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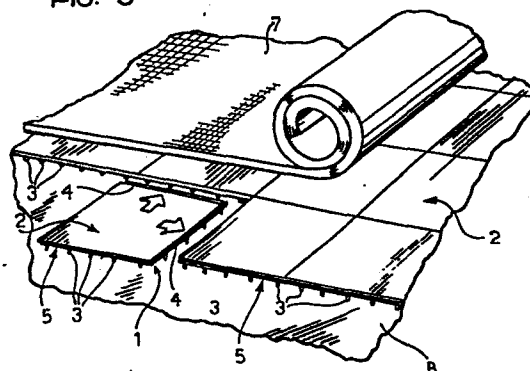
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54 Resilient flooring, particularly for sports establishments.

57 Resilient flooring comprises a layer of material (2) which is resistant to compression and is provided underneath with resiliently compressible support formations (3) at least partially separate from each other. The flooring is constituted by modular elements (1) which can be connected together by gluing and/or jointing and further includes a tread layer (7) applied to the upper surface of the layer of rigid material (2). The preferred application of the flooring is in sports establishments.

FIG. 3



DESCRIPTION

Resilient flooring, particularly for sports establishments.

The present invention relates to flooring and is particularly concerned with resilient flooring.

It has been shown (see the article "Fast Running Tracks" by Thomas A. McMahon and Peter R. Greene -
5 Scientific American, Volume 239, No. 6, pages
148-163, December 1978) that the use of resilient
(springy) flooring, that is to say, flooring which
yields resiliently under the weight of the person who
treads on it, is particularly advantageous in sports
10 establishments, for example, on running tracks in
athletics establishments. The use of tracks with springy
flooring has resulted in significant improvements
in the performances of the athletes, while also reducing,
by virtue of better adaptation of the flooring to the
15 motor system of the athletes, the forces on and the
fatiguing of the muscles and tendons which are
frequently the cause of injuries during training and
competitions.

This adaptation of the flooring to the characteristics
20 of the motor system of the athlete is also advantageous
in other sports, such as tennis and particularly basket
ball and volley ball, which are sports in which the
vertical forces exerted on the lower limbs of the players
are very intense.

25 Until now, springy floorings have been formed by covering
a basically wooden structure with a layer of synthetic
material such as polyurethane.

These solutions have several disadvantages among which,
in addition to their high cost and the difficulty of
30 making them with a modular, possibly removable structure,
must be mentioned the fact that the characteristics
of deformation of the flooring are not uniform,
the presence of "softer" and "harder" areas

being detectable, the distribution of which on the surface of the flooring reproduces the arrangement of the reinforcing elements of the wooden structure.

5 A further disadvantage lies in the fact that the wooden structure means that the deformation of the flooring occurs not only in the portion acted upon directly by the weight of a person standing on it but also in adjacent parts. Thus, vibrations may be propagated through the flooring, and this is particularly harmful
10 for example, when two athletes are running very close together on a track having a springy flooring.

The object of the present invention is to provide flooring of the type specified above which does not have the disadvantages described.

15 In order to achieve this object, the present invention provides resilient flooring characterised in that it comprises a layer of material which resists compression and is provided underneath with resiliently compressible support formations at least partially separate from
20 each other.

By virtue of this characteristic, a flooring is formed which retains its springy behaviour even when rather high loads are applied, without the flooring itself exhibiting any stiffening phenomena. The springiness of
25 the flooring indeed corresponds to the resilience of the support formations which, being at least partially separate from each other, retain a resilient behaviour even when subject to considerable compression. The support formations may be distributed uniformly over the
30 lower surface of the flooring, for example in a grid-like arrangement, so as to give the flooring absolutely homogenous deformation characteristics, avoiding the formation of more or less yielding zones.

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According to a preferred embodiment, the layer of rigid material has a high shear stress compliance such as to prevent substantial transmission of deformation waves across the surface of the flooring in use.

5 Thus, another of the disadvantages typical of conventional springy flooring is remedied.

To advantage, the flooring according to the invention is formed integrally from moulded, vulcanised rubber, with additions of sulphur and mineral fillers in the portions defining the rigid layer so as to give
10 this layer the necessary characteristics of resistance to compression and wear. As well as resulting in considerable advantages in terms of costs, this makes it easy to form the flooring in panels or tiles which can be placed on a base that is finished only very
15 roughly, and can be connected together by jointing and/or gluing.

According to the embodiments preferred at present, the support formations of the flooring are constituted by
20 pegs projecting from the lower surface of the layer of rigid material. The final characteristics of the resilience of the flooring may thus be adapted to the specific requirements of use both by modifying the dimensions of the pegs and by varying the density of their distribution over the lower surface of the rigid layer
25 of flooring, or even by modifying the characteristics of hardness and resilience of the material constituting the pegs themselves.

The fact that the flooring is, so to speak, suspended on the pegs means that any moisture or water collected
30 on the base may flow through the space between the plane of the flooring and the base.

For this purpose, particularly for open-air use, the layer of rigid material, and a further tread layer (of polyurethane, linoleum, PVC, etc.) possibly superimposed thereon, may have holes for allowing
5 rain or water to flow into the interspace so as to prevent the formation of puddles of water on the surface of the flooring.

The presence of the interspace, as well as allowing for small surface irregularities in the base on which the
10 flooring is laid, also has a ventilating function such as to prevent the flooring reaching high temperatures as a result of exposure to sunlight, which would be harmful with regard to the preservation and working life of the flooring and annoying for the users. The
15 flooring according to the invention is thus particularly suitable for open-air use in hot countries.

The flooring also has a considerable sound-proofing effect which makes its use advantageous in environments other than those intended for sporting activities, such
20 as, for example, places adapted for use as offices, laboratories or workshops for carrying out light engineering work.

The invention will now be described, purely by way of non-limiting example, with reference to the appended
25 drawings, in which:

Figure 1 is a perspective view from below of a flooring element according to the invention;

Figure 2 is a partial vertical sectional view of flooring according to the invention located on a base;

Figure 3 illustrates schematically the laying of flooring according to the invention;

Figure 4 is a graph illustrating the resilient characteristics of the flooring shown in Figures 1 to-
5 3, and

Figure 5 illustrates a variant of the flooring according to the invention.

10 In Figure 1, a modular element of flooring according to the invention is generally indicated 1 and is in the form of a rectangular tile.

In Figure 2, the edges of two tile elements 1 are shown in their laid position on a base B constituted, for example, by a subsurface of asphalt or cement, or an existing floor.

15 The upper surface of a layer of material 2 which is resistant to compression defines the surface of the flooring. Axially compressible cylindrical pegs 3 constitute resilient support formations for the flooring.

20 In the embodiment illustrated, the pegs 3 are integral with the layer of rigid material 2. Preferably, each element 1 of the flooring is moulded and vulcanised from a single mass of rubber or elastomer, for example, rubber having a hardness of between 35 and 45 Shore A. During manufacture, the portion of
25 the rubber mass constituting the surface from which the pegs 3 project has high quantities of sulphur and fillers added to it, so that this portion hardens until it reaches a hardness value which is typically between 90 and 100 Shore A.

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Each element 1 may be manufactured individually.
Alternatively, the flooring according to the invention
may be formed as a continuous sheet, which is subsequently
cut and divided into modular elements constituted by
5 panels or tiles.

In order to facilitate the laying of the flooring,
the modular elements are normally provided with coupling
surfaces which are a mating fit. In the embodiment of
the tile element 1 illustrated in Figures 1 to
10 3, the layer of rigid material 2 has projections 4 on
two adjacent sides, which are made by milling. On its
other two sides, the rigid layer 2 has a groove 5
also made by milling.

Each element 1 may thus be connected by a mating
15 fit with other similar elements in the sequence of
laying the flooring schematically illustrated in
Figure 3.

The modular elements 1 may be used both for free laying
and for fixed laying. In the latter case, the
20 connection between the adjacent modular elements is
strengthened by gluing.

By virtue of the structure described, the flooring
according to the invention has resilient
characteristics which make it advantageous for use
25 in sporting establishments, particularly on running
tracks, tennis courts and courts for basket ball and
volley ball, since it improves the speed of the
athletes and, in particular, considerably reduces the
forces and harmful fatigue of their muscles and tendons.

The characteristics of resistance to compression of the layer 2 and the pegs 3 are selected so that the resilient characteristics of the flooring correspond essentially to the resilient characteristics of axial -
5 compression of the pegs 3. The flooring keeps its resilient behaviour even when high loads are applied, thus avoiding the stiffening characteristic of conventional flooring in response to violent forces.

10 This is demonstrated, by way of example, in the graph of Figure 4 which illustrates the changes in the vertical deformation of flooring according to the invention on the abscissa with variations in the load applied thereto, indicated on the ordinate.

15 The curve reproduced in Figure 4 was obtained with rubber flooring of the type illustrated in Figure 2, comprising a rigid layer 2 with a hardness of about 90 Shore A and having underneath a rectangular grid-like array of support pegs 3 constituted by rubber with a hardness of 35 Shore A. The pegs, which have a height
20 and diameter of about 7 mm, are arranged in rows located at a distance (measured from the axes of the pegs 3) of about 3 cms. The distance between the axes of two adjacent pegs in each row is about 2 cms.

25 The overall resistance to compression of the pegs 3 corresponds approximately to the resistance to compression which would initially be given by a layer of rubber having a hardness of about 3.5 - 4 Shore A. The overall resistance to compression of the pegs 3 is thus at least an order of magnitude less
30 than the resistance to compression of the layer 2.

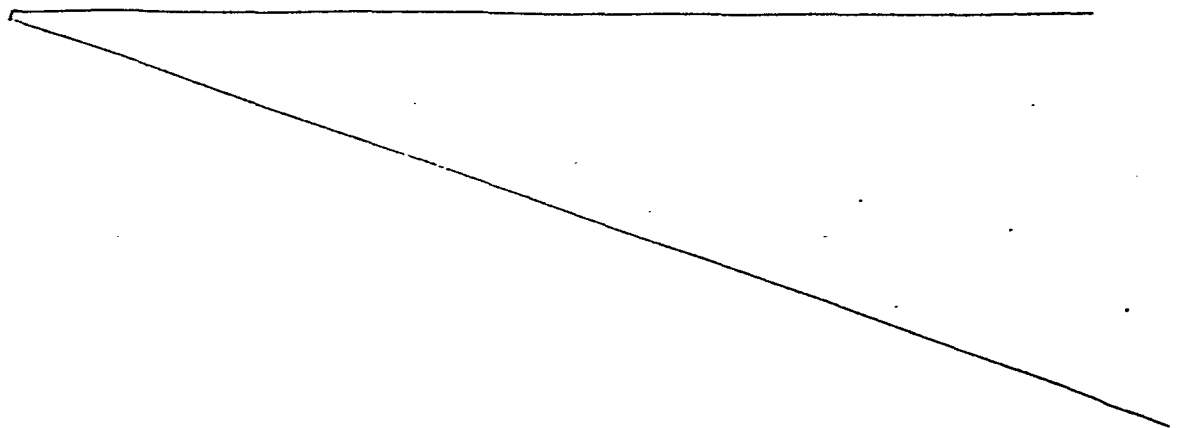
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As may be seen from Figure 4, the functional relationship between the deformation of the flooring and the force applied is approximately linear over a wide range of values of the applied force, without the flooring exhibiting any stiffening phenomena.

The values illustrated in Figure 4 correspond essentially to the values which are thought to be the optimum for the flooring of a running track.

10 The resilient characteristic of the flooring may thus be varied widely so as to adapt to specific requirements in use, both by the selection of the material used for forming the pegs 3 and by the variation of the dimensions of the pegs themselves
15 or even by varying the density of distribution of the pegs on the lower surface of the rigid layer 2 of the flooring. This density may be varied within wide limits, while maintaining the homogeneity of the distribution which gives the flooring resilient characteristics
20 that are distributed uniformly over its surface without the formation of more or less yielding zones.

As described above, the material forming the layer 2 is selected so as to give a high resistance to compressive forces. The use of a rubber-based
25 material of the type described above, as well as allowing this resistance to compressive forces to be obtained, also gives the layer 2 a high shear stress compliance which prevents the propagation of deformation waves across the surface in use.



The flooring according to the invention thus remedies a typical disadvantage of springy flooring with a wooden structure, in which deformation waves are propagated through the surface of the flooring
5 itself.

The upper surface of the rigid layer 2 normally has strength and finishing characteristics such as to allow its direct exposure to treading. In most sporting applications, it is, however, preferable to provide the
10 flooring with an upper tread or surface layer 6 constituted, for example, by a layer of rubber or plastics material, or wood.

This tread layer may be in sections 6 which reproduce the layout of the elements 1 (Figure 2) or in the form
15 of sheets 7 which are placed on the flooring already laid (Figure 3).

In the embodiment illustrated in Figure 2, each section of the tread layer 6 is glued or heat-sealed to the underlying layer 2 so as to be an integral part of the
20 flooring element 1. In the example illustrated in Figure 3, the sheets 7 may simply be placed carefully on the underlying flooring so as to allow the sheets 7 themselves to be removed and the flooring to be dismantled. Naturally, whenever it is desired to achieve more secure
25 adherence of the tread layer to the underlying flooring, the sheets 7 may be glued to the upper surface of the layer 2 of elements 1. In this assembled arrangement, the sheets 7 render the connections between the elements 1 of the flooring more secure.

In the case (not illustrated) in which the tread layer is formed by a layer of wooden battens, the upper surface of the rigid layer 2 is highly planar so as to facilitate the laying of the battens themselves.

- 5 The fact that the flooring according to the invention is, so to speak, suspended on the pegs 3 means that the flooring itself may be located on bases which are only roughly finished, the irregularities being absorbed.

- 10 The interspace between the plane of the flooring and the base B, as well as allowing the escape of moisture and water which may collect on the base B, also has a ventilating function which prevents the flooring reaching very high temperatures as a result of exposure to solar radiation.

- 15 As illustrated in Figure 2, holes 8 may be formed in the rigid layer 2 and the tread layer 6 placed thereon, which put the upper surface of the flooring into communication with the spaces between the pegs 3. The holes 8 thus allow any water (for example, rain)
20 which collects on the upper surface of the flooring to flow into the space beneath the plane of the flooring itself.

- Figure 5 illustrates another embodiment of the flooring according to the invention, in which each
25 element 1 includes a grid-like support structure 13 of resiliently compressible material (for example, soft rubber).
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The sides of the meshes of the grid structure 13 constitute support formations at least partially separate from each other and having a resilient behaviour about the same as the resilient behaviour of the pegs 3. Again, in this case, the resilient characteristics of the flooring may be modified by using materials of a different hardness for the manufacture of the support structure 13 or by modifying the dimensions and the form of the meshes of the structure 13 itself.

- 10 The structure 13 may be formed by cutting from the layer of rigid material 2. In this case, both the layer 2 and the support structure 13 are formed from a single mass of rubber by a process substantially similar to that described with reference to the elements 1 illustrated in Figures 1 to 3. Alternatively, the rigid layer 2 and the support structure 13 may be manufactured separately and subsequently glued together. A further alternative is to form the grid support structure 13 in the form of strips intended to be made up on the base B so as to form a resiliently compressible support plane for the layer of rigid material 2 defining the plane of the flooring.

The embodiment illustrated in Figures 1 to 3 is preferred at present, however, particularly with regard to the possibility of allowing water to flow into the space beneath the flooring.

Claims:

1. Resilient flooring, characterised in that it comprises a layer of material (2) which is substantially resistant to compression and is provided underneath with resiliently compressible support formations (3;13) which are at least partially separate
5 from each other.
2. Flooring according to Claim 1, characterised in that the overall resistance to compression of the support formations (3;13) is at least an order of
10 magnitude less than the resistance to compression of the layer of rigid material (2).
3. Flooring according to Claim 1, characterised in that said layer of rigid material (2) has a shear stress compliance such as substantially to prevent
15 the propagation of deformation waves over its surface in use.
4. Flooring according to Claim 1, characterised in that the support formations are in the form of pegs (3) projecting from the lower surface of the layer
20 of rigid material (2).
5. Flooring according to Claim 1, characterised in that the layer of rigid material (2) and the support formations (3;13) are manufactured by moulding from a single mass of rubber, a substantial proportion
25 of hardeners and fillers being added to that portion of the mass forming the layer of rigid material (2).
6. Flooring according to Claim 5, characterised in that the rubber constituting the layer of rigid material (2) has a hardness of substantially between
30 90 and 100 Shore A, and the rubber constituting the support formations (3;13) has a hardness of substantially between 35 and 45 Shore A.

7. Flooring according to Claim 1, characterised in that it includes a grid-like support structure (13) of resiliently compressible material on which the layer of rigid material (2) is superimposed.
- 5 8. Flooring according to Claim 1, characterised in that it includes a tread layer (6;7) applied to the upper surface of the layer of rigid material (2).
- 10 9. Flooring according to Claim 1, or Claim 8, characterised in that holes (8) are provided in the layer of rigid material (2) and in any tread layer (6), so as to put the upper surface of the flooring into communication with spaces between the support formations (3;13).
- 15 10. Flooring according to Claim 1, characterised in that it comprises a plurality of modular elements (1) which can be connected together by jointing and/or gluing.

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FIG. 1

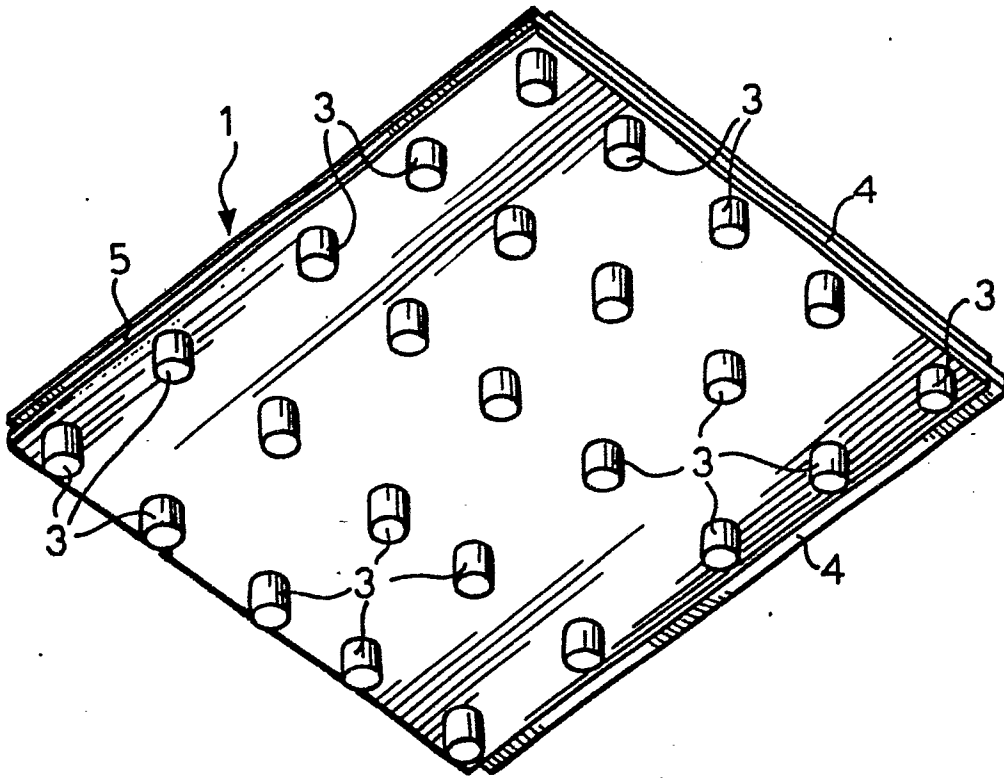
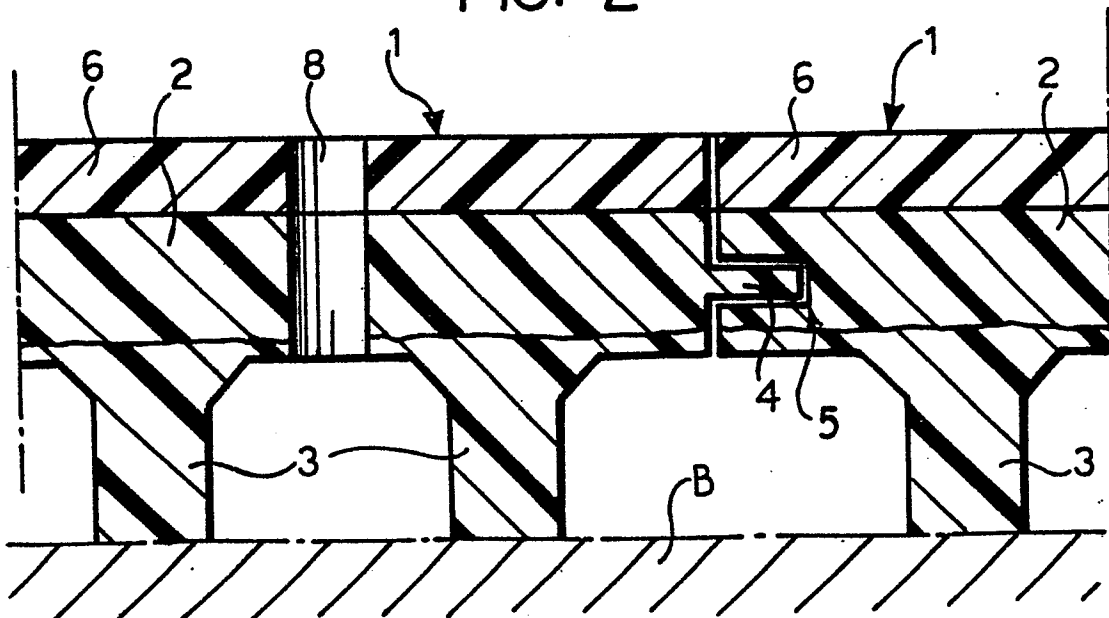


FIG. 2



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FIG. 3

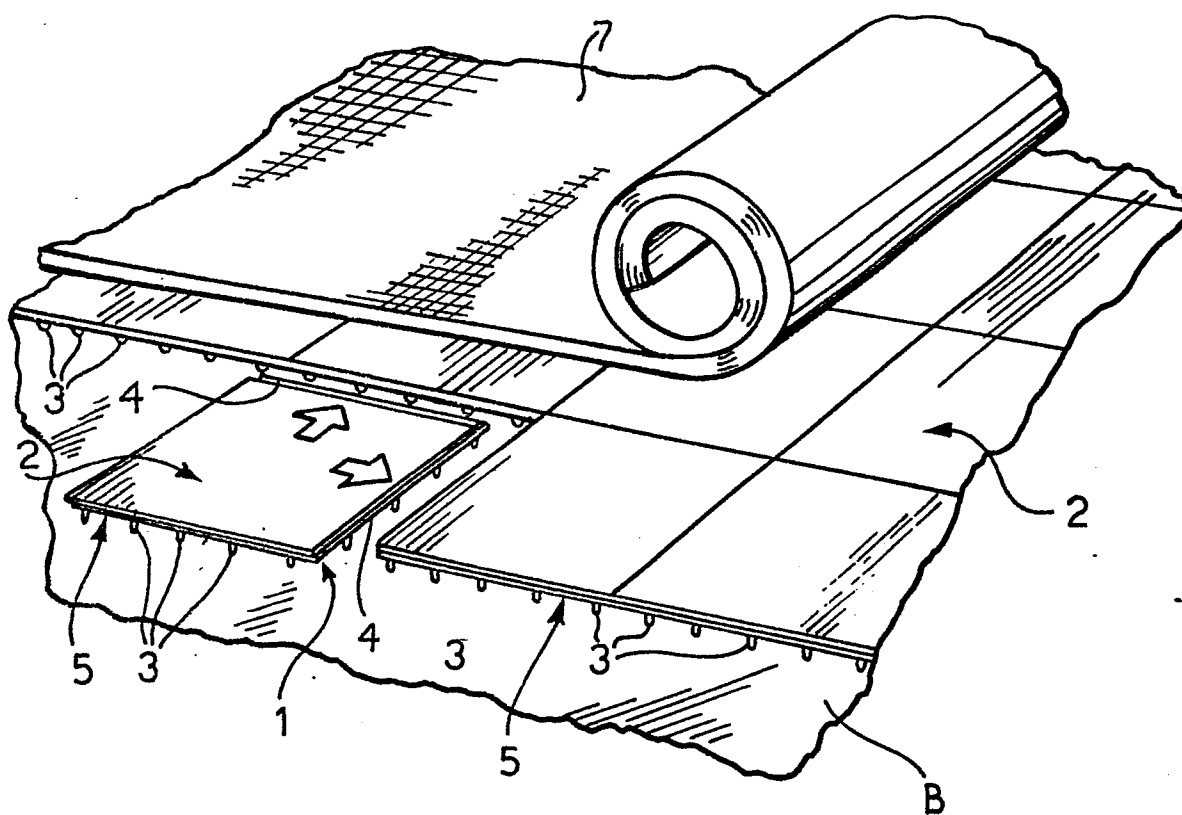
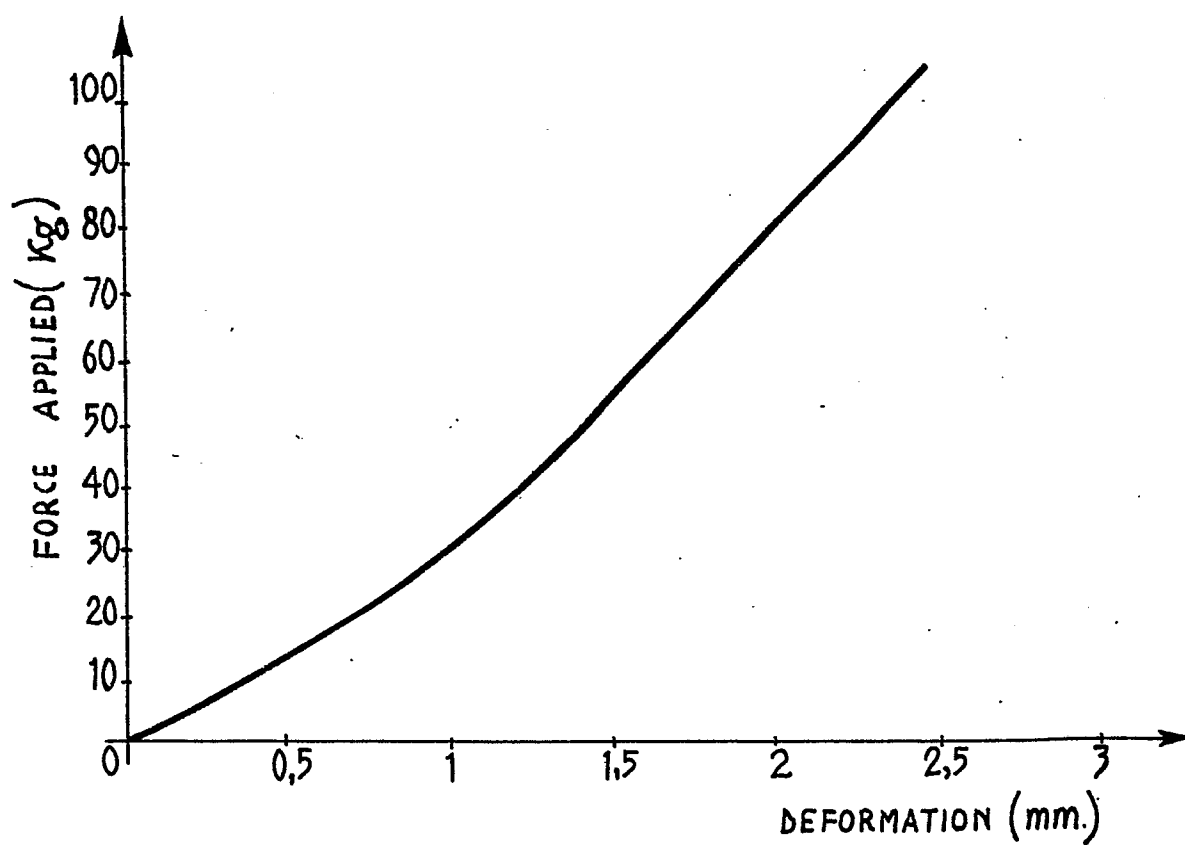
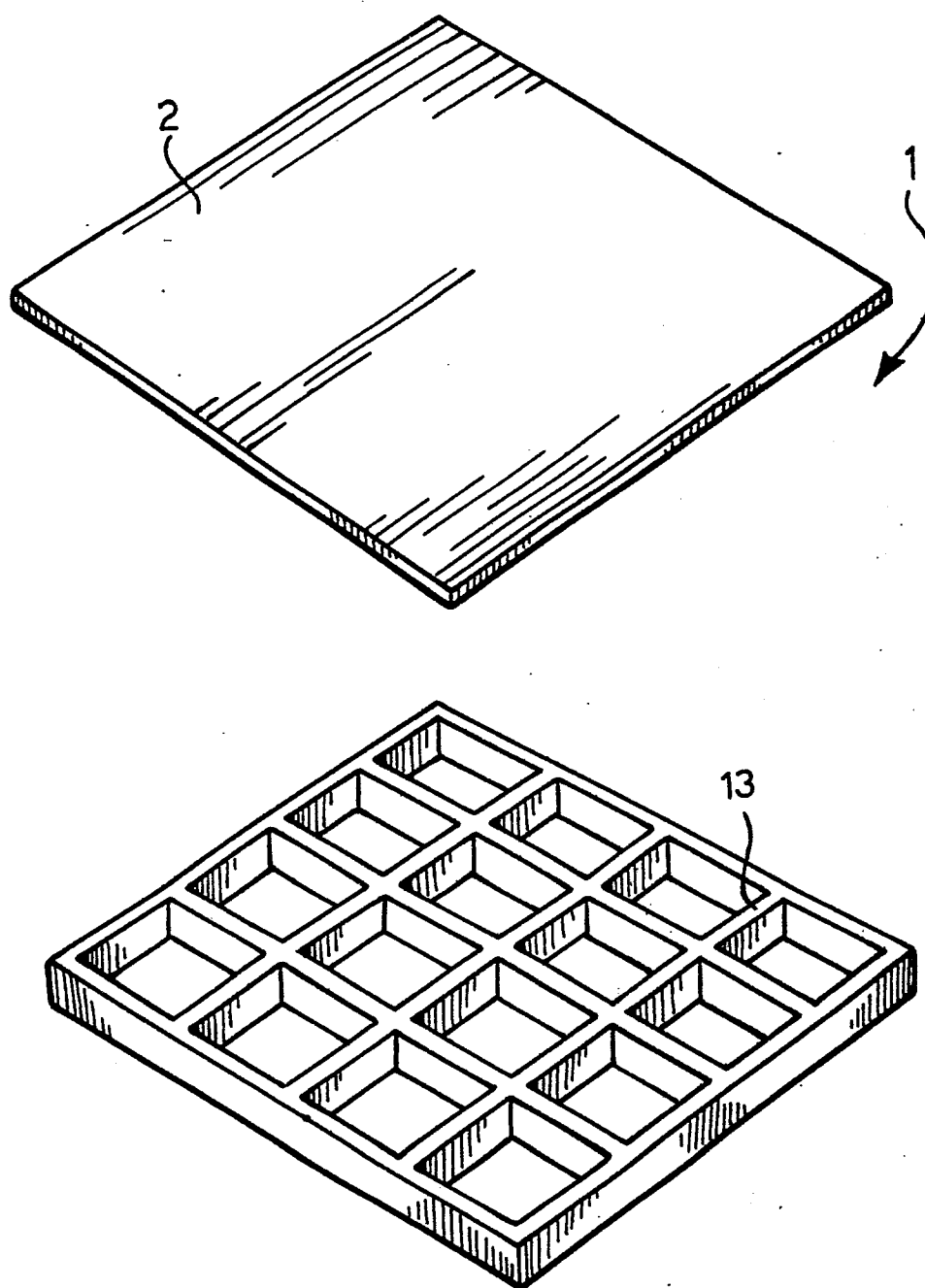


FIG. 4



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FIG. 5





European Patent
Office

EUROPEAN SEARCH REPORT

0109941

Application number

EP 83 83 0227

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. 3)
X	DE-A-2 534 333 (G.K.E.) * Page 2, last paragraph; page 6, paragraph 4; page 7, paragraphs 3,4; page 8, paragraph 1; figures 1,2,6-10 *	1,4,10	E 04 F 15/22
Y	---	7,8	
Y	GB-A- 880 388 (S.A.G.A.) * Page 2, lines 16-62; figure 2 *	7	
Y	---	8	
Y	DE-A-3 020 706 (M.T.F.G.S.) * Page 10; figures 1-2 *		
A	---	2,5	
A	US-A-3 345 245 (HANUSA) * Column 3, lines 18-70; figures 1-4 *		TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
A	---	6	E 04 F
A	DE-A-2 206 858 (KUHN) * Page 4; figures 1-3 *		

The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22-02-1984	Examiner PERROTTA A.
CATEGORY OF CITED DOCUMENTS			
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