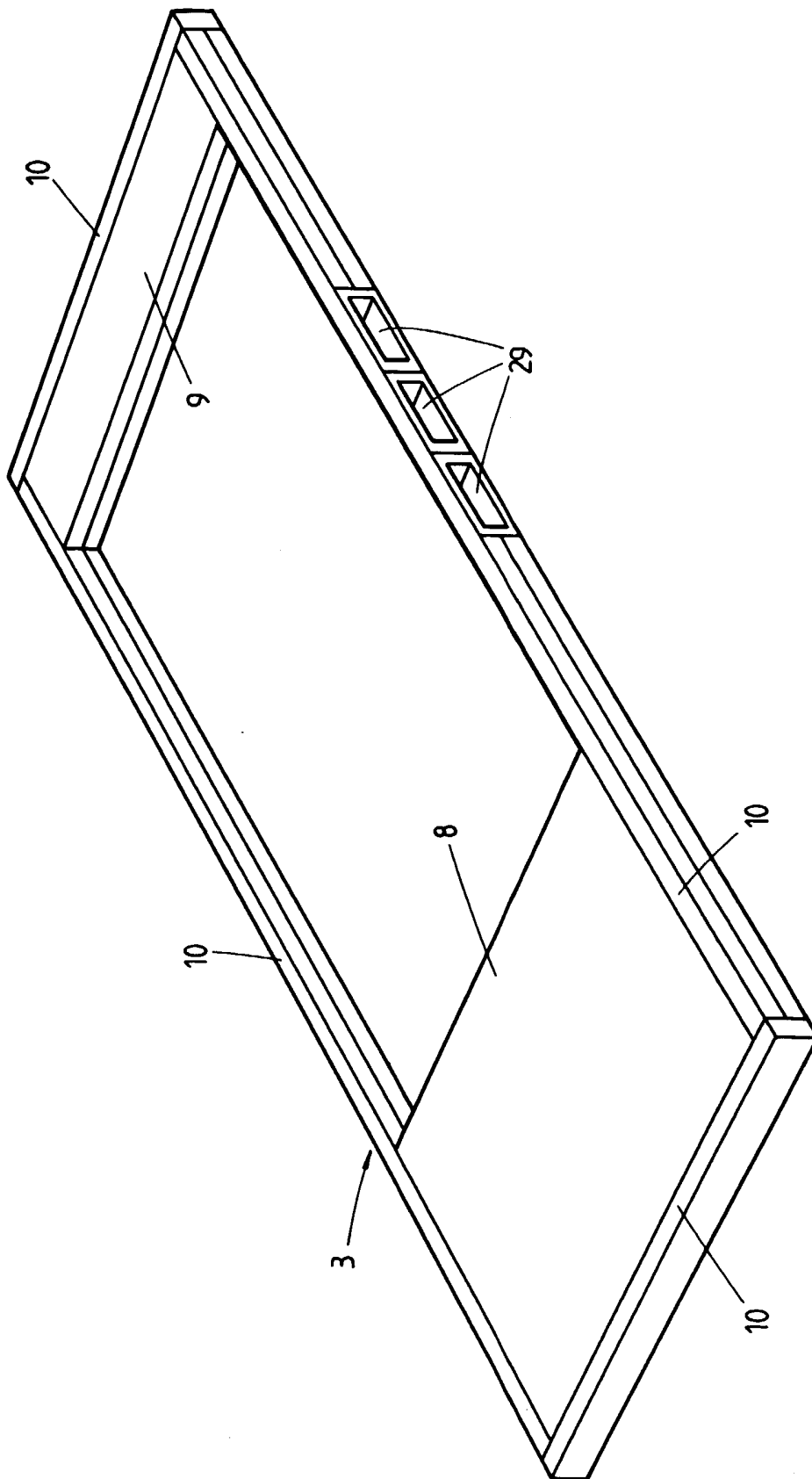


Fig. 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 87 0005

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)
D,A	FR 2 743 995 A (CRETE) 1 August 1997 (1997-08-01) * claim 1; figures *	1	A47C27/18 A47C27/10
A	US 3 653 083 A (LAPIDUS) 4 April 1972 (1972-04-04) * the whole document *	1,3,5	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			A47C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25 April 2000	Examiner VandeVondele, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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

EP 00 87 0005

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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25-04-2000

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82