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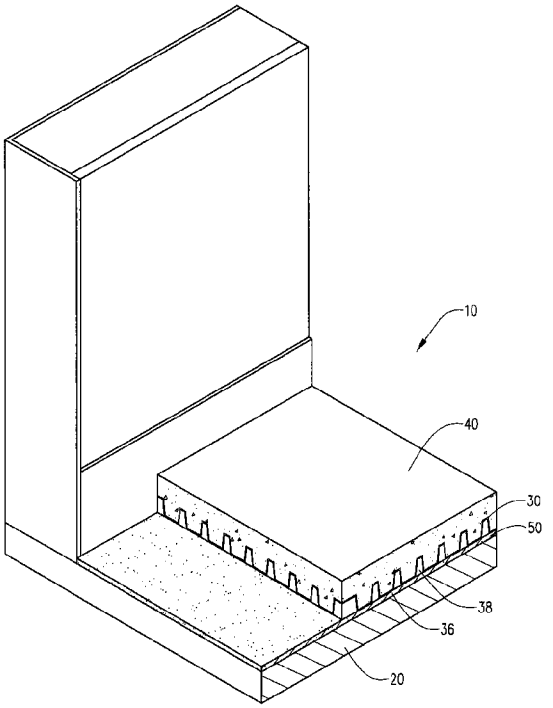
(54) **Titre : ATTENUATEUR DE SON A HAUTE RESISTANCE A LA COMPRESSION**
(54) **Title: HIGH COMPRESSIVE STRENGTH SOUND ATTENUATION**



(57) **Abrégé/Abstract:**
The present disclosure describes a sound attenuating flooring system. The sound attenuating flooring system has a subfloor, a sound attenuating material overlaying and contacting only a portion of the subfloor, and an overlayment. The sound attenuating material has a first surface and second surface. The first surface is defined by a plurality of outwardly projecting hollow protrusions. The second surface is defined by a plurality of open recesses corresponding to the plurality of outwardly projecting hollow protrusions. The overlayment overlays the second surface of the sound attenuating material.

ABSTRACT

The present disclosure describes a sound attenuating flooring system. The sound attenuating flooring system has a subfloor, a sound attenuating material overlaying and contacting only a portion of the subfloor, and an overlayment. The sound attenuating material has a first surface and second surface. The first surface is defined by a plurality of outwardly projecting hollow protrusions. The second surface is defined by a plurality of open recesses corresponding to the plurality of outwardly projecting hollow protrusions. The overlayment overlays the second surface of the sound attenuating material.

HIGH COMPRESSIVE STRENGTH SOUND ATTENUATION

CROSS REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to U.S. Provisional Application No. 62/827,610 filed on April 1, 2019, which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates generally to above-ground floor systems, and, more specifically, to an above-ground sound attenuating floor system for reducing the transmission of impact sound while maintaining the flexural strength of the flooring system.

BACKGROUND

[0003] In multi-storied buildings, it is desirable to insert a sound attenuating mat into the above-ground floor systems to reduce the transmission of impact sound. Typically, these floor systems utilize three layers: subfloor, overlayment, and flooring, as well as the other structural features and finishes of the building. In this typical application, the overlayment's flexural strength provides the primary protection from an impact failure in the system. However, the insertion of a sound attenuating mat significantly weakens the flexural strength of the flooring system because the sound attenuating mat separates the overlayment from the subfloor, and the matted material has significantly lower compressive and flexural strength, i.e., the matted material has a significantly weaker resistance to deformation under load. In these systems, a thicker application of overlayment is required to maintain the flexural strength of the flooring system to prevent an unacceptable movement causing a floor failure. In flooring systems consisting of a subfloor supported by joists and including the typical sound attenuating mat, the overlayment will normally have a thickness between 0.75" and 1.5". This disclosure describes a sound attenuating flooring system that provides sound attenuation while substantially preserving

the flexural strength in the integrity of the flooring system, thereby eliminating the need for thicker applications of overlayment in order to provide the desired flexural strength.

SUMMARY

[0004] The present invention provides a sound attenuating flooring system which overcomes the deficiencies described above, and has other advantages.

[0005] In one embodiment, a sound attenuating flooring system is provided. The sound attenuating flooring system comprises a subfloor, a sound attenuating material, and an overlayment. The sound attenuating material overlays and contacts a portion of the subfloor. The sound attenuating material includes a first surface and a second surface. The first surface is defined by a plurality of outwardly projecting hollow protrusions. The second surface is defined by a plurality of open recesses corresponding to the plurality of outwardly projecting hollow protrusions. The overlayment overlays the second surface of the sound attenuating material and fills the open recesses.

[0006] In some embodiments, the sound attenuating flooring system is characterized by the plurality of outwardly projecting hollow protrusions extending outward by about 0.125 inch to about 0.75 inch. Such embodiments are further characterized by the sound attenuating flooring system supporting between about 10,000 pounds per square foot and about 35,000 pounds per square foot without flexing more than about 0.06 inch.

[0007] In some embodiments, the sound attenuating flooring system is characterized by the plurality of outwardly projecting hollow protrusions extending outward by about 0.125 inch to about 0.75 inch. Such embodiments are further characterized by the sound attenuating flooring system supporting between about 10,000 pounds per square foot and about 35,000 pounds per square foot without flexing more than about 0.04 inch.

[0008] In additional embodiments, the sound attenuating flooring system further comprises an underlayment located between the subfloor and the sound attenuating material. In other embodiments, the underlayment has a plurality of holes corresponding to the plurality of outwardly projecting hollow protrusions such that the plurality of outwardly projecting hollow protrusions pass through the underlayment and contact the subfloor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The drawings included with this application illustrate certain aspects of the embodiments described herein. However, the drawings should not be viewed as exclusive embodiments. The subject matter disclosed is capable of considerable modifications, alterations, combinations, and equivalents in form and function, as will occur to those skilled in the art with the benefit of this disclosure.

[0010] FIG. 1 is a top side perspective view of a sound attenuating flooring system in accordance with one embodiment of the present disclosure.

[0011] FIG. 2 is a top side perspective view of a sound attenuating material in accordance with one embodiment of the present disclosure.

[0012] FIG. 3 is a bottom side perspective view of a sound attenuating material in accordance with one embodiment of the present disclosure.

[0013] FIG. 4 is a cross-sectional side view of a sound attenuating flooring system without an underlayment in accordance with one embodiment of the present disclosure.

[0014] FIG. 5 is a cross-sectional side view of a sound attenuating flooring system with an underlayment in accordance with one embodiment of the present disclosure.

[0015] FIG. 6 is a cross-sectional side view of a sound attenuating flooring system with an underlayment having a plurality of holes corresponding to the plurality of outwardly projecting

hollow protrusions such that the plurality of outwardly projecting hollow protrusions pass through the underlayment and contact the subfloor with the underlayment filling at least a portion of the airgaps.

[0016] FIG. 7 is a table reporting test data.

[0017] FIG. 8 is a table reporting test data.

[0018] FIG. 9 is a table reporting test data.

DETAILED DESCRIPTION

[0019] The present disclosure may be understood more readily by reference to these detailed descriptions. For simplicity and clarity of illustration, where appropriate, reference numerals may be repeated among the different figures to indicate corresponding or analogous elements. In addition, numerous specific details are set forth in order to provide a thorough understanding of the various embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein can be practiced without these specific details. In other instances, methods, procedures, and components have not been described in detail so as not to obscure the related relevant feature being described. Also, the description is not to be considered as limiting the scope of the embodiments described herein. The drawings are not necessarily to scale and the proportions of certain parts have been exaggerated to better illustrate details and features of the present disclosure.

[0020] As shown by FIGS. 1-6 generally, the sound attenuating flooring system is illustrated and generally designated by the numeral 10. With reference to FIGS. 1 and 4, the general form of sound attenuating flooring system 10 includes a subfloor 20, a sound attenuating material 30, and an overlayment 40. Subfloor 20 may be manufactured from a number of different materials including plywood, oriented strand board, concrete, or high performance panels. One skilled in

the art will understand that the type of subfloor 20 depends on the building configuration and/or the builder's or owner's preference.

[0021] With reference to FIGS. 2 and 3, sound attenuating material is illustrated and generally designated by the numeral 30. When installed, sound attenuating material 30 overlays and contacts subfloor 20. Typically, sound attenuating material 30 is prepared from a thermoplastic or thermosetting material. However, one skilled in the art understands that sound attenuating material 30 may be manufactured from a number of different types of durable, and pliable, plastic, rubber, or other polymer material.

[0022] Sound attenuating material 30 includes a first surface 32a and a second surface 32b. First surface 32a is defined by a plurality of outwardly projecting hollow protrusions 34a. Second surface 32b is defined by a plurality of open recesses 34b which correspond to hollow protrusions 34a. The generally flat surfaces 31 between hollow protrusions 34a and open recesses 34b define a plane 35.

[0023] Typically, hollow protrusions 34a extend outwardly from plane 35 about 0.125 inch to about 0.75 inch. More typically, hollow protrusions 34a extend outwardly from plane 35 about 0.125 inch to about 0.5 inch. Even more typically, hollow protrusions extend outwardly from plane 35 about 0.125 inch to about 0.375 inch, and, in some embodiments, about 0.125 inch to about 0.1875 inch. For the purposes of this disclosure, the distance hollow protrusion 34a extends outward from plane 35 is also referred to as the length of hollow protrusion 34a.

[0024] Sound attenuating material 30 may have from about 1 and about 50 hollow protrusions 34a per square inch. More typically, the density of hollow protrusions 34a is from about 4 to about 50 hollow protrusions 34a per square inch of sound attenuating material 30. For example, in some embodiments, sound attenuating material 30 has 16 hollow protrusions 34a per

square inch. In other embodiments, sound attenuating material 30 has 25 protrusions 34a per square inch.

[0025] Hollow protrusions 34a include a tip 36. Upon installation of sound attenuating material 30, tip 36 contacts subfloor 20. Tip 36 may be defined as a pointed surface or a flat, conical, or rounded surface. In some embodiments, tip 36 has a flat surface in the form of a geometric shape. For example, as shown in FIG. 3, tip 36 is square. In other embodiments, tip 36 is a circle, a hexagon, a sphere, or other geometric shape. In some embodiments, tip 36 is coated with a reactive material, i.e. a flexible and/or compressible material suitable for dampening vibrations between sound attenuating material 30 and subfloor 20. Rubber, foam rubber and other similar materials may be used as the reactive material on tip 36. One skilled in the art will understand that the reactive material may be any material that reduces the transmission of vibration. Typically, the reactive material will be applied over tip 36 in order to maintain the rigidity of tip 36 and hollow protrusions 34a.

[0026] The generally flat surfaces 31 between hollow protrusions 34a and open recesses 34b typically have a thickness of about 0.002 inch to about 0.1 inch. More typically, flat surfaces 31 have a thickness of 0.006 inch. One skilled in the art will understand that the thickness of flat surfaces 31 depends on the tensile strength, elasticity, and flexibility of sound attenuating material 30.

[0027] Overlayment 40 overlays second surface 32b of sound attenuating material 30. When poured as a slurry over sound attenuating material 30, overlayment 40 flows into open recesses 34b of sound attenuating material 30. The combination of overlayment 40 and sound attenuating material 30 allows for a near-direct contact between overlayment 40 and subfloor 20. Only the thickness of sound attenuating material 30 at tips 36 and airgaps 38 separate overlayment 40

from subfloor 20. Typically, the filling of recesses 34b ensures that between about 5% and about 35% of overlayment 40 is in near-direct contact with subfloor 20. More typically, about 25% of overlayment 40 is in near-direct contact with subfloor 20. Thus, as used herein, the term near-direct contact refers to the length of hollow protrusions 34a. As an added benefit of using sound attenuating material 30, upon application of overlayment 40 to sound attenuating material 30, the resulting cured overlayment 40 has a relatively uniform plane. Overlayment 40 may be a cement material, gypsum, portland, fly ash, or any other material of similar structure upon curing. One skilled in the art will understand overlayment 40 is a flowable grout material, a cement or other similar flooring material, capable of filling hollow protrusions 34a.

[0028] Formation of overlayment 40 on sound attenuating material 30 preserves the flexural strength of sound attenuating flooring system 10 while minimizing the thickness of overlayment 40. For example, when subfloor 20 is wooden and supported by floor joists, cement overlayment 40 will normally require a thickness from 0.75" to 1.5" to provide the desired flexural strength. However, due to the cooperation of sound attenuating material 30 with overlayment 40, the thickness of overlayment 40 used over a wood subfloor 20 supported by joists can be reduced to a thickness of 0.25 inch or less of cement overlayment 40. Typically, in sound attenuating flooring system 10, overlayment 40 has a thickness of about 0.25 inch to about 0.7 inch.

[0029] Typically, sound attenuating flooring system 10 has sufficient vertical rigidity to support between about 10,000 pounds per square foot and about 35,000 pounds per square foot without flexing more than about 0.06 inch. More typically, sound attenuating flooring system 10 has sufficient vertical rigidity to support between about 10,000 pounds per square foot and about 35,000 pounds per square foot without flexing more than about 0.04 inch. For example, in some embodiments, sound attenuating flooring system 10 has sufficient rigidity to support about

33,000 pounds per square foot without flexing more than 0.04 inch. Accordingly, sound attenuating flooring system 10 allows for sound attenuation while also substantially preserving the flexural strength in the integrity of the sound attenuating flooring system 10.

[0030] As depicted in FIG. 7, the depth, volume, and number of hollow protrusions 34a per square inch provide significant flexural strength to sound attenuating flooring system 10. The combination of sound attenuating material 30 and overlayment 40 provides sound attenuating flooring system 10 the capability of supporting about 10,000 pounds per square foot to about 35,000 pounds per square foot of pressure. Under these conditions, sound attenuating flooring system 10 will compress or flex, but will not fail. Even with the greatest amount of pressure per square foot, sound attenuating flooring system 10 typically will not compress or flex more than about 0.06 inch. More typically, even under the application of 35,000 pounds per square foot, sound attenuating flooring system 10 will not compress or flex more than about 0.04 inch. For example, in at least one embodiment, as disclosed herein, when 33,000 pounds per square foot of pressure was applied to sound attenuating flooring system 10, the combination of overlayment 40 and sound attenuating material 30 did not compress more than about 0.04 inch. Such higher compression resistance reduces the likelihood of a failure of sound attenuating flooring system 10, i.e. overlayment 40 portion of sound attenuating flooring system 10 is very resistant to cracking. The unexpected result of sound attenuating flooring system 10 derives from the strong, incompressible sound attenuating material 30 which allows overlayment 40 to be poured as a thinner layer in near-direct contact with subfloor 20 while maintaining the flexural strength of sound attenuating flooring system 10. Maintaining flexural strength provides resistance to flex of subfloor 20. Thus, sound attenuation in a flooring system has been achieved without the reduction of flexural strength of the flooring system.

[0031] With reference to FIG. 7 and FIG. 8, the compressive strength of sound attenuating material 30 was tested on a lab scale using ASTM D1621. One of ordinary skill in the art will be familiar with the ASTM D1621 standard for testing. Testing was carried out on a dynamometer having a top plate. Compressive strength was measured as the top plate was pressed against a 10 cm x 10 cm sample of material. The compressive strength is recorded at 5%, 10%, 20%, 30%, 40%, and 50% of deformation of the initial thickness of the material.

[0032] The tests were carried out on three samples of each material. The average result for each material is reported in the tables shown in FIG. 7 and FIG. 8. The table in FIG. 7 provides the results of testing on only the sound attenuating material used. The table in FIG. 8 provides the results of testing on the sound attenuating material after that sound attenuating material has been coated with a layer of gypsum. The materials in FIG. 8 were allowed to cure for two days prior to testing. With reference to FIG. 7 and FIG. 8, each of the sound attenuating materials tests had a different original thickness. Therefore, the mm depression also varied. As a result, the percentage (%) displacement is the value of interest. The percent displacement correlates to the compressive strength of the material. In FIG. 7 and FIG. 8, for sound attenuating material 30, displacement of 20% of total thickness correlates to 1 mm. However, as the original thickness of each sound attenuating material tested differs, displacement of 20% of total thickness may be more or less than 1 mm for the other sound attenuating materials.

[0033] Under the testing conditions, a subfloor was omitted. However, the test results provide a clear indication of the compressive strength of the tested materials. The results depicted in the tables of FIG. 7 and FIG. 8 clearly show excellent compressive strength performance of sound attenuating material 30. With reference to the table of FIG. 8, when the top plate of the dynamometer test equipment has been displaced by 1 full millimeter, i.e.

equaling displacement of 20% of total thickness, the combination of sound attenuating material 30 with gypsum overlay is capable of supporting 21,000 pounds per square foot.

[0034] With reference to FIG. 9, the sound attenuating ability of sound attenuating material 30 was tested on a lab scale using ASTM E492. One of ordinary skill in the art will be familiar with the ASTM E492 standard for testing. ASTM E492 testing determines the Impact Insulation Class ("IIC") rating of a typical construction assembly to determine the contribution that a sound attenuating/deadening material adds to the floor assembly's ability to absorb impact sound. The larger the IIC number, the more impact sound is being blocked.

[0035] Testing was carried out with the following configuration (bottom up): a single layer of 0.625 fire rated gypsum board, a metal resilient channel, an 18 inch wood truss joist spaced 24 inch on center, a 4 inch batt fiberglass insulation loose laid in the cavity, 0.75 inch oriented strand board panels as the subfloor, then either no sound attenuating material, sound attenuating material 30, or sound attenuating material with a 3mm fibrous mat between sound attenuating material 30 and the subfloor, a gypsum layer, and the finished floor covering. Under the testing conditions, the results in the table of FIG. 9 clearly show excellent sound attenuation properties of sound attenuating material 30.

[0036] For example, as shown in the table of FIG. 9, when no sound attenuating material was used, and the finished floor covering was vinyl, the IIC rating was 44. Under those same conditions, but with sound attenuating material 30 used, the IIC rating was 51. In addition, under those same conditions, with the combination of sound attenuating material 30 and a 3 mm fibrous mat, the IIC rating was 55. Such test results clearly show the sound attenuation ability of sound attenuating material 30.

[0037] Sound attenuating flooring system 10 may optionally include an underlayment 50. Underlayment 50 further improves the sound attenuation ability of sound attenuating flooring system 10 by providing an additional sound attenuating barrier. As depicted in FIG. 1 and FIG. 5, when used, underlayment 50 will be located between subfloor 20 and sound attenuating material 30. Optionally, as shown by FIG. 6, underlayment 50 includes a plurality of holes corresponding to hollow protrusions 34a. The plurality of holes hollow protrusions 34a to pass through underlayment 50 and contact subfloor 20. In such embodiments, underlayment 50 may partially fill, as shown in FIG. 6, or completely fill air gaps 38. In some embodiments, underlayment 50 is a fibrous material, a rubber material, or a non-woven material such as a resilient polymer material. As a further option, underlayment 50 may be adhered to first surface 32a.

[0038] Assembly of sound attenuating flooring system 10 includes the steps of: installing subfloor 20; placing sound attenuating material 30 on subfloor 20 such that tips 36 of hollow protrusions 34a contact subfloor 20; and pouring overlayment 40 on sound attenuating material 30. The application of the overlayment 40 should be at a rate such that overlayment 40 flows into and substantially fills all open recesses 34b of sound attenuating material 30. Optionally, during assembly of sound attenuating flooring system 10, underlayment 50 will either be adhered to sound attenuating material 30 or placed on subfloor 20 prior to placement of sound attenuating material 30 on subfloor 20.

[0039] As depicted in FIGS. 1 and 4, tips 36 of hollow protrusions 34a contact subfloor 20 and define air gaps 38. Without being bound by theory, combination of air gaps 38 and the near-direct contact of overlayment 40 with subfloor 20 is believed to provide improved sound attenuation and increased flexural strength when compared to prior art systems. When used,

underlayment 50 further improves the sound attenuation of sound attenuating flooring system 10. Thus, sound attenuating material 30 provides both enhanced flexural strength and cooperates with subfloor 20 to form air gaps 38 to provide sound attenuation. As a result, when a person walks over the finished floor, the impact of each step is attenuated by the air trapped within air gaps 38 thereby reducing the transmission of sound through the finished floor to a residence below.

[0040] As a further benefit, use of sound attenuating material 30 with hollow protrusions 34a reduces the volume of overlayment 40 necessary for sound attenuating flooring system 10 while maintaining the structural rigidity of sound attenuating flooring system 10. Typically, the thickness of overlayment 40 is about 0.25 inch to about 0.7 inch. In general, the reduced volume of overlayment 40 will correspond to the volume displaced by airgaps 38. Thus, use of sound attenuating material 30 provides sound attenuation without detrimentally impacting the flexural strength of sound attenuating flooring system 10. Accordingly, the sound attenuating flooring system 10 does not require an increased volume of overlayment 40 when using sound attenuating material 30. The vertical flexural strength of the combination of subfloor 20, sound attenuating material 30, and overlayment 40 provide the ability to maintain structural rigidity without increasing the volume or thickness of overlayment 40.

[0041] Hollow protrusions 34a in sound attenuating material 30 also offer an advantage in installation over prior sound attenuating materials. Adjacent sections of sound attenuating material 30 may overlap such that hollow protrusions 34a of one section nest in recesses 34b of an adjacent section. Preferably, the nesting of hollow protrusions 34a in recesses 34b provides a snap for confirmation that hollow protrusions 34a are nested in recesses 34b.

[0042] Although the disclosed invention has been shown and described in detail with respect to a preferred embodiment, it will be understood by those skilled in the art that various changes in the form and detailed area may be made without departing from the spirit and scope of this invention as claimed. Thus, the present invention is well adapted to carry out the object and advantages mentioned as well as those which are inherent therein. While numerous changes may be made by those skilled in the art, such changes are encompassed within the spirit of this invention as defined by the appended claims.

What is claimed is:

1. A sound attenuating flooring system comprising:

a subfloor;

a sound attenuating material overlaying and contacting only a portion of the subfloor, the sound attenuating material having a first surface and a second surface, the first surface defined by a plurality of outwardly projecting hollow protrusions, and the second surface defined by a plurality of open recesses corresponding to the plurality of outwardly projecting hollow protrusions; and

an overlayment overlaying the second surface of the sound attenuating material.

2. The sound attenuating flooring system of claim 1, wherein the sound attenuating material includes between about 4 outwardly projecting hollow protrusions to about 50 outwardly projecting hollow protrusions per square inch.

3. The sound attenuating flooring system of claim 1, characterized by the plurality of outwardly projecting hollow protrusions extending outward from the first surface of the sound attenuating material by about 0.125 inch to about 0.75 inch and further characterized by the sound attenuating flooring system supporting between about 10,000 pounds per square foot and about 35,000 pounds per square foot without flexing more than about 0.06 inch.

4. The sound attenuating flooring system of claim 1, characterized by the plurality of outwardly projecting hollow protrusions extending outward from the first surface of the sound attenuating material by about 0.125 inch to about 0.75 inch and further characterized by the

sound attenuating flooring system supporting about 33,000 pounds per square foot without flexing more than about 0.06 inch.

5. The sound attenuating flooring system of claim 1, characterized by the plurality of outwardly projecting hollow protrusions extending outward from the first surface of the sound attenuating material by about 0.125 inch to about 0.75 inch and further characterized by the sound attenuating flooring system supporting between about 10,000 pounds per square foot and about 35,000 pounds per square foot without flexing more than about 0.04 inch.

6. The sound attenuating flooring system of claim 1, characterized by the plurality of outwardly projecting hollow protrusions extending outward from the first surface of the sound attenuating material by about 0.125 inch to about 0.75 inch and further characterized by the sound attenuating flooring system supporting about 33,000 pounds per square foot without flexing more than about 0.04 inch.

7. The sound attenuating flooring system of claim 1, further comprising an underlayment.

8. The sound attenuating flooring system of claim 7, wherein the underlayment is located between the subfloor and the sound attenuating material.

9. The sound attenuating flooring system of claim 8, the underlayment having a plurality of holes corresponding to the plurality of outwardly projecting hollow protrusions such that, when the underlayment is located between the subfloor and the sound attenuating material, the

plurality of outwardly projecting hollow protrusions pass through the underlayment and contact the subfloor.

10. The sound attenuating flooring system of claim 1, each of the plurality of outwardly projecting hollow protrusions having a tip contacting the subfloor, wherein the tip is coated with a reactive material such that vibration is dampened between the sound attenuating material and the subfloor.

11. The sound attenuating material of claim 10, wherein the percentage of surface area per square inch of the subfloor covered by the tip of each of the plurality of outwardly protruding hollow protrusions is about 5% to about 35%.

12. The sound attenuating material of claim 1, wherein the percentage of surface area per square inch of the subfloor covered by the plurality of outwardly protruding hollow protrusions is about 5% to about 35%.

13. The sound attenuating material of claim 1, wherein the plurality of outwardly projecting protrusions extend from the first surface of the sound attenuating material between 0.125 inch to about 0.75 inch.

14. The sound attenuating material of claim 1, wherein the plurality of outwardly projecting protrusions extend from the first surface of the sound attenuating material between 0.125 inch to about 0.5 inch.

15. The sound attenuating material of claim 1, wherein the plurality of outwardly projecting protrusions extend from the first surface of the sound attenuating material between 0.125 inch to about 0.375 inch.

16. The sound attenuating material of claim 1, wherein the plurality of outwardly projecting protrusions extend from the first surface of the sound attenuating material between 0.125 inch to about 0.1875 inch.

17. The sound attenuating flooring system of claim 1, the overlayment having a relatively uniform plane upon curing.

18. A sound attenuating flooring system comprising:

a subfloor;

a sound attenuating material overlaying and contacting only a portion of the subfloor, the sound attenuating material having a first surface and a second surface, the first surface defined by about 4 outwardly projecting hollow protrusions to about 50 outwardly projecting hollow protrusions per square inch, and the second surface defined by a plurality of open recesses corresponding to outwardly projecting hollow protrusions; and

an overlayment overlaying the second surface of the sound attenuating material.

19. The sound attenuating flooring system of claim 18, characterized by the outwardly projecting hollow protrusions extending outward from the first surface of the sound attenuating

material by about 0.125 inch to about 0.75 inch and further characterized by the sound attenuating flooring system supporting between about 10,000 pounds per square foot and about 35,000 pounds per square foot without flexing more than about 0.06 inch.

20. The sound attenuating flooring system of claim 18, characterized by the plurality of outwardly projecting hollow protrusions extending outward from the first surface of the sound attenuating material by about 0.125 inch to about 0.75 inch and further characterized by the sound attenuating flooring system supporting about 33,000 pounds per square foot without flexing more than about 0.06 inch.

21. The sound attenuating flooring system of claim 18, characterized by the outwardly projecting hollow protrusions extending outward from the first surface of the sound attenuating material by about 0.125 inch to about 0.75 inch and further characterized by the sound attenuating flooring system supporting between about 10,000 pounds per square foot and about 35,000 pounds per square foot without flexing more than about 0.04 inch.

22. The sound attenuating flooring system of claim 18, characterized by the outwardly projecting hollow protrusions extending outward from the first surface of the sound attenuating material by about 0.125 inch to about 0.75 inch and further characterized by the sound attenuating flooring system supporting about 33,000 pounds per square foot without flexing more than about 0.04 inch.

23. The sound attenuating flooring system of claim 18, further comprising an underlayment.

24. The sound attenuating flooring system of claim 23, wherein the underlayment is located between the subfloor and the sound attenuating material.

25. The sound attenuating flooring system of claim 24, the underlayment having a plurality of holes corresponding to the outwardly projecting hollow protrusions such that, when the underlayment is located between the subfloor and the sound attenuating material, the outwardly projecting hollow protrusions pass through the underlayment and contact the subfloor.

26. The sound attenuating flooring system of claim 18, each of the outwardly projecting hollow protrusions having a tip contacting the subfloor, wherein the tip is coated with a reactive material such that vibration is dampened between the sound attenuating material and the subfloor.

27. The sound attenuating material of claim 26, wherein the percentage of surface area per square inch of the subfloor covered by the tip of each of the outwardly protruding hollow protrusions is about 5% to about 35%.

28. The sound attenuating material of claim 18, wherein the percentage of surface area per square inch of the subfloor covered by the hollow protrusions is about 5% to about 35%.

29. The sound attenuating material of claim 18, wherein the plurality of outwardly projecting protrusions extend from the first surface of the sound attenuating material between 0.125 inch to about 0.75 inch.

30. The sound attenuating material of claim 18, wherein the outwardly projecting protrusions extend from the first surface of the sound attenuating material between 0.125 inch to about 0.5 inch.

31. The sound attenuating material of claim 18, wherein the plurality of outwardly projecting protrusions extend from the first surface of the sound attenuating material between 0.125 inch to about 0.375 inch.

32. The sound attenuating material of claim 18, wherein the plurality of outwardly projecting protrusions extend from the first surface of the sound attenuating material between 0.125 inch to about 0.1875 inch.

33. The sound attenuating flooring system of claim 18, the overlayment having a relatively uniform plane upon curing.

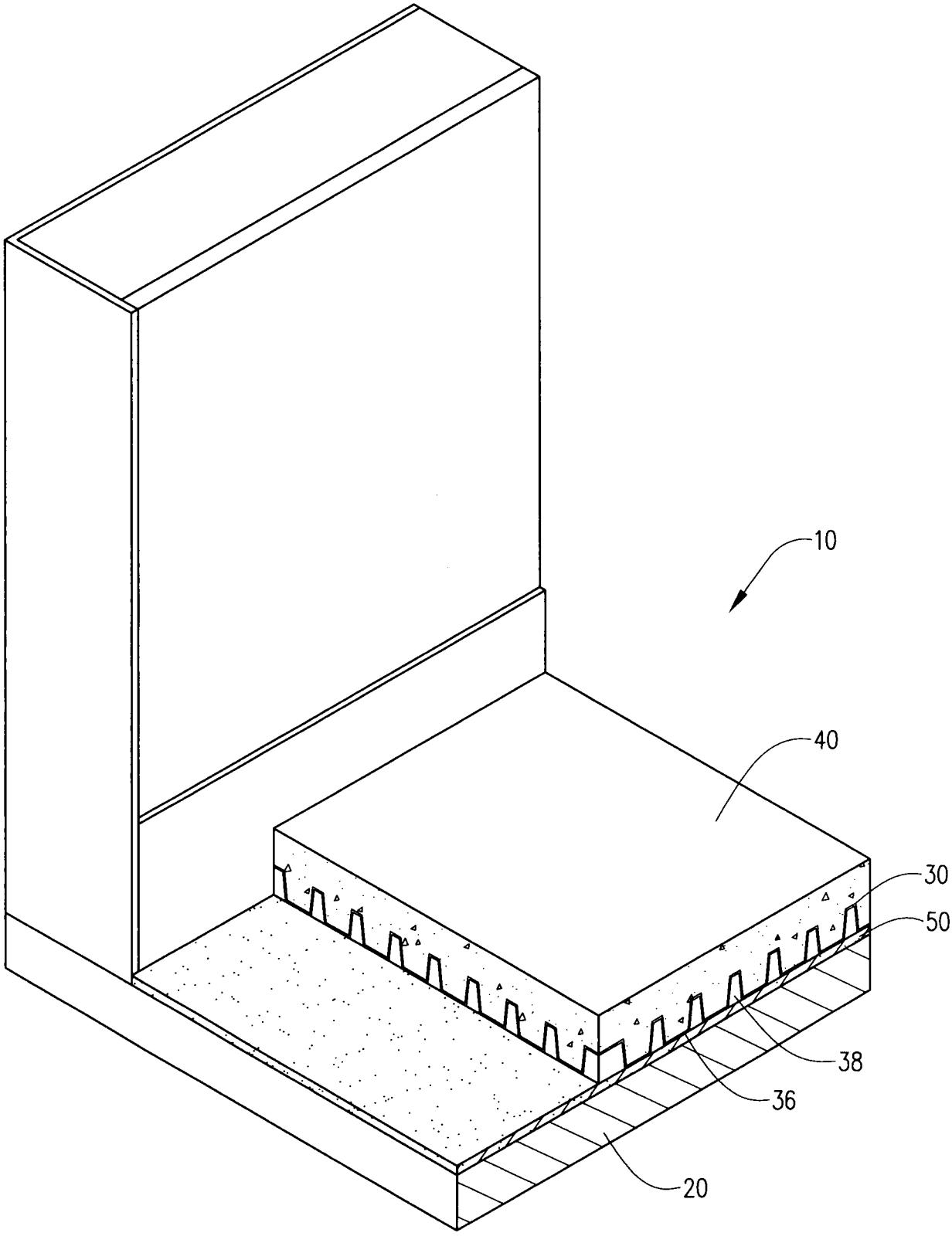


FIG. 1

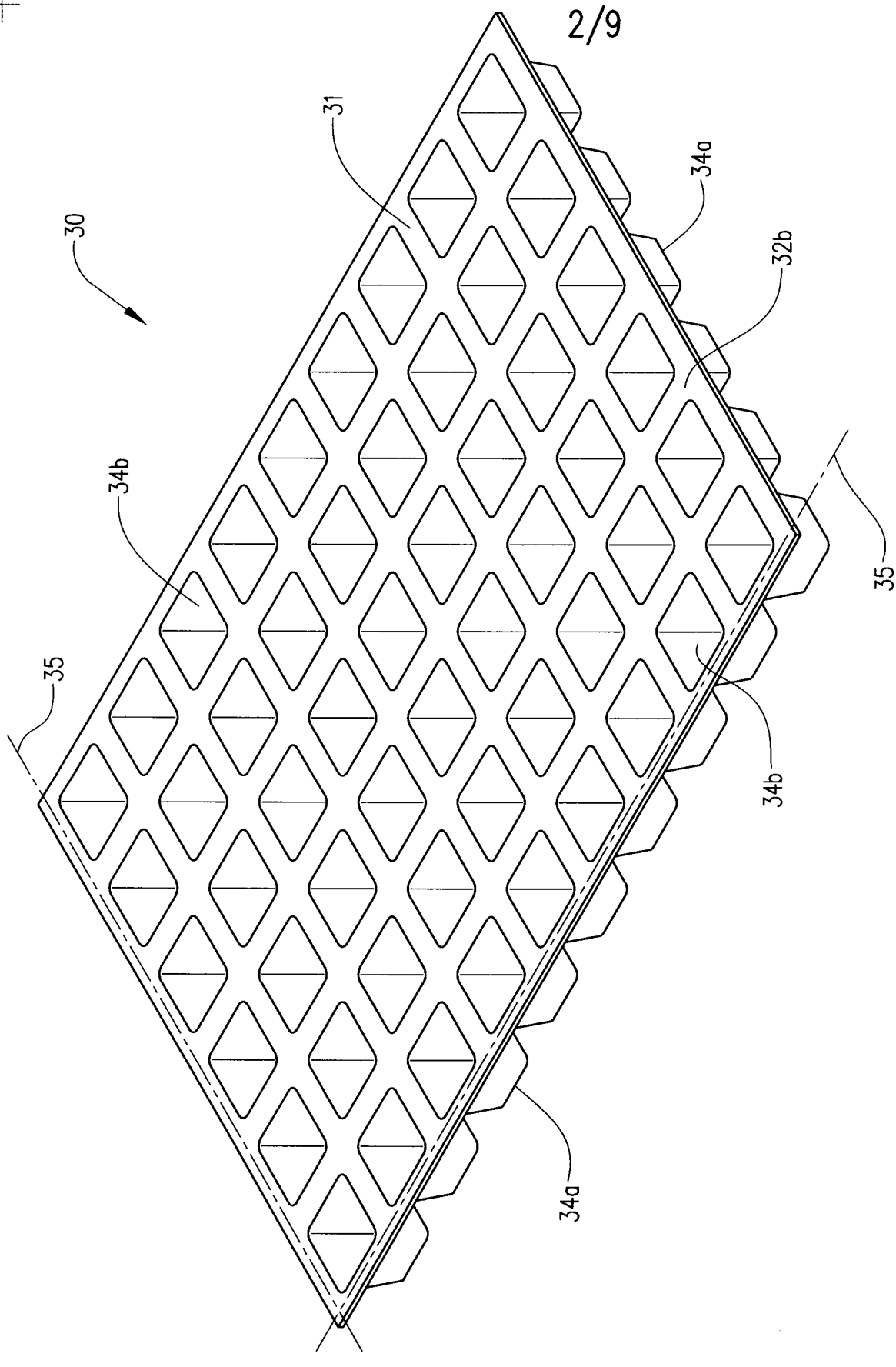


FIG-2

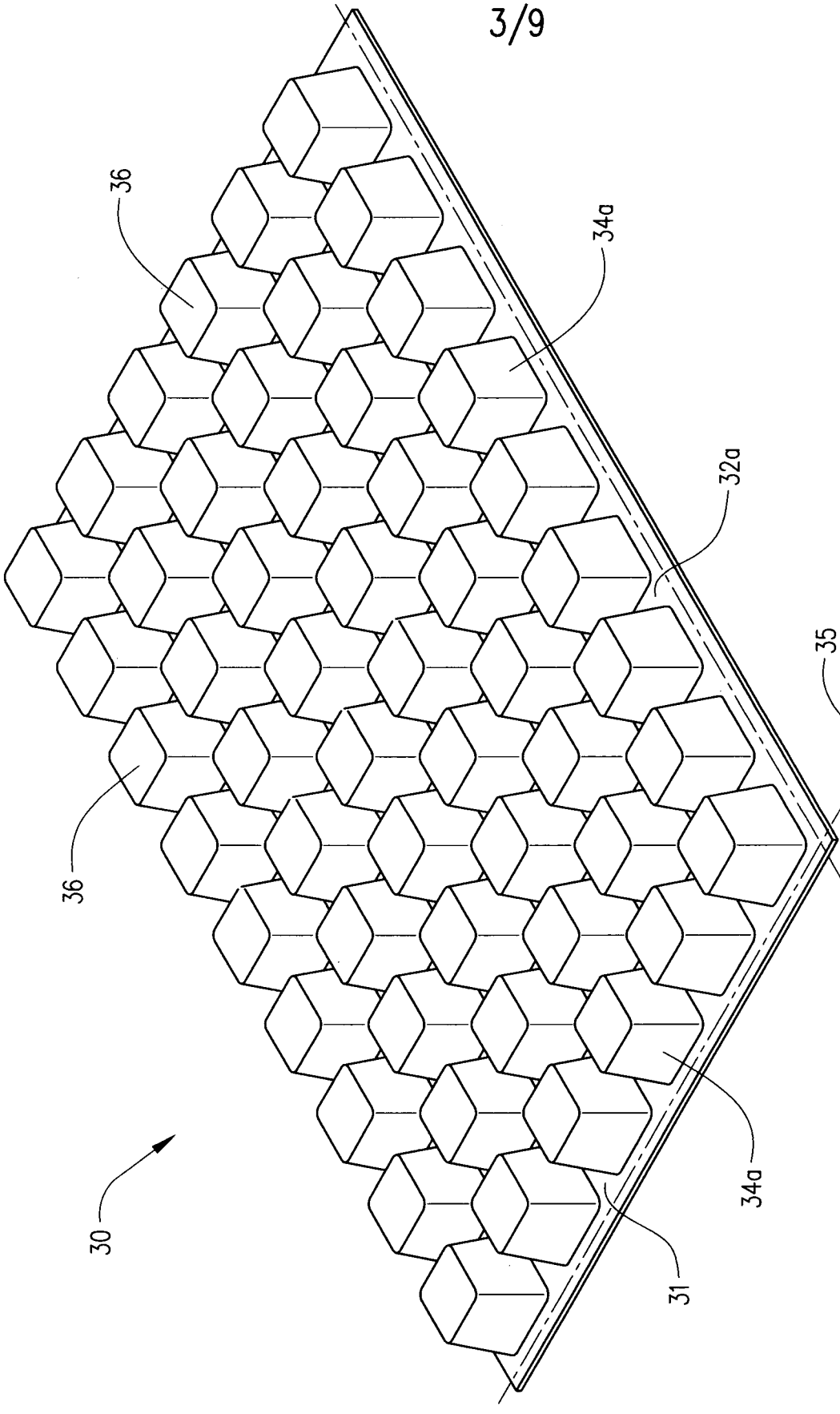


FIG-3

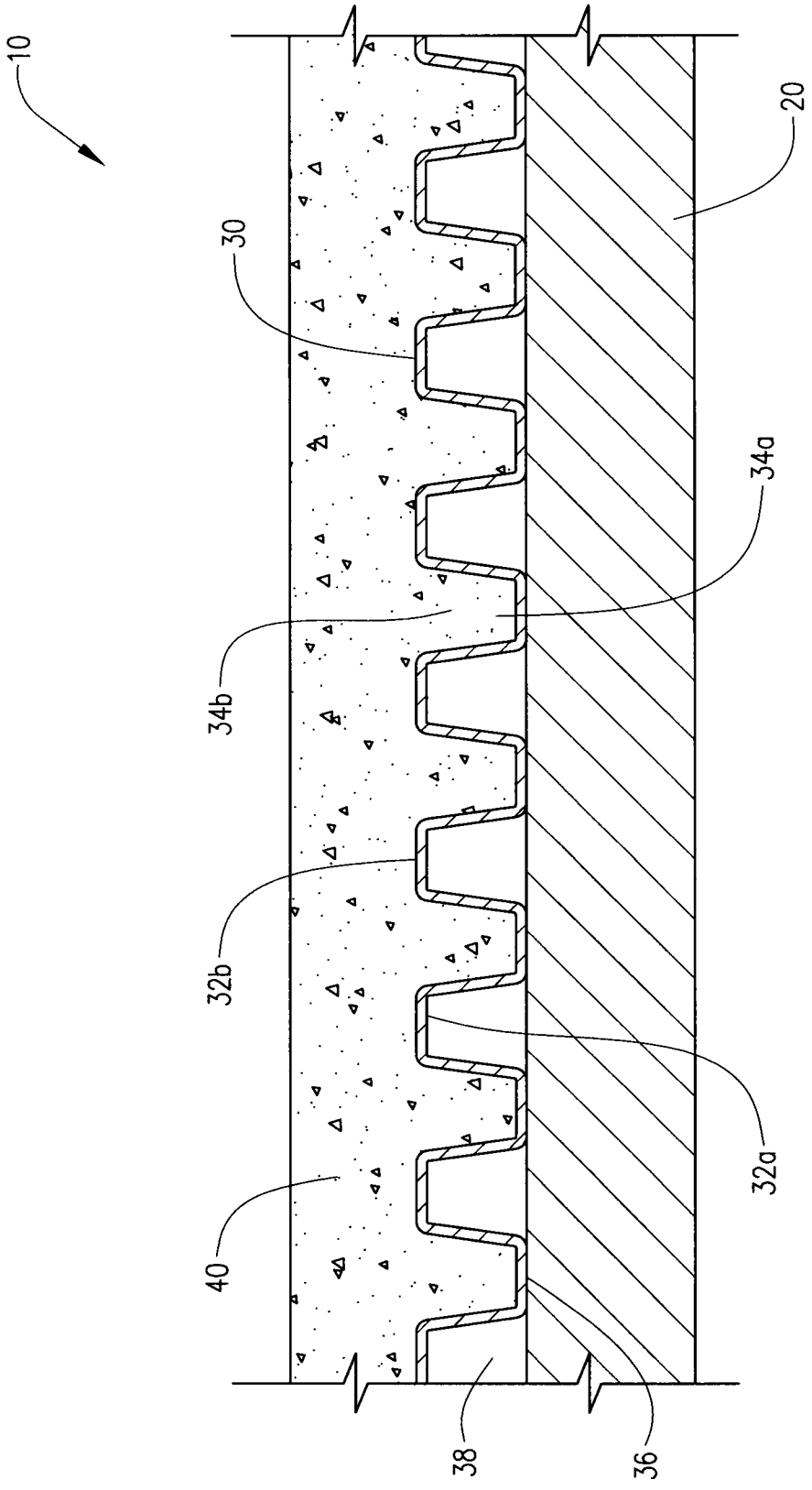


FIG. 4

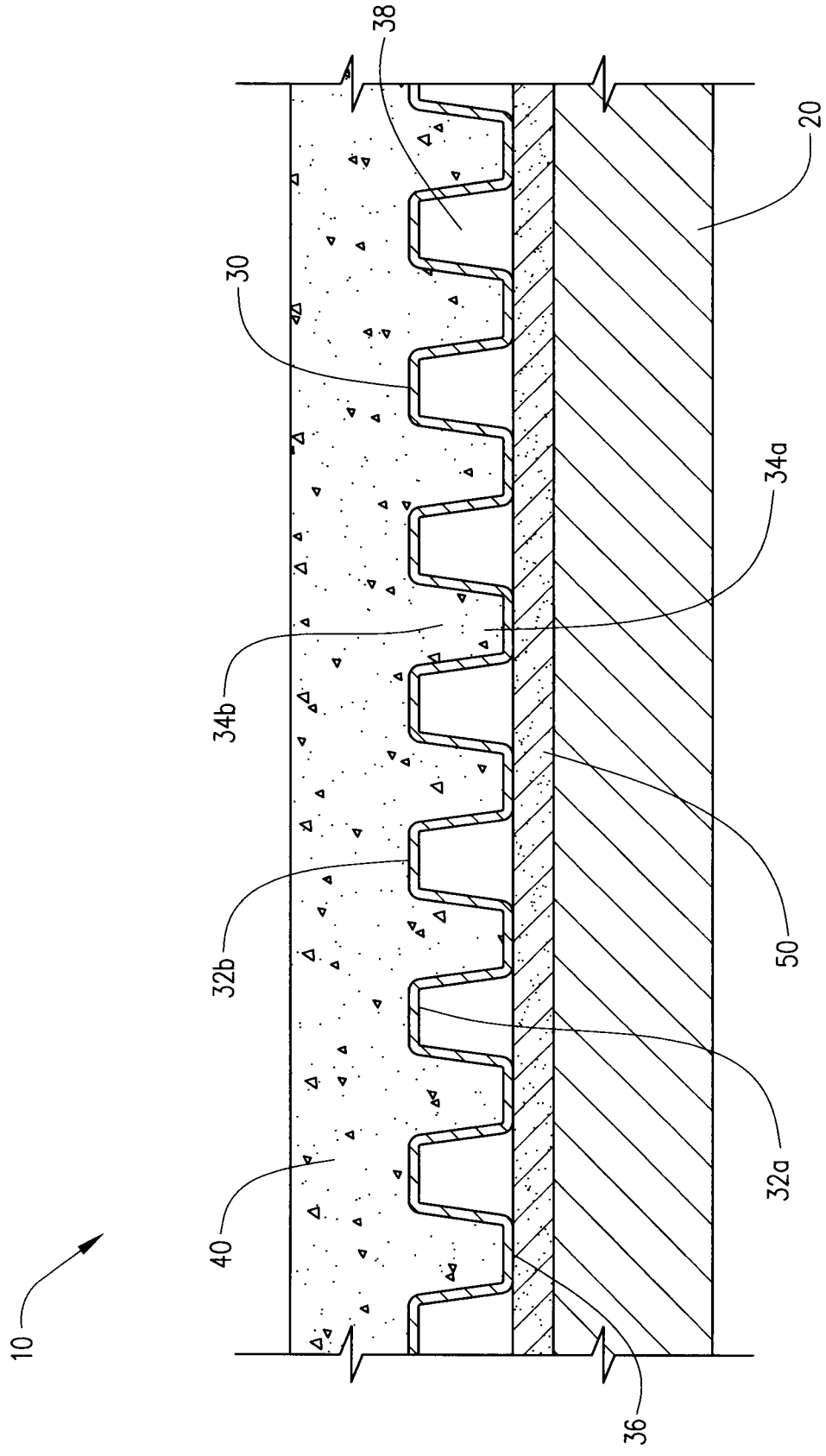


FIG. 5

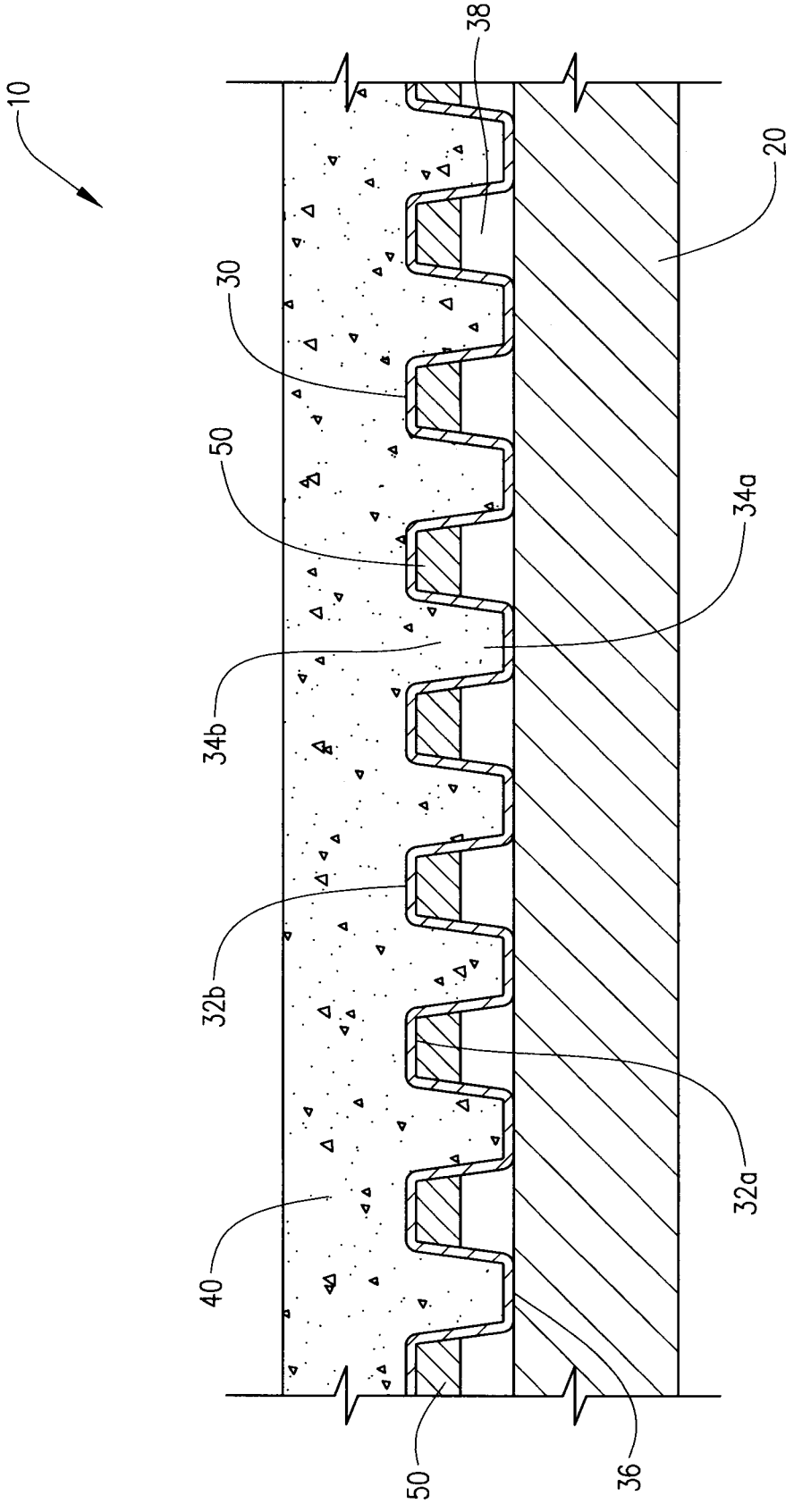


FIG. 5

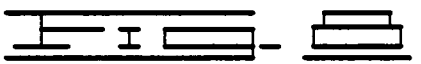
SOUND ATTENUATING MAT

Displacement (% of total thickness)	Sound Attenuating Mat 30 Compressive Strength	Cylindrical Studded Membrane of Polyolefins laminated to Polypropylene Fabric Compressive Strength	Diamond Studded Polypropylene laminated to Polypropylene Fabric Compressive Strength	3 - Dimensional Mesh of Polypropylene on a Polypropylene Barrier Fabric Compressive Strength	3 - Dimensional Mesh of Polypropylene on a Polypropylene Barrier Fabric Compressive Strength
%	pounds / ft^2	pounds / ft^2	pounds / ft^2	pounds / ft^2	pounds / ft^2
5%	2558	164.7	235	222	153
10%	6924	491.8	811	417	279
20%	12722	2720	3920	785	721
30%	15346	6963	6748	1181	1430
40%	15525	9048	9038	1603	2202
50%	15099	9727	11431	2161	3038

FIG. 7

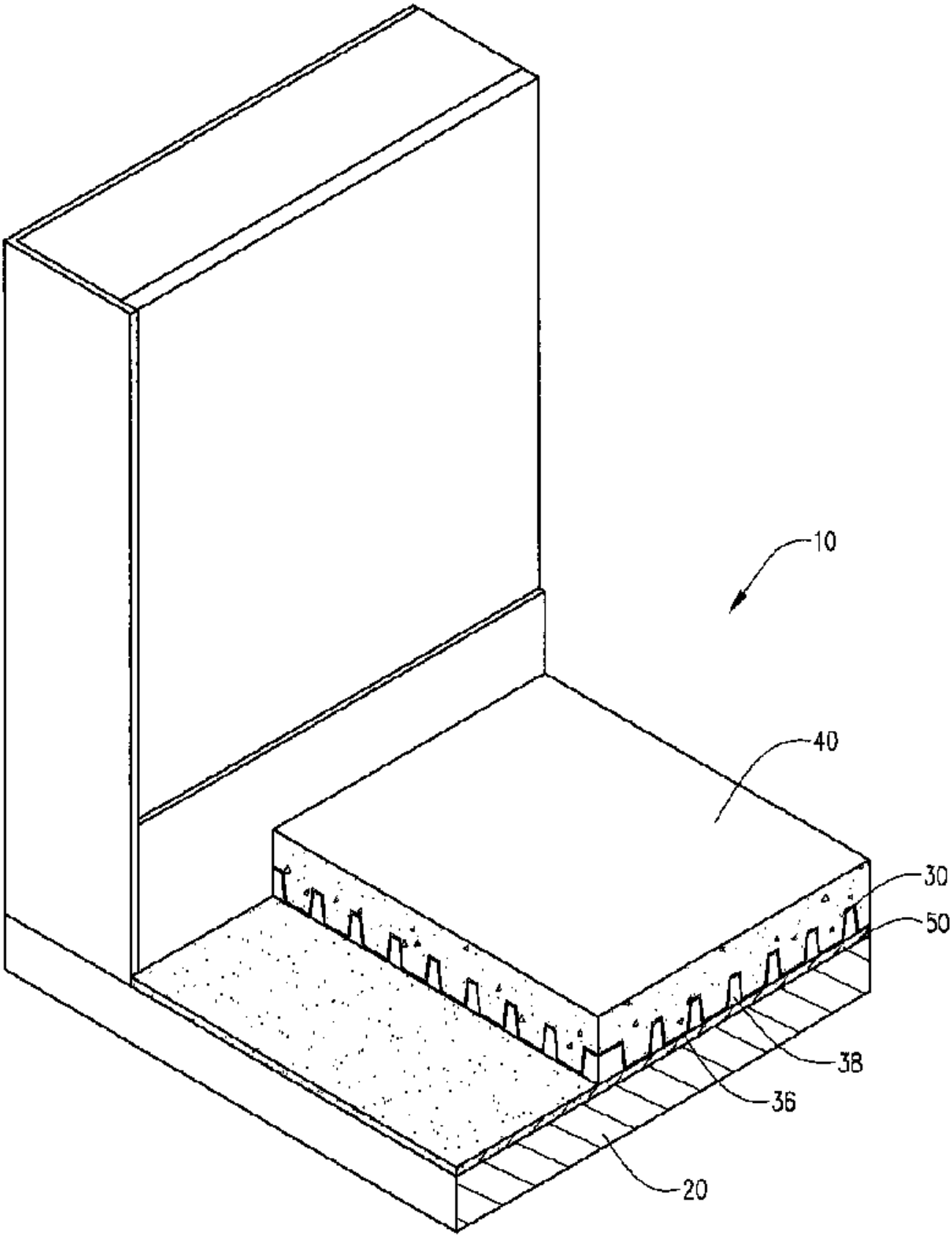
SOUND ATTENUATING MAT WITH GYPSUM LAYER OVERLAYMENT

Displacement (% of total thickness)	Sound Attenuating Mat 30 Compressive Strength	Cylindrical Studded Membrane of Polyolefins laminated to Polypropylene Fabric Compressive Strength	Diamond Studded Polypropylene laminated to Polypropylene Fabric Compressive Strength	3 - Dimensional Mesh of Polypropylene on a Polypropylene Barrier Fabric Compressive Strength	3 - Dimensional Mesh of Polypropylene on a Polypropylene Barrier Fabric Compressive Strength
%	pounds / ft^2	pounds / ft^2	pounds / ft^2	pounds / ft^2	pounds / ft^2
5%	674	813	315	160	191
10%	5000	1503	982	313	396
20%	21000	3583	2993.6	688	827
30%	-	6055	5306	1051	1511.6
40%	-	-	7952	1536	2423.9
50%	-	-	10019	2217.8	3629.5



Type of Sound Attenuating Material	Finished Floor Covering	Impact Isolation Class (IIC) Test Results
None	Vinyl	44
	Tile	41
	Wood Laminate	49
Sound Attenuating Material 30	Vinyl	51
	Tile	51
	Wood Laminate	55
Sound Attenuating Material 30 with 3mm Fibrous Mat Underneath	Vinyl	55
	Tile	56
	Wood Laminate	56

FIG. 3


10
40
30
50
38
36
20