(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 647 645 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
19.04.2006 Bulletin 2006/16

(51) Int Cl.:
E04B 1/80 *(2006.01)*

(21) Application number: **05109500.8**

(22) Date of filing: **12.10.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **13.10.2004 IT RM20040499**

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(54) Element for thermal insulation of houses and buildings in general

(57) An element (100) for thermal insulation of houses and buildings in general, having two opposite peripheral surfaces (1, 2) and being formed by plastic foam material with substantially closed cells, is characterized in that it comprises a plurality of through microholes (200) apt to allow transpiration (breathability) between said two opposite surfaces (1, 2).

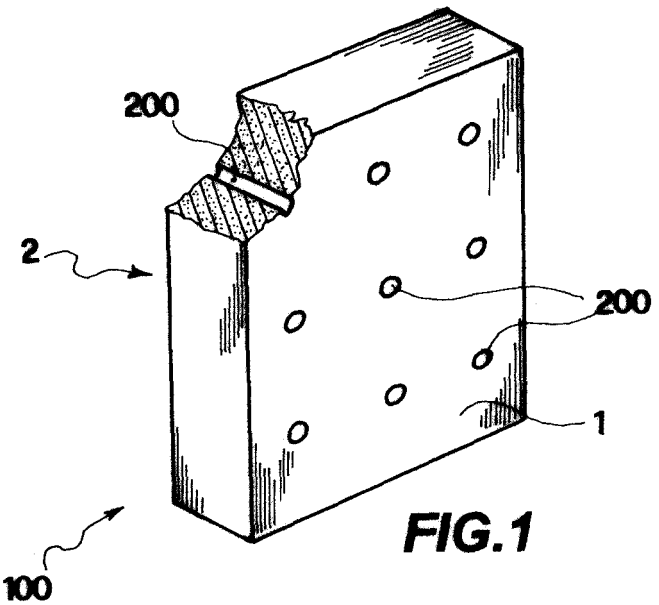

FIG.1

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Description

[0001] The present invention refers to an element for thermal insulation of houses and buildings in general.

[0002] In the field of building industry it is known the use of thermally insulating elements, used inside walls, floors and covers of various kinds, in order to decrease thermal conductivity between the inside of the building and the outside environment.

[0003] In fact, a multitude of situations exist, among which probably the most common is the household one, in which thermal insulation is required; a feature implemented by means of the use of thermally insulating elements composed of foam materials, like, e.g., polyurethane and polystyrene.

[0004] Thermal insulation properties are implemented by means of the foaming of the constituent material of the insulating elements: thus, during the processing of the material an array of closed cells are formed, containing therein the gas used for the foaming, which may also merely be air, thereby giving optimal thermal insulator capabilities.

[0005] It is air itself, or other low-conductivity gas, which, trapped inside the closed cells of the material, gives an elevated thermal insulation thereto.

[0006] Therefore, all of the abovementioned materials are characterised by a structure mainly or completely constituted by closed cells.

The thermally insulating elements thus produced exhibit optimal mechanical and thermally insulating features, yet limited or nil breathability (transpiration), i.e. permeability to steam or other aeriforms.

[0007] Buildings, in which insulating materials are used, are subjected to various flows, the most important being the thermal one and the hygrometric one.

[0008] It is known that inside building premises water is present in the form of steam, produced mainly from people's breathing and perspiration, yet also from other sources, such as food cooking, plant watering, shower and bathtub use and several other activities that further contribute to the increase of moisture in rooms.

[0009] It has to be mentioned that the human body present in a house perceives a sense of wellbeing when temperature and moisture range between definite values, as a general rule temperatures of from 18°C to 24°C, and relative moisture of from 30% to 70%.

[0010] A good house design aims at attaining these values with the minimum energy consumption possible. Hence, while it is desirable and advisable that heat be retained by the thermally insulating elements, it is not advisable that excess moisture and steam be retained thereby.

[0011] In fact, moisture and steam are absorbed from masonry and ceilings, inside which the thermally insulating elements are inserted, and, not being disposable, apart from creating less-than-comfortable climatic conditions due to the increase of the relative moisture in the room, cause various damages, e.g. moulds, spots on the paint, damages to plasters.

[0012] Hence, the technical problem underlying the present invention is to provide a thermally insulating element enabling to perform an optimal thermal insulation, overcoming the drawbacks mentioned hereto with reference to the known art.

[0013] Such a problem is solved by an element for thermal insulation of houses and buildings in general according to claim 1 and by the method for the production thereof according to claim 14.

[0014] The present invention provides several relevant advantages. The main advantage lies in allowing an elevated thermal insulation between the inside of a building and the outside environment, without however excessively retaining moisture, hence without limiting the comfort of the house or causing damages to walls, floors or covers.

[0015] Other advantages, features and the operation modes of the present invention will be made evident in the following detailed description of some embodiments thereof, given by way of example and without limitative purposes. Reference will be made to the figures of the annexed drawings, wherein:

figure 1 is a partially sectional perspective view of a thermally insulating element according to the present invention;

figures 2A to 2C are perspective views illustrating the thermally insulating element according to three different embodiments;

figure 3 is a perspective view showing an application example of the thermally insulating element according to the present invention;

figure 4 is a side view, schematically illustrating a production line for thermally insulating elements according to the present invention; and

figure 5 is a perspective view illustrating a carpet having a plurality of needles, detail of figure 4.

[0016] Initially referring to figure 1, an element 100 for thermal insulation of houses and buildings in general is generally parallelepiped-shaped and comprises a plurality of microholes 200 extending between two peripheral surfaces 1 and 2.

[0017] In particular, the element 100 has a substantially plane development; said surfaces 1 and 2 are arranged opposed therebetween and correspond to the surface of greater extension of the element 100.

[0018] The insulation element 100 is formed by plastic foam materials, like, e.g., polyester or polyurethane. During the foaming process that, as it is known, is carried out to make insulating panels, said materials generate a closed-cell structure, enabling to enclose air, or optionally another gas, thereinside.

[0019] The air or gas present in the material assures thermal insulation properties, by virtue of the low conductivity of the aeriform.

It has to be noted that the presence of the microholes

200 basically does not modify the closed-cell structure of the material: the number of cells in the structure is extremely high and therefore the presence of the microholes 200 generates a limited quantity of open cells, without altering the thermal insulation capability of the material.

[0020] Moreover, it will be understood that said materials are known to any person skilled in the art; therefore, a further description of their features and industrial manufacturing processes will be omitted.

[0021] Referring now to figure 3, the elements 100 are used to make an insulating layer inside of masonry: a typical application example is provided by a wall composed of an internal plaster 21, an internal masonry 31, a plurality of elements 100 for thermal insulation, arranged the one side-by-side to the other, so as to form a continuous plane layer, an external masonry 32 and a related external plaster 22.

[0022] Therefore, note that the two surfaces 1 and 2 will be facing the inside and the outside of the building, respectively. Hence, they will suitably be indicated as inner 1 and outer 2 surface of the element 100. However, it will be understood that in the present embodiment the two surfaces 1 and 2 exhibit the same features.

[0023] Moreover, it is known that plaster 21, 22 and masonry 31, 32 are constituted by materials at least partially permeable; therefore, in case of an elevated presence of moisture inside the room, steam tends to permeate the wall, until reaching the element 100 for thermal insulation present inside the wall.

[0024] The constituent material of the elements 100 does not assure any breathability; therefore, through the structure of the material it is not possible to dispose the moisture coming from the room through wall and plaster.

[0025] Instead, the presence of the microholes 200 enables the flow of steam through the elements 100.

In fact, the microholes 200 have a diameter of an extension sufficing to allow the flow of the steam particles, thereby enabling the free flow of excess moisture to the outside of the building.

[0026] However, to prevent the presence of microholes 200 from altering the insulating and mechanical features of the elements 100, ensuring however a good breathability, it is advisable that these exhibit specific features.

[0027] Hence, the diameter of the microholes 200 indicatively ranges from about 0.1 to 2.5 mm, whereas the microhole density substantially ranges from 600 to 3600 microholes per square meter of material.

[0028] By controlling the size of the microholes 200, excess moisture can be adequately disposed of, without however allowing a flow of any water particles that otherwise could come from the outside.

[0029] Moreover, it is advisable to control the density of the microholes 200 present, as an excessive number of microholes 200 could limit the thermal insulation capability of the element 100, as well as its mechanical features.

[0030] In the present embodiment the microholes 200 have a direction basically orthogonal to the surfaces 1 and 2, however the same breathability features may be implemented also by means of microholes arranged along different orientations, like e.g. all along a same inclination or according to random directions.

[0031] The combination between the diameter of the microholes 200 and the density thereof allows to attain a particularly flexible system, suitable for the designing and making of thermally insulating elements, from closed non-breathing cells, with breathability values each time calibrated for solving various problems that the various applications entail.

[0032] The element 100 exhibits breathability values nearly similar to those of traditional masonries in burnt clay building components commonly used in building, and concomitantly no permeability to water, it being closed-cell.

[0033] Lastly, the element 100 exhibits high values of lasting thermal insulation and is capable of offering the maximum level of comfort and wellbeing from a hygrothermal standpoint.

As it is evident from the application example described hereto, the elements 100 are arranged side-by-side the one to the other so as to create a substantially continuous insulating layer inside a wall, a floor, a cover, or other partitioning element.

[0034] Referring now to figures 2A to 2C, different embodiments of the element 100 are reported.

[0035] In particular, referring to figure 2A, the surfaces 1 and 2 may have a respective groove 11 and 12 extending along one-half of their periphery. Moreover, the two grooves 11 and 12 are made on different and opposed sides for the two surfaces 1 and 2.

[0036] Thus, by arranging the elements 100 side-by-side, it is possible to implement a joint between the grooves 11 and 12, and substantially facilitate the making of the insulating layer inside the walls.

[0037] According to a different embodiment, illustrated in figure 2B, the elements 100 have two side extensions 13 and two suitable seats 14, carved along the periphery of the element, substantially at the median plane thereof, enabling the side-by-side coupling of one element 100 to the other one, to newly create an insulating layer inside the walls.

[0038] Referring to figure 2C, according to a further embodiment the element 100 additionally comprises a plurality of recesses 15, made on one or both surfaces 1 and 2, of a substantially rectangular shape and a few millimetres in depth.

[0039] The recesses 15 have the purpose of allowing an improved adhesion of the plaster 21 and 22, or of other layers of alike materials, when directly applied on the element 100.

[0040] In fact, thanks to the recesses 15, the plaster may effectively adhere to the surfaces 1 and 2 of the element 100.

[0041] The recesses 15 have dimensions approxi-

mately ranging from a few millimetres to about 0.5 cm, and moreover they may be made according to a distribution alike that of the microholes 15 or even follow different lattices.

[0042] Lastly, the method for making the element 100 for thermal insulation according to the present invention is illustrated in figure 4.

[0043] The installation for producing the element 100 provides a first extrusion section 41, in which the foaming and the extrusion of the plastic material take place. Thus, at the outlet from the section 41 a continuous layer 5 of foam plastic material is present, already exhibiting said thermally insulating features, yet no breathability whatsoever.

[0044] Then, the continuous layer 5, already hardened, is advanced through a conveyor belt to a punching section 42, in which the microholes 200 onto the continuous layer 5 are made by means of a carpet 43 provided with needles 44, illustrated in figure 5.

[0045] The carpet 43 cyclically lowers so as to penetrate the layer 5 until making the through microholes 200.

[0046] The system for moving the carpet 43 is such as to allow also motions along the feed direction of the continuous layer 5, so that the carpet 43 may progress along with the layer 5 during the making of the microholes 200, hence without having to stop the outletting of material of the extrusion section 41 and accordingly without stopping the extrusion thereof.

[0047] After the making of the microholes 200, the continuous layer 5 is transported, always by means of conveyor belts, to two subsequent cutting 45 and processing 46 sections. In the former section there occurs the cutting of the continuous layer 5 to create individual elements 100, whereas in the subsequent section there are carried out optional processings for the making of said grooves 11 and 12, of the extensions 13 and the seats 14 thereof, or of the recesses 15.

[0048] Thus, at the outlet either of the cutting section 45 or of the processing section 46 there are made the finished elements 100, according to one of the disclosed embodiments.

[0049] The present invention has hereto been described with reference to preferred embodiments thereof. It is understood that there could be other embodiments afferent to the same inventive kernel, all falling within the protective scope of the claims hereinafter.

Claims

1. An element (100) for thermal insulation of houses and buildings in general, having two opposite peripheral surfaces (1, 2) and being formed by plastic foam material with substantially closed cells, **characterized in that** it comprises a plurality of through microholes (200) apt to allow transpiration between said two opposite surfaces (1, 2) .

2. The element (100) for thermal insulation of houses and buildings in general according to the preceding claim, wherein said microholes (200) have a diameter ranging from about 0.10 to 2.5 millimetres.

3. The element (100) for thermal insulation of houses and buildings in general according to one or more of the preceding claims, wherein said microholes (200) are evenly distributed.

4. The element (100) for thermal insulation of houses and buildings in general according to one or more of the preceding claims, wherein said microholes (200) exhibit a density ranging from about 500 to 3000 microholes per square meter of extension of said surfaces (1, 2).

5. The element (100) for thermal insulation of houses and buildings in general according to one or more of the preceding claims, whose development is substantially parallelepiped-shaped, so that said peripheral surfaces (1, 2) correspond to two opposite faces of the parallelepiped.

6. The element (100) for thermal insulation of houses and buildings in general according to one or more of the preceding claims, wherein said microholes (200) develop all along a same direction.

7. The element (100) for thermal insulation of houses and buildings in general according to the preceding claim, wherein said microholes (200) develop along a direction substantially perpendicular to said two surfaces (1, 2).

8. The element (100) for thermal insulation of houses and buildings in general according to one or more of the preceding claims, comprising at least one side extension (13) at the periphery of the element (100), apt to engage a corresponding seat (14) of another element.

9. The element (100) according to one or more of the preceding claims, having at least one seat (14) apt to receive a corresponding side extension (13) of another element.

10. The element (100) for thermal insulation of houses and buildings in general according to one of the claims 1 to 7, comprising grooves (11, 12) arranged along the periphery of said surfaces.

11. The element (100) for thermal insulation of houses and buildings in general according to one or more of the preceding claims, wherein at least one of said surfaces (1, 2) comprises a plurality of recesses (15).

12. An insulating panel comprising a pair of side walls

in masonry or other breathable material between which it is interposed a layer of insulation elements (100) according to one or more of the preceding claims.

13. A method for the making of elements (100) for thermal insulation of houses and buildings in general, **characterized in that** it comprises:

- A first step of foaming and subsequent extrusion of a plastic material, apt to make a continuous layer (5) of foam material;
- A subsequent step of punching said continuous layer (5), apt to make a plurality of microholes (200) on said continuous layer (5); and
- A step of cutting and optional processing, apt to cut said continuous layer (5) into individual elements (100).

14. The method for the making of elements (100) for thermal insulation of houses and buildings in general according to the preceding claim, wherein said punching step is carried out by means of a carpet (43) having a plurality of needles (44), said carpet (43) being apt to make said needles (44) penetrate on said continuous layer (5).

15. An installation for producing elements for thermal insulation of houses and buildings in general, comprising an extrusion section (41), suitable for carrying out the foaming of a plastic material and the extrusion thereof in the form of a continuous layer (5), a punching section (42), and one or more cutting and/or processing sections (45, 46).

16. The installation for producing elements for thermal insulation of houses and buildings in general according to the preceding claim, wherein said punching section comprises a carpet (43) provided with needles (44) for the punching of said continuous layer (5).

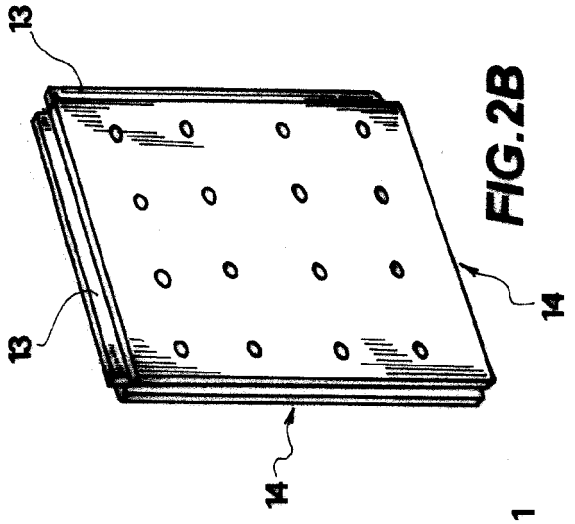

FIG.2B

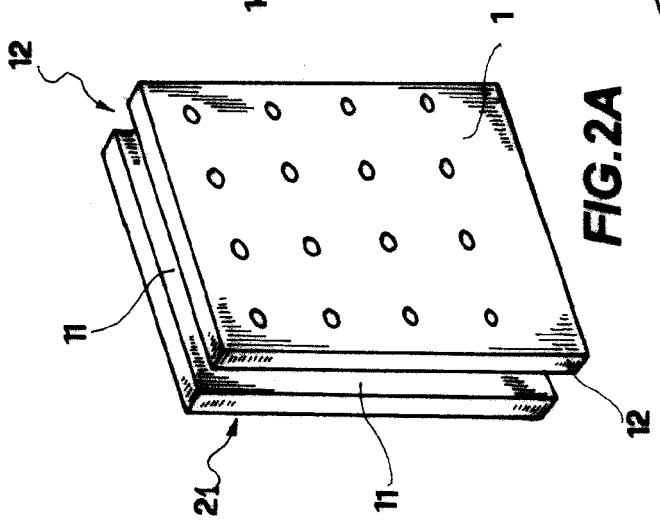

FIG.2A

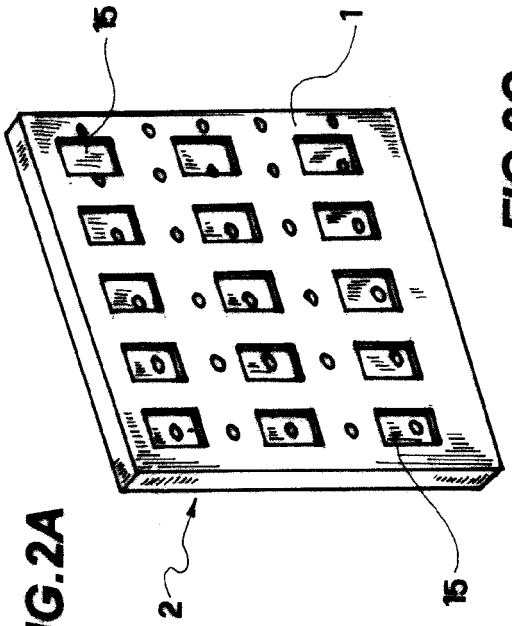

FIG.2C

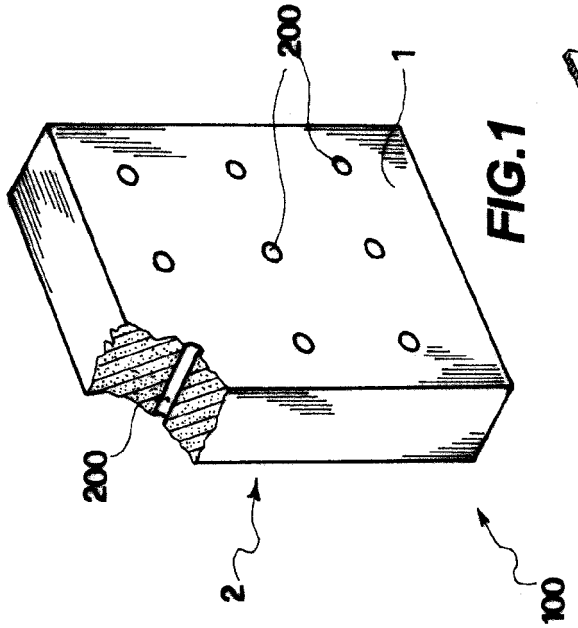

FIG.1

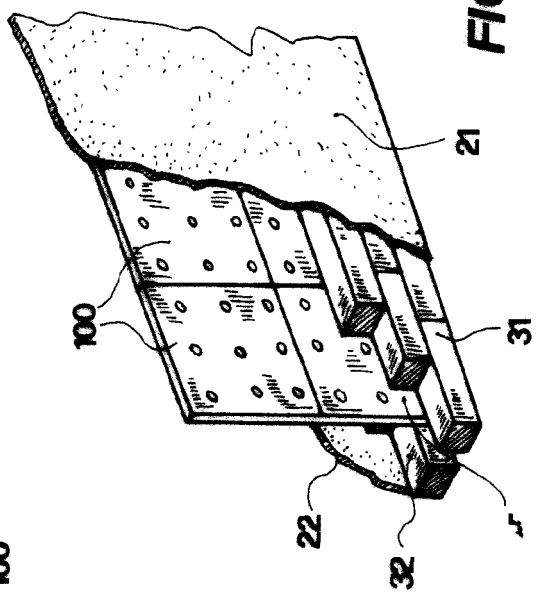

FIG.3

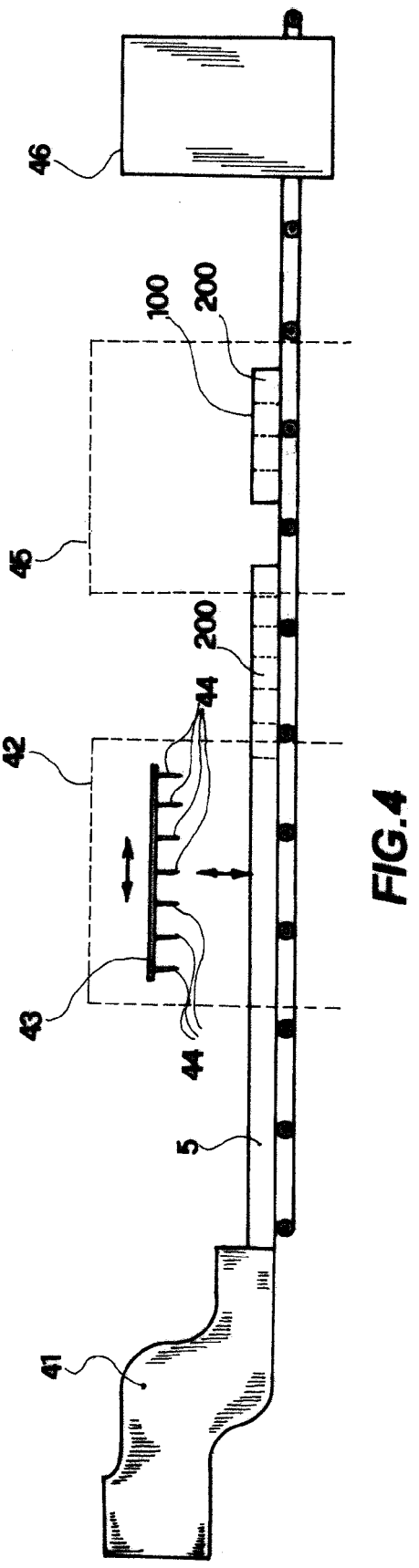

FIG.4

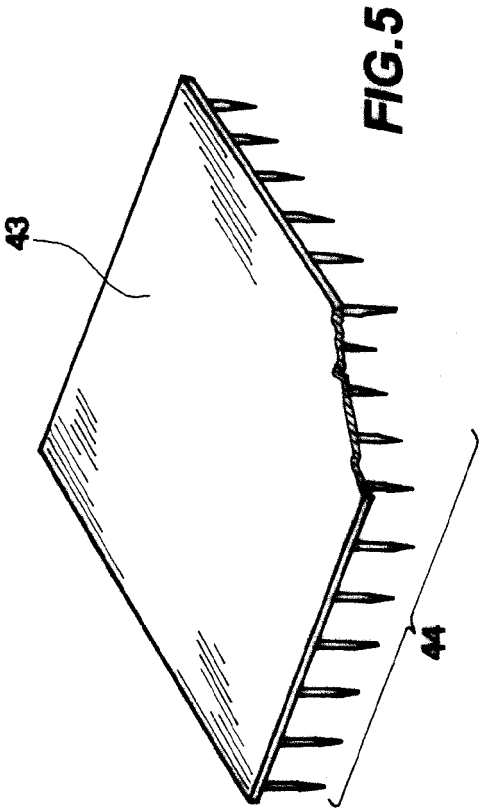

FIG.5