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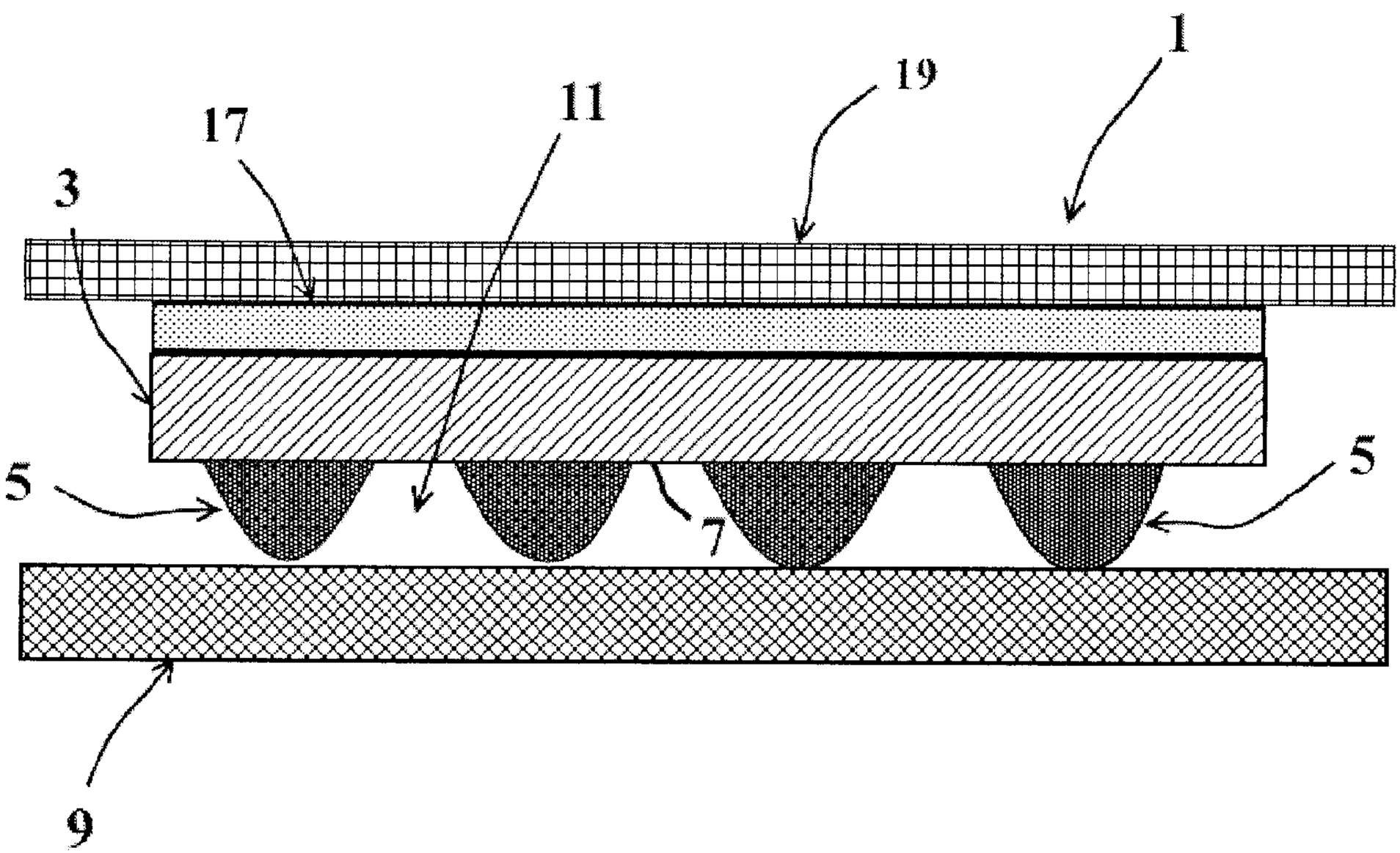
(54) Titre : MEMBRANE DE SOUS-COUCHE INSONORISANTE
(54) Title: SOUND PROOF UNDERLAYMENT MEMBRANE




(57) Abrégé/Abstract:
A soundproof underlayment membrane is disclosed. The membrane comprises a main layer having a given thickness made of a flexible material and a plurality of points extending from one of the surfaces of the main layer. The points are located on the surface in order to create an absorbing chamber between the main layer and an adjacent surface on which the membrane is placed, while reducing a surface of contact between floor coverings installed on the membrane and the adjacent surface. By combining at least two different structural elements, the membrane is particularly efficient for sound reduction in a construction such as the impact or structure borne noise (Impact Insulation Class - IIC) and the sound transmission or airborne sound (Sound Transmission Class - SCC). Compared to existing membranes in the fields, the present invention provides a light material, easy to manufacture, ship and install, while providing effective soundproof properties .

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## ABSTRACT

A soundproof underlayment membrane is disclosed. The membrane comprises a main layer having a given thickness made of a flexible material and a plurality of points extending from one of the surfaces of the main layer. The points are located on the surface in order to create an absorbing chamber between the main layer and an adjacent surface on which the membrane is placed, while reducing a surface of contact between floor coverings installed on the membrane and the adjacent surface. By combining at least two different structural elements, the membrane is particularly efficient for sound reduction in a construction such as the impact or structure borne noise (Impact Insulation Class – IIC) and the sound transmission or airborne sound (Sound Transmission Class – SCC). Compared to existing membranes in the fields, the present invention provides a light material, easy to manufacture, ship and install, while providing effective soundproof properties.

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# SOUND PROOF UNDERLAYMENT MEMBRANE

## Field of the Invention

[0001] The present invention generally relates to acoustic damping articles for use in construction, and more particularly to sound proof underlayment membranes.

## Background of the Invention

[0002] Sound or noise control has long been an issue in residential and business buildings or constructions. With increasing urbanization and an increasing cost of real estate, individuals are living and working in closer proximity, increasing the need for noise reduction. To combat noise in such urban settings, several cities have implemented noise control building codes. Further, many building owners specify noise tolerance in construction specifications during construction.

[0003] The control of noise in constructions involves reducing the travel or transmission of both airborne sound and structure borne sound.

[0004] Airborne sound is produced initially by a source which radiates directly into the air. Many of the sounds we live with daily are of airborne origin; for example, voices of people, music from stereo sets, kitchen activities. Airborne sound waves are transmitted simply as pressure fluctuations in the open air, or in buildings along continuous air passages such as corridors, doorways, staircases and duct systems. The disturbing influences of airborne sound generated within a building generally are limited to areas near the sound source. This is due to the fact that airborne sounds are less intense and are easier to dissipate than structure borne sound.

[0005] Structure borne sound occurs when floor or other building elements are set into vibratory motion by direct contact with vibrating sources such as mechanical equipment or domestic appliances, footsteps, falling of hard objects, objects being moved, bounced or rolled across the floor, to name a few examples. In a building for example, the vibrational or mechanical energy from one floor or wall assembly is transmitted

throughout the structure to other wall and floor assemblies with large surface areas, which in turn are forced into vibration. These vibrating surfaces amplify and transmit the vibrational energy to the surrounding air, causing pressure fluctuations resulting in airborne sound to adjacent areas. The intensity of structure borne sound produced by a wall or floor structure when it has been forced into vibration is generally more intense and harder to dissipate than an airborne sound wave. Unlike sound propagated in air, the vibrations of structure born sound are transmitted rapidly with very little attenuation through the skeletal frame or other structural paths of the building and radiate the sound at high levels.

[0006] Many traditional methods for controlling noisy sounds are either cumbersome to install or ineffective. Traditional methods include the instillation of thick insulative membranes which have limited effectiveness and add additional steps to the installation and construction of walls, floors or ceilings.

[0007] For instance, multilayered membranes have been developed. Patent application no. WO 2006/005164 A1 (Ducharme) discloses a radiating thermoacoustic membrane for use on a floor consisting of at least one polyethylene, polypropylene, polyester or metal support layer whereon are laminated rubber granules having a size ranging between 2 and 30 strands, on a thickness ranging from 0.25 to 0.5 inches. Indeed, rubber, latex or crumb rubber has been widely used for the making of the dampening layers in sound proof membranes, such as those also disclosed in U.K. patent application no. GB 2,478,962 A (Maynard).

[0008] US 2016/0053497 A1 (Chang) discloses a floor underlay comprises adhesive layers, support layers, waterproof layers, and a multiple-media intermediate layer. The multiple-media intermediate layer is formed by mixing a plurality of medium particles. The medium particles are formed by elastic materials, such as rubber, rubber foam, polyurethane, or polyurethane foam.

[0009] U.S. patent no. US 8,590,670 B1 discloses a sound barrier multi-layered membrane including a dampening layer made of modified bitumen. Other types of

membrane are disclosed in US 2016/0086779 A1 (Erasmus) or US 2006/0105136 A1 (Brazier et al.).

[0010] Other techniques than the use of elastic damping layers have been developed. For instance, US 7,886,488 B2 (Payne et al.) discloses a membrane having first layer which is disposed upon the subfloor as a sound reduction mat (SRM). The SRM is made of a polymeric material and configured as a plurality of open hollow, cylinders disposed in an array of spaced, preferably parallel rows with lower ends facing the subfloor. The cylinders are held together at opposite ends by a polymeric lattice. Three functions are served by the SRM layer: it provides a water or vapor barrier, the cylinders cushion the floor system and absorb impact forces, and it provides one level of discontinuity of material and substantially reduced contact area, which is an important factor in reducing sound transmissions through the flooring system. Other acoustic membranes using hollowed foam layer are disclosed in U.S. patents nos. US 4,340,129 (Salyers) or US 6,569,509 B1 (Alts). However these kinds of membrane constructions, even if they are certainly pretty efficient in damping sounds, are particularly complex and expensive to make and present poor flexibility.

[0011] As such, there is still a need for an improved acoustic / damping article that would combine sound reduction while being easy to manufacture, flexible and easy to install.

**Summary of the Invention**

[0012] The aforesaid and other objectives of the present invention are realized by generally providing a soundproof underlayment membrane and a method for reducing airborne and structure borne sound transmission.

[0013] The invention first concerns a soundproof underlayment membrane, the membrane comprising:

a main layer having a given thickness made of a flexible material, and

a plurality of points extending from at least from one of the surfaces of the main layer; the points being located on the at least one surface in order to create an absorbing chamber between the main layer and an adjacent surface on which the membrane is placed in order to reduce sounds, the plurality of points also

reducing a surface of contact between a floor covering installed on the membrane and the adjacent surface..

[0014] The invention also concerns a method for reducing sound in a construction, the method comprising the steps of:

a) providing a main layer of a membrane having a given thickness and made of a flexible material;

b) providing a plurality of points extending from the surface of the main layer;

c) creating an absorbing chamber in order to reduce sounds by placing the membrane on an adjacent surface with the plurality of points extending from the main layer towards the adjacent surface, while reducing a surface of contact between a floor covering installed on the membrane and the adjacent surface.

[0015] The invention is also directed to the use of the soundproof underlayment membrane as disclosed herein, for reducing noise in a construction. Preferably, the membrane is placed between the floor, the walls and/or the ceiling of the construction and a covering element. For instance, the membrane can be placed on the construction floor before covering the floor with a laminate floor, a (hard)wood floor, a carpet, or the like. Other applications or uses of the membrane can be considered to reduce sound and noise transfer in a construction.

[0016] According to a preferred embodiment of the invention, the number of points to be provided on the main layer of the membrane, their sizes, their location and the nature of the material used to make the points can be modified in order to customize the soundproof property of the membrane. The same applies to the main layer that can be customized by modifying its thickness for instance.

[0017] The present invention combines at least two different elements, each of them providing several soundproof properties. Each element can both absorb the impact and structure borne noise (Impact Insulation Class – IIC) and the sound transmission or airborne sound (Sound Transmission Class – SCC). The presence of the points between the main floor of the construction and the covering element (laminate, (hard)wood floor,

carpet, ...) considerably reduces the surface of contact between the two structural elements and therefore reduces the structure borne noise.

[0018] Compared to existing membranes in the fields, the present invention provides a light material, easy to manufacture, ship and install, while providing effective soundproof properties.

[0019] Other and further objects and advantages of the present invention will be better understood with the illustrative embodiments about to be described, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

**Brief Description of the Drawings**

[0020] The above and other objects, features and advantages of the invention will become more readily apparent from the following description, reference being made to the accompanying drawings in which:

[0021] Figure 1 is a schematic view of the membrane in contact with a support in accordance with a preferred embodiment of the invention;

[0022] Figure 2 is bottom schematic view of the membrane illustrated in Figure 1;

[0023] Figure 3 is a picture of the membrane in accordance with a preferred embodiment of the invention; and

[0024] Figure 4 is a close-up view of the top and bottom of the membrane in accordance with a preferred embodiment of the invention.

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## Detailed Description of Preferred Embodiments

[0025] A novel soundproof underlayment membrane will be described hereinafter. Although the invention is described in terms of specific illustrative embodiment(s), it is to be understood that the embodiment(s) described herein are by way of example only and that the scope of the invention is not intended to be limited thereby.

[0026] As illustrated in Figures 1 to 4, the invention first consists in a soundproof underlayment membrane (1). The membrane comprises a main layer (3) having a given thickness. The main layer (3) can be made of a flexible material, generally a light material. For instance, the flexible material can be made of a non-woven fabric, preferably a needle-punched non-woven fabric.

[0027] In accordance with a preferred embodiment of the invention, the main layer is made of a needle-punched non-woven fabric of polyester. Other materials having similar properties than polyester can be used.

[0028] In accordance with a preferred embodiment of the invention, the polyester needle-punched non-woven fabric has a density of about 250 gsm.

[0029] As illustrated on Figures 1, 3 and 4, the membrane (1) also comprises a plurality of points (5) extending from the bottom surface (7) of the main layer. The points could also extend from the other surfaces of the main layer (3), but this embodiment is not illustrated therein.

[0030] The points (5) create an absorbing chamber (11) between the main layer (3) and an adjacent surface (9) on which the membrane is placed. The air trapped in the chamber (11) allows reducing sounds. The presence of the points between the main floor of the construction (11) and any sort of covering elements (19) such as laminate, (hard)wood floor, engineered floor, mat or carpet, or the like, placed on the membrane also considerably reduce the surface of contact between the covering element (19) and the construction (9) and therefore considerably reduce the structure borne noise, for instance when someone walk on the covering element (19) of the floor or an object falls on the same.

[0031] In accordance with a preferred embodiment of the invention, the given thickness of the main layer and/or the number of points can be selected in order to customize the soundproof property of the membrane.

[0032] As illustrated on Figure 2, the plurality of points can be regularly located on the surface from which they extend from and spaced apart of a distance of about 4 to 12 mm, more preferably of about 6 mm. Figure 2 shows a pattern of points organised as columns and rows in view of the edges of the membranes (13), whereas Figure 4 shows a different pattern in view of the edge (13) of the membrane (1) wherein the points form diamonds (15) or intercalated columns and rows. Other patterns could be considered without departing from the present invention.

[0033] In accordance with a preferred embodiment of the invention, wherein the points are made of a resilient or non-resilient material, such as but not limited to rubber, Polyvinylchloride or PVC, wood such as cork, or silicone. In case of PVC, the plurality of points made of PVC form a layer having a density of about 60 gsm.

[0034] In accordance with a preferred embodiment of the invention, the points may have a round base in contact with the main layer, such as the base illustrated on Figure 1. In general, the diameter of the base is of from 1 to 5 mm, more preferably of about 2.5 mm. The points can have a height of from 1 to 3 mm, more preferably of about 2 mm. The present invention is not limited to the sized and shape of the points forming the chamber (11).

[0035] By "about" used in the present application, it is meant that the value of length (mm) can vary within a certain range depending on the margin of error of the method or device used to evaluate such length. A margin of error of 10% is generally accepted.

[0036] As illustrated on Figure 1, the membrane of the invention can have the surface opposite to the surface comprising the plurality of points, laminated (17). Preferably, the laminated surface comprises Polyvinylchloride or PVC. The laminated surface may have a density of about 100 gsm. The laminate (17) is used to reinforce the membrane, to provide better resistance and soundproof properties, and to reduce or avoid vapor transmission. Indeed, the laminate plays the role of vapor retarder with a given perm

rating, generally inferior to 1. For instance, a laminate of unplasticized PVC with a thickness of 0.002 inch has a perm rate of about 0.68.

[0037] Regarding the making of the membrane, the points can be applied to the main layer either by extrusion or by adhesion.

[0038] As aforesaid, the intention also concerns a method for reducing sound in a construction. The method comprising the steps of:

a) providing a main layer of a membrane having a given thickness and made of a flexible material ;

b) providing a plurality of points extending from the surface of the main layer;

c) creating an absorbing chamber in order to reduce sounds by placing the membrane on an adjacent surface with the plurality of points extending from the main layer towards the adjacent surface.

[0039] The different elements of the method are as disclosed above.

[0040] In accordance with a preferred embodiment of the invention, the method further comprises the steps of modifying the given thickness of the membrane and/or of selecting the number of points to be provided in the membrane, in order to customize the soundproof property of the membrane. The thickness of the main layer and the number of points of the membrane, their size and location, and the nature of the material used to make the points can be selected for customizing the membrane in view of the building construction requirements for soundproof property.

[0041] By combining at least two different elements, the membrane is particularly efficient for sound reduction in a construction. The membrane absorbs the impact and/or structure borne noise (Impact Insulation Class – IIC) but also the sound transmission or airborne sound (Sound Transmission Class – SCC). The membrane considerably reduces the surface of contact between the floor covering and the main construction floor. Compared to existing membranes in the fields, the present invention provides a light material, easy to manufacture, ship and install, while providing effective soundproof properties.

[0042] While illustrative and presently preferred embodiment(s) of the invention have been described in detail hereinabove, it is to be understood that the inventive concepts may be otherwise variously embodied and employed and that the appended claims are intended to be construed to include such variations except insofar as limited by the prior art.

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## Claims

1. A soundproof underlayment membrane, the membrane comprising:
a main layer having a given thickness and made of a flexible material; and
a plurality of points extending from at least from one of the surfaces of the main layer; the points being located on the at least one surface in order to create an absorbing chamber between the main layer and an adjacent surface on which the membrane is placed in order to reduce sounds, the plurality of points also reducing a surface of contact between a floor covering installed on the membrane and the adjacent surface.

2. The membrane of claim 1, wherein the given thickness of the main layer and/or the number of points are selected in order to customize the soundproof property of the membrane.

3. The membrane of claim 1 or 2, wherein the plurality of points are regularly located on the surface from which they extend from and spaced apart of a distance of about 4 to 12 mm.

4. The membrane of claim 3, wherein the points are spaced apart of a distance of about 6 mm.

5. The membrane of any one of claims 1 to 4, wherein the flexible material is made of a non-woven fabric.

6. The membrane of any one of claims 1 to 5, wherein the flexible material is made of a needle-punched non-woven fabric.

7. The membrane of claim 6, wherein the needle-punched non-woven fabric comprises polyester.

8. The membrane of claim 7, wherein the needle-punched non-woven fabric has a density of about 250 gsm.

9. The membrane of any one of claims 1 to 8, wherein the points are made of a - material selected from the group consisting of rubber, Polyvinylchloride or PVC, silicone or wood.

10. The membrane of claim 9, wherein the points are made of Polyvinylchloride or PVC.

11. The membrane of claim 10, wherein the plurality of points made of PVC form a layer having a density of about 60 gsm.

12. The membrane of any one of claims 1 to 11, wherein the points have a round base in contact with the main layer with a diameter of from 1 to 5 mm.

13. The membrane of claim 12, wherein the diameter is about 2.5 mm.

14. The membrane of any one of claims 1 to 13, wherein the points have a height of from 1 to 3 mm.

15. The membrane of claim 14, wherein the height is about 2 mm.

16. The membrane of any one of claims 1 to 15, wherein the surface opposite to the surface comprising the plurality of points is laminated.

17. The membrane of claim 16, wherein the laminated surface comprises Polyvinylchloride or PVC.

18. The membrane of claim 17, wherein the laminated surface has a density of about 100 gsm.

19. A method for reducing sound in a construction, the method comprising the steps of:

i. providing a main layer of a membrane having a given thickness and made of a flexible material;

ii. providing a plurality of points extending from the surface of the main layer; and

iii. creating an absorbing chamber in order to reduce sounds by placing the membrane on an adjacent surface with the plurality of points extending from the main layer towards the adjacent surface, while reducing a surface of contact between a floor covering installed on the membrane and the adjacent surface.

20. The method according to claim 19, further comprising the steps of modifying the given thickness of the membrane and/or of selecting the number of points to be provided in the membrane, in order to customize the soundproof property of the membrane.

21. Use of the soundproof underlayment membrane as claimed in any one of claims 1 to 18, for reducing noise in a construction.

22. Use of claim 21, wherein the membrane is placed on the floor, the walls and/or the ceiling of the construction before covering the floor, the walls and/or ceiling with a covering element.

23. Use of claim 21 or 22, wherein the membrane is placed on the floor of the construction before covering said floor with a wood floor, tiles or a carpet.

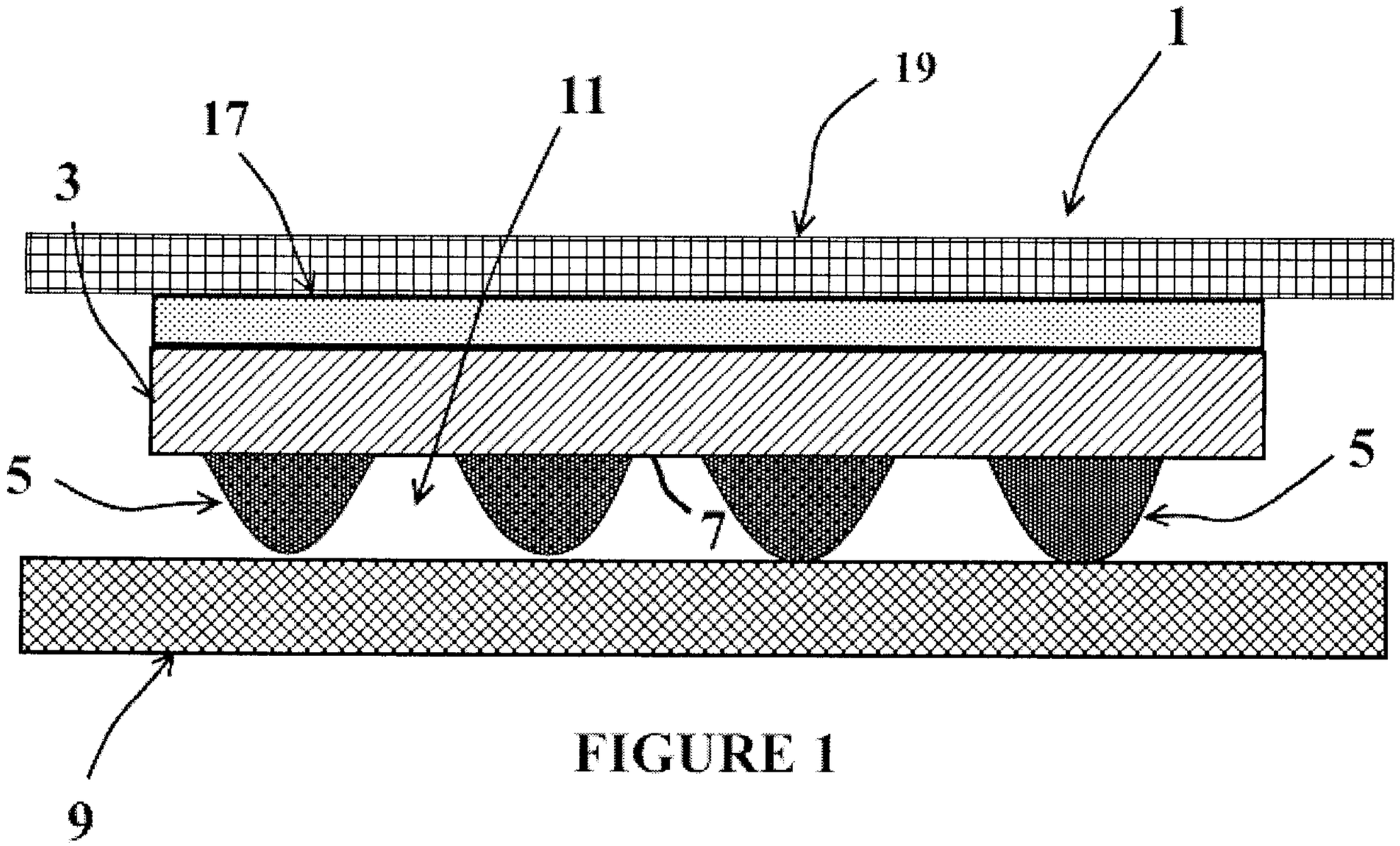



FIGURE 1

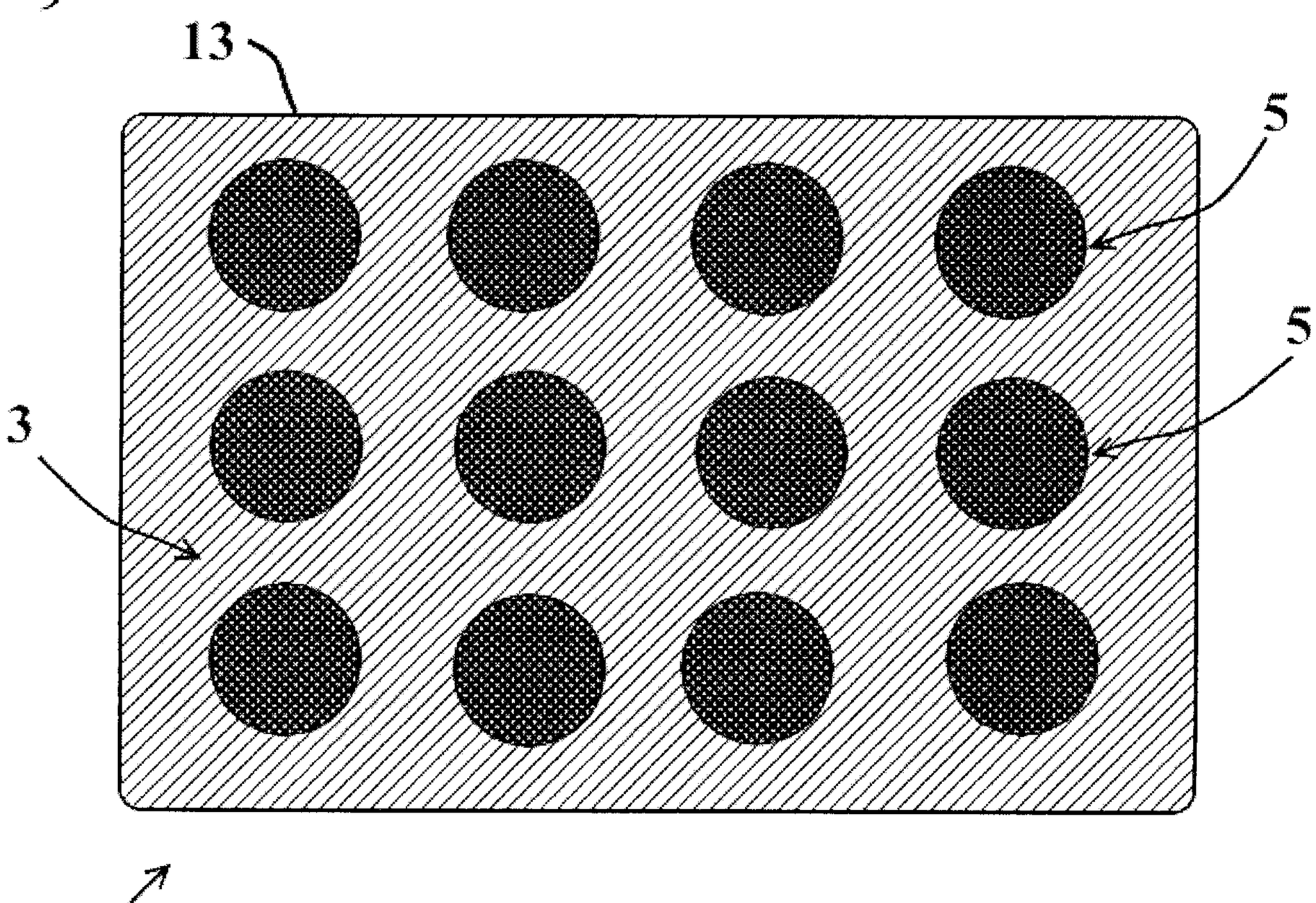



FIGURE 2

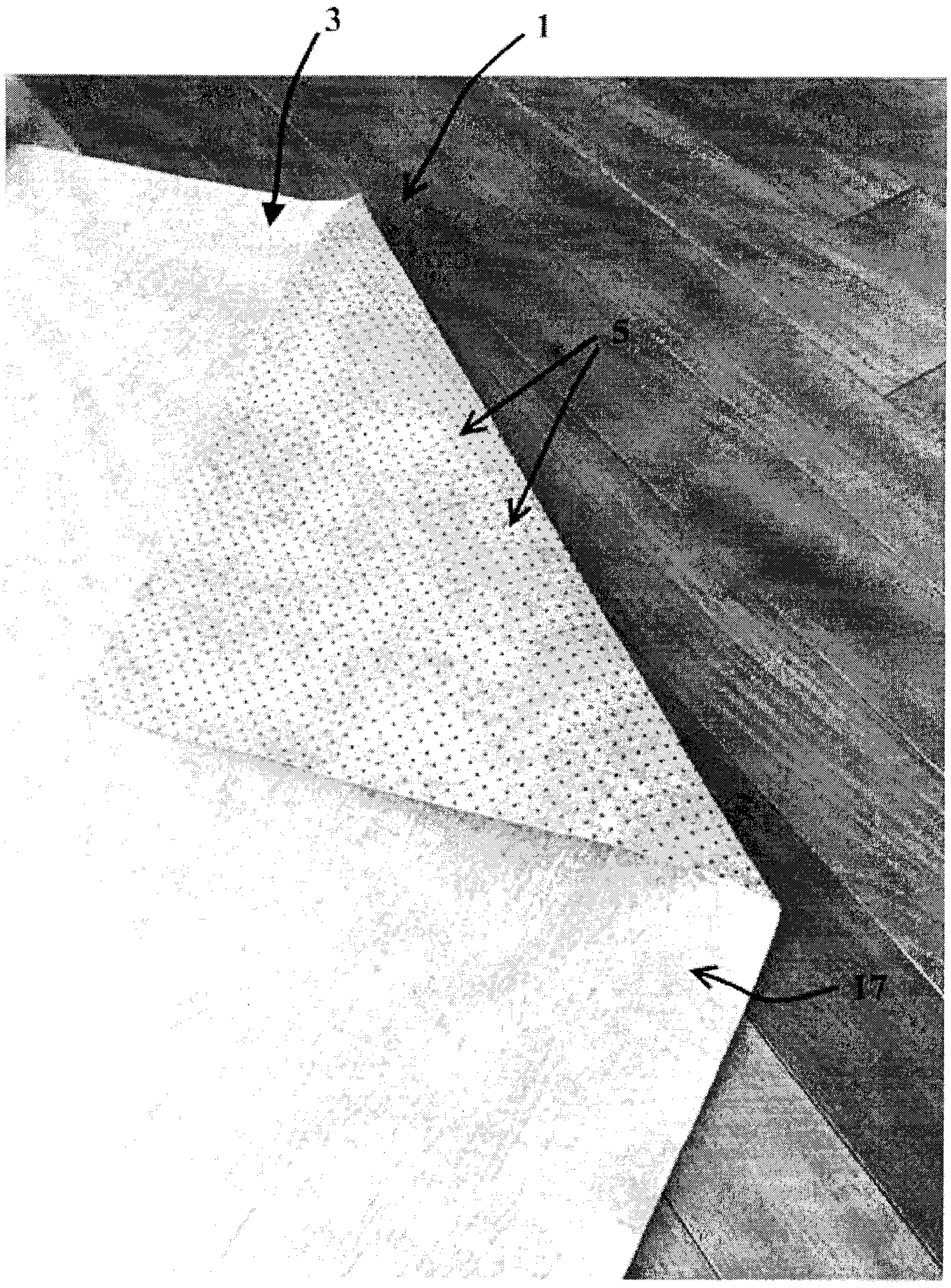



FIGURE 3

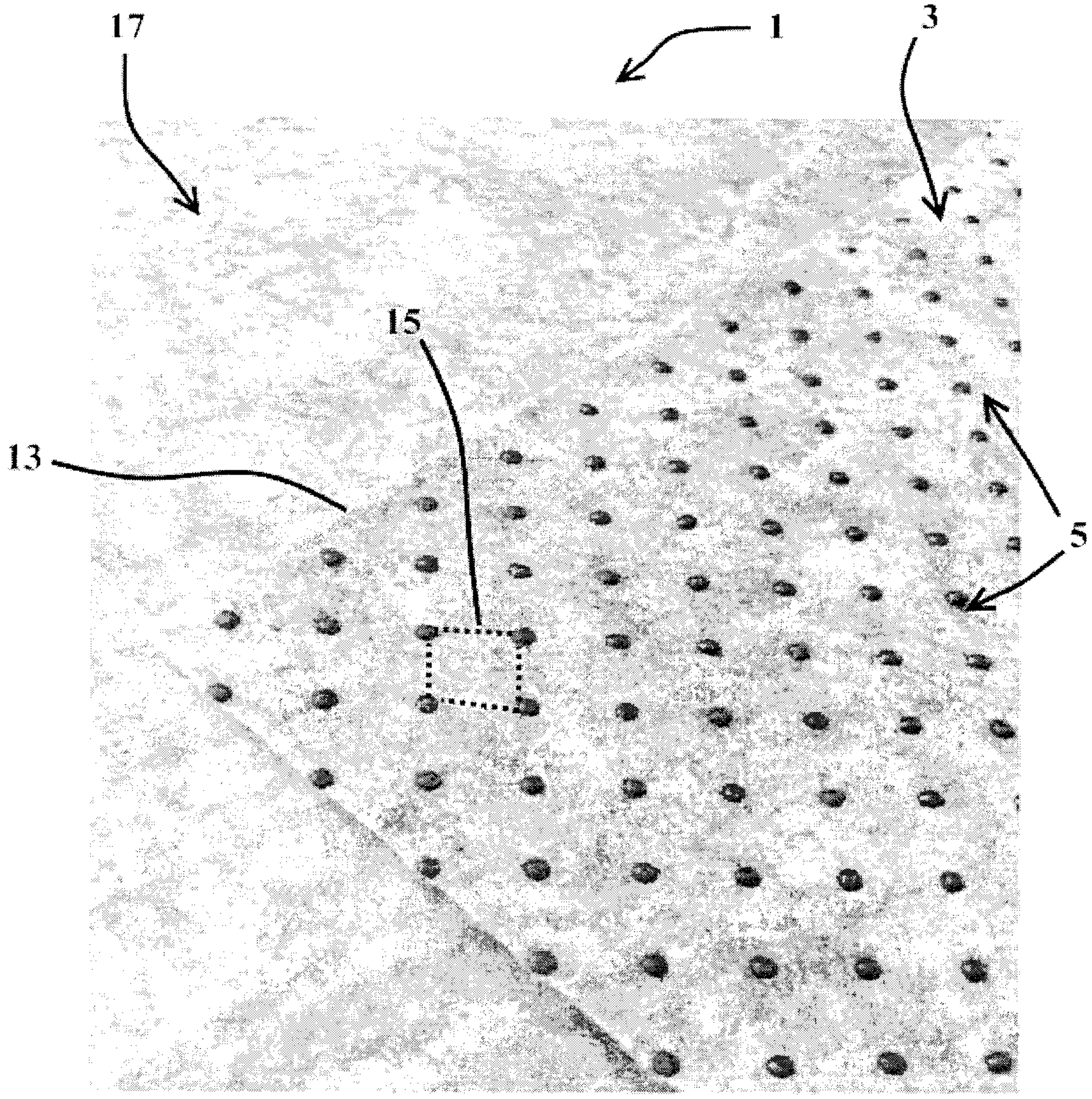
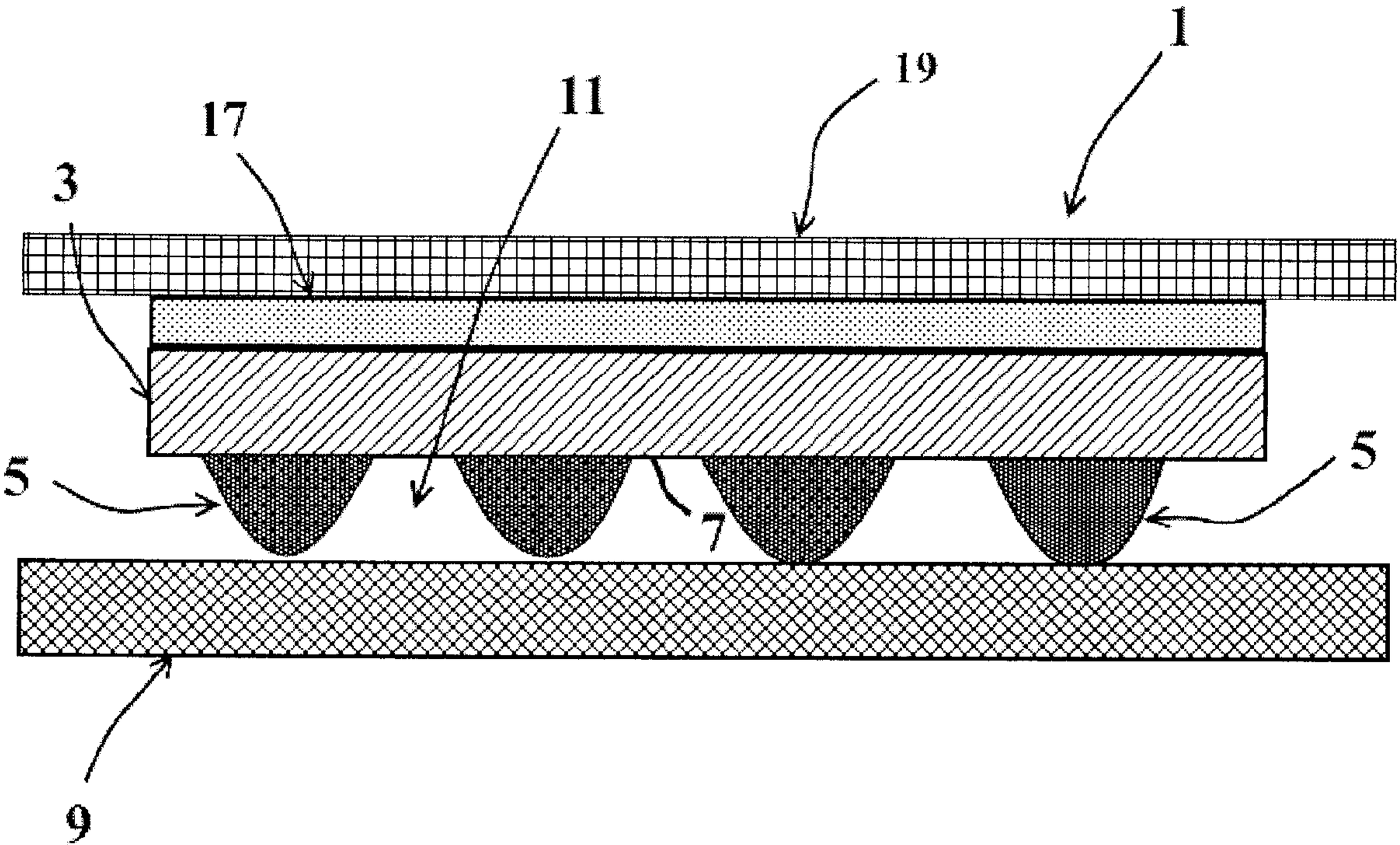



FIGURE 4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