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(19) **United States**(12) **Patent Application Publication**
AN(10) **Pub. No.: US 2017/0051506 A1**(43) **Pub. Date: Feb. 23, 2017**(54) **CONCRETE PANEL FOR CONSTRUCTING
FLOOR OF BUILDING, SHOCK
ABSORPTION UNIT, AND FLOOR
CONSTRUCTION STRUCTURE FOR
BUILDING INCLUDING SAME***E04C 2/52* (2006.01)*E04B 1/86* (2006.01)*E04C 2/06* (2006.01)*E04B 5/02* (2006.01)*E04B 1/82* (2006.01)(71) Applicant: **Seung Han AN**, Wonju-si (KR)(72) Inventor: **Seung Han AN**, Wonju-si (KR)(21) Appl. No.: **15/307,819**(22) PCT Filed: **Apr. 28, 2015**(86) PCT No.: **PCT/KR2015/004220**

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(57)

ABSTRACT

The present invention relates to a concrete panel for forming a floor of a building, a shock absorption unit, and a floor construction structure including the same. The present invention provides a concrete panel comprising: a base plate; a partition wall protruding from the upper portion of the base plate in a lattice structure or in honeycombed structure; and a filling cell which is formed by the partition wall and includes a filling material embedded therein. Further, the present invention provides a floor construction structure for a building, including the concrete panel. According to the present invention, a floor of a building can be firmly and simply constructed with the excellent inter-floor sound insulation property, etc.

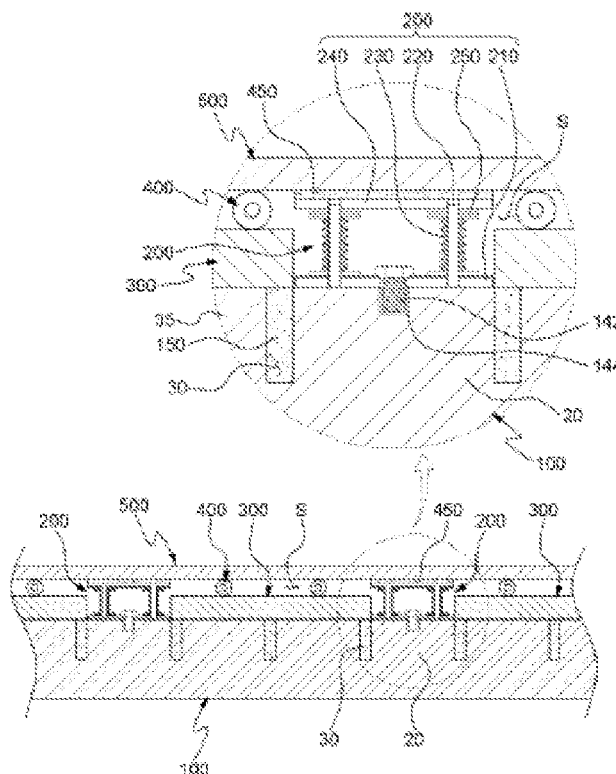


FIG. 1

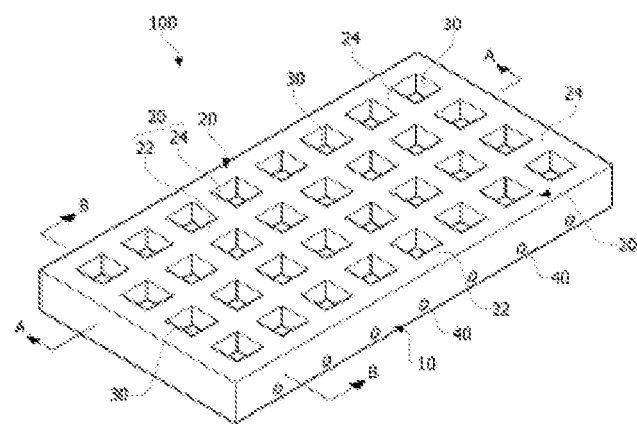


FIG. 2

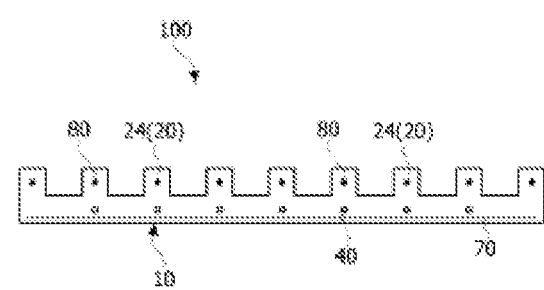


FIG. 3

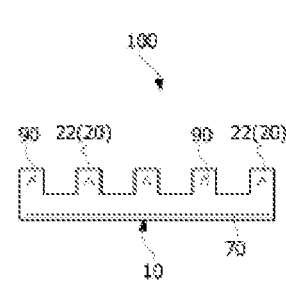


FIG. 4

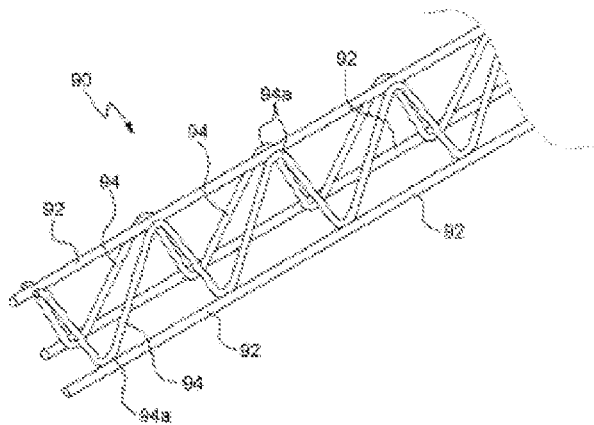


FIG. 5

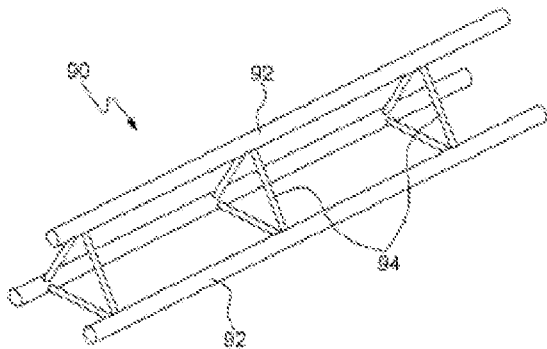


FIG. 6

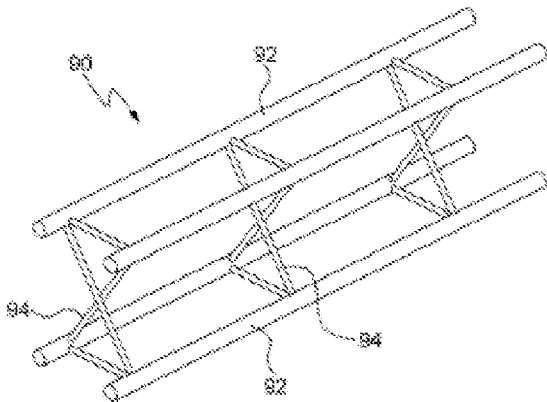


FIG. 7

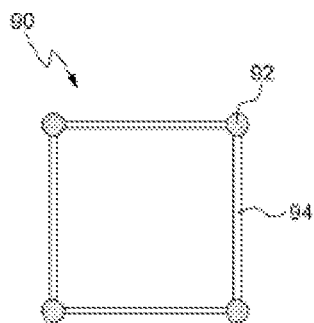


FIG. 8

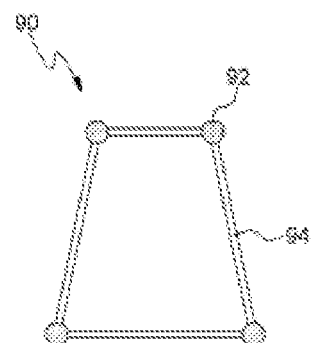


FIG. 9

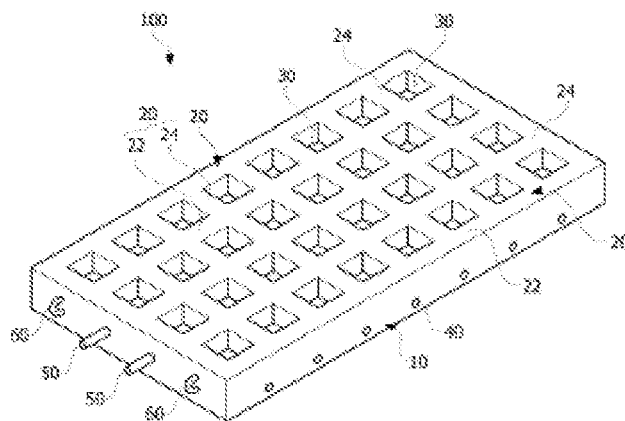


FIG. 10

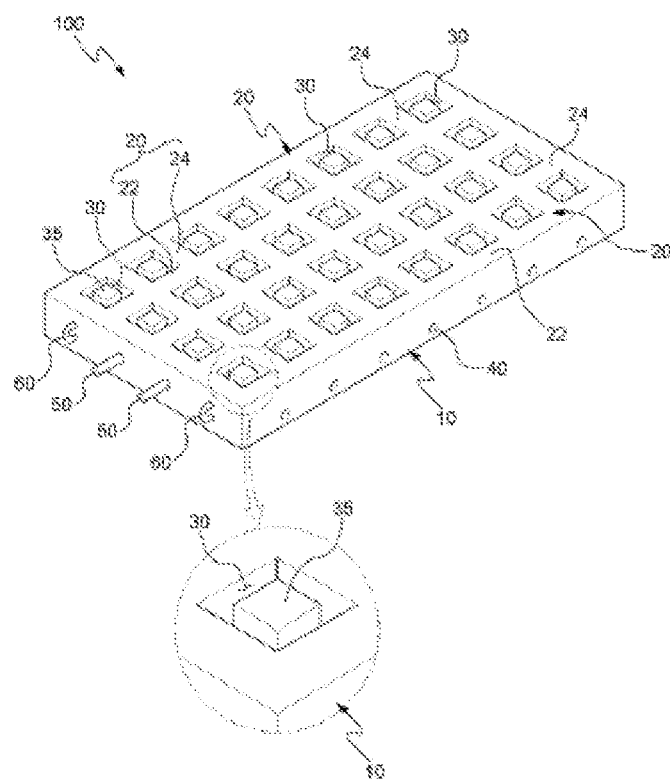


FIG. 11

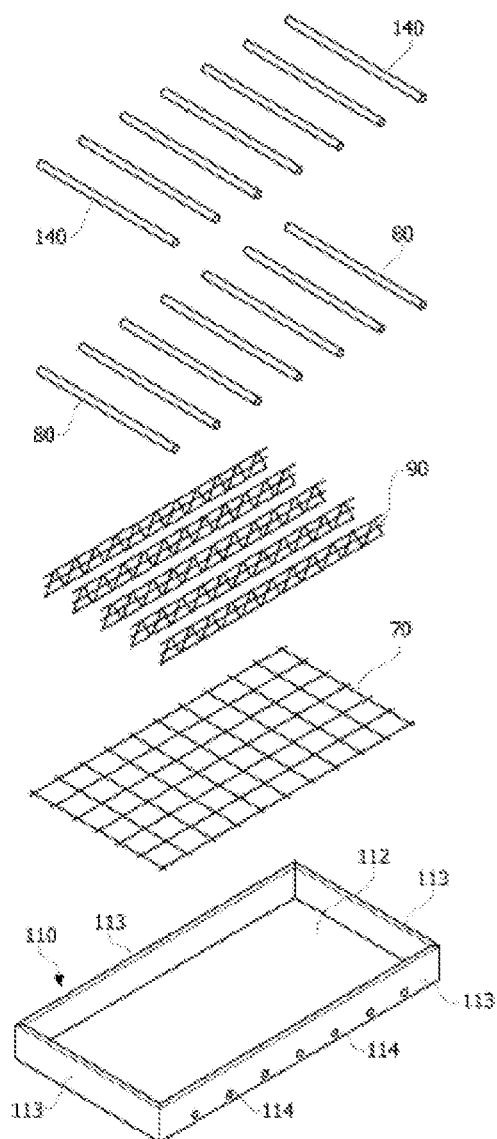


FIG. 12

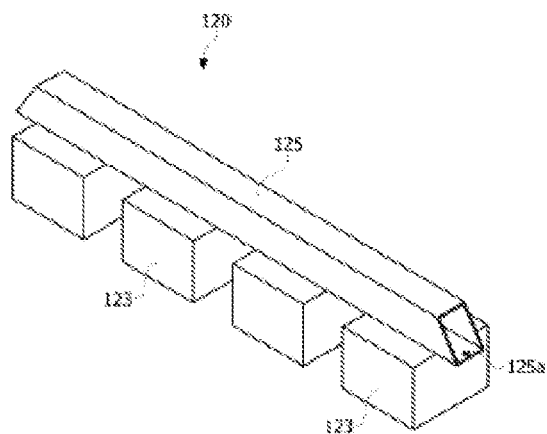


FIG. 13

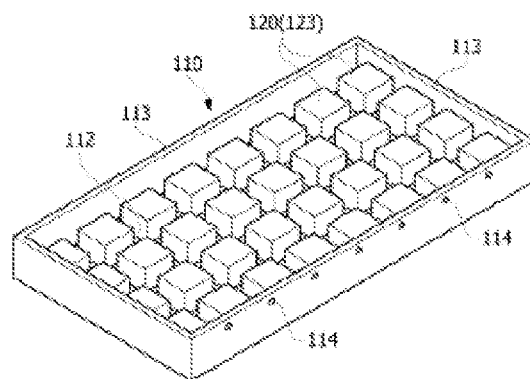


FIG. 14

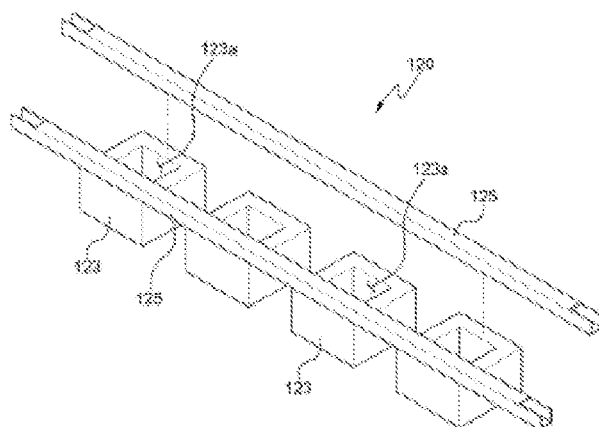


FIG. 15

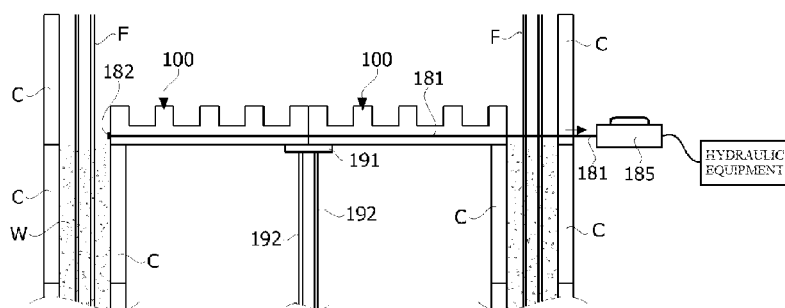


FIG. 16

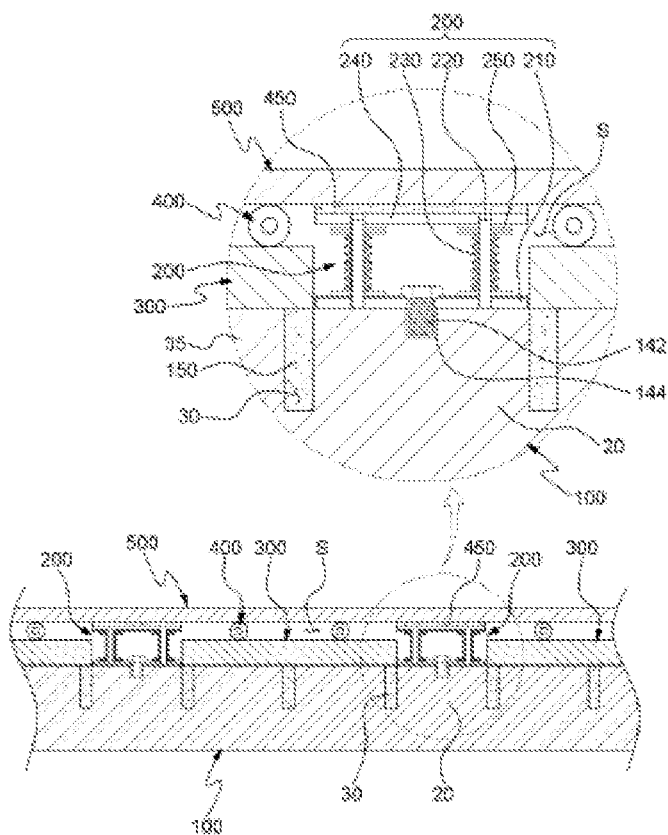


FIG. 17

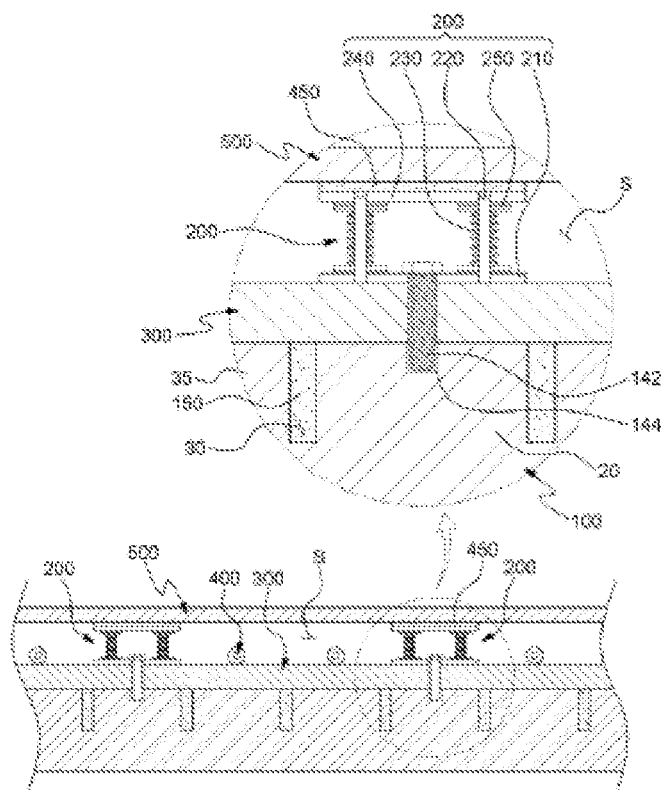


FIG. 18

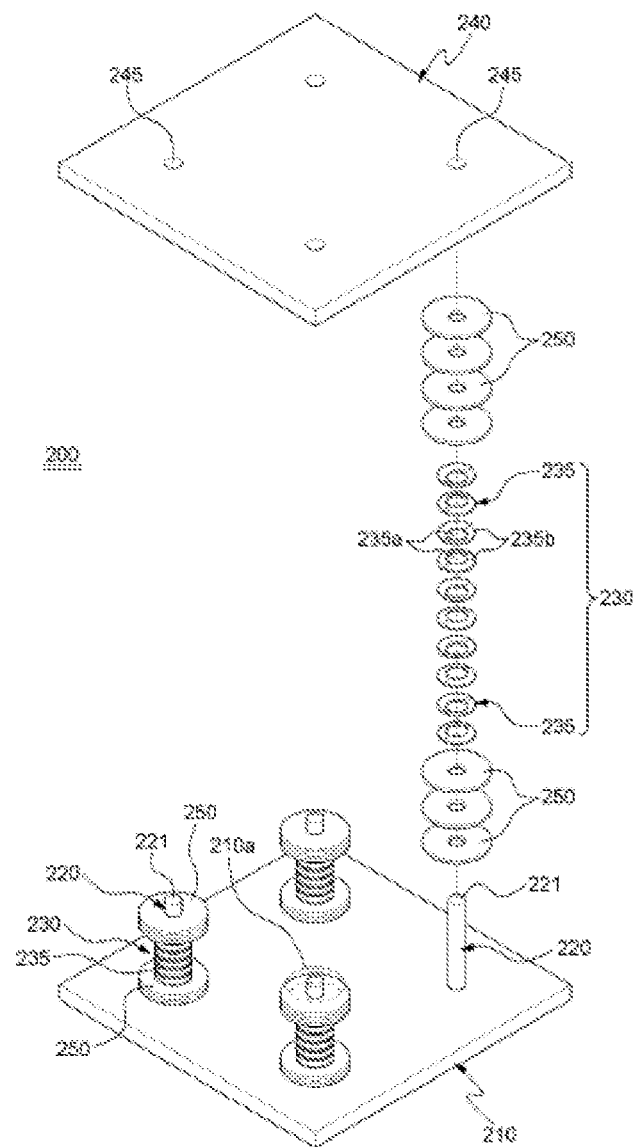


FIG. 19

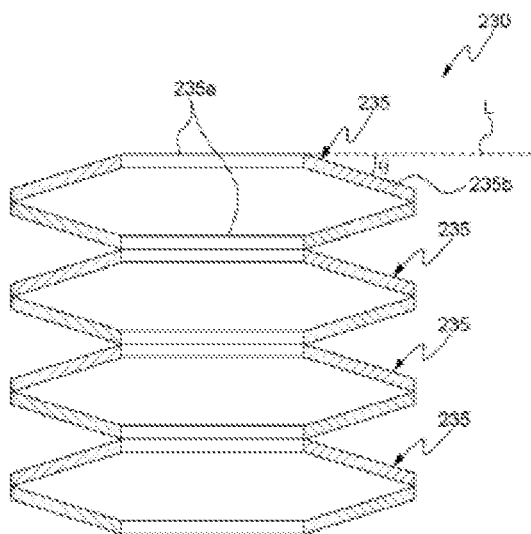


FIG. 20

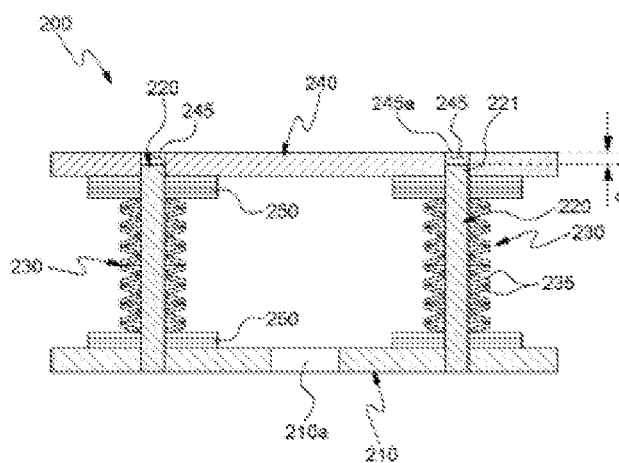


FIG. 21

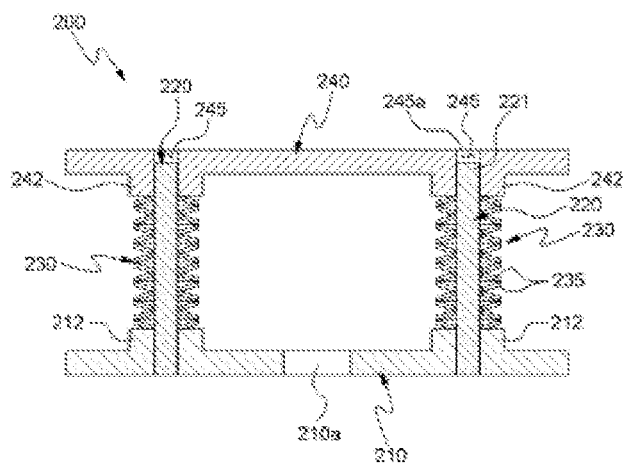
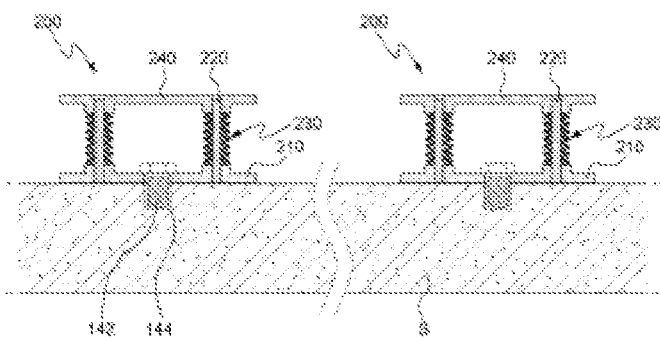


FIG. 22



CONCRETE PANEL FOR CONSTRUCTING FLOOR OF BUILDING, SHOCK ABSORPTION UNIT, AND FLOOR CONSTRUCTION STRUCTURE FOR BUILDING INCLUDING SAME

TECHNICAL FIELD

[0001] The present invention relates to a concrete panel for constructing a floor of a building and a shock absorbing unit, which can firmly and simply construct a floor of a building with the excellent inter-floor sound insulation property, and a floor construction structure for a building including the same.

BACKGROUND ART

[0002] In constructing a multistory building such as a multiplex house, an apartment, or the like, it is common that all of the works are performed in a construction site. In addition, some high-rise buildings such as apartments are constructed in an assembly method using a precast concrete (PC) construction method.

[0003] In constructing a floor of a building, it is very important to prevent noise and vibration between floors (upstairs and downstairs). A shock applied to a bottom, and in particular, a shock which is caused by kids' strong motions in a multistory building such as an apartment may cause inconvenience to a neighbor who lives downstairs. Accordingly, installation of shock absorption material (or sound insulation material) to absorb a shock is essential for the construction of a floor of a building.

[0004] To achieve this, sound insulation material such as rubber or synthetic resin foam is typically installed on a slab floor of a building. For example, Korean Patent Registration No. 10-0166993 discloses a floor structure construction method, which installs rubber on a floor foundation slab, installs polyethylene (PE) foamed sponge thereon, and then forms a bottom layer (bottom material) on the foamed sponge by bonding. In addition, Korean Patent Publication No. 10-2006-0038862 discloses nonflammable foamed thermoplastic material which is used as inter-floor noise prevention material (sound insulation material) for a building, and has an expansion ratio of 5 to 200 times and has a foam cell having a diameter from 10 μm to 3,000 μm .

[0005] However, the related-art floor construction structure including the above-described prior art documents has a problem that a shock (noise and vibration) applied from upstairs cannot be effectively absorbed and blocked. Accordingly, a neighbor living in downstairs may suffer from noise and vibration.

[0006] In addition, in order to heat a floor of a related-art building, a heating pipe is typically embedded in a finishing mortar layer. However, this method may reduce thermal conductivity and cause a problem of high energy consumption (high expense of heating).

DETAILED DESCRIPTION OF THE PRESENT INVENTION

Technical Object

[0007] Accordingly, an object of the present invention is to provide a concrete panel for constructing a floor of a building and a shock absorbing, which can firmly and simply construct a floor of a building with the excellent inter-floor

sound insulation property by effectively absorbing and exhausting (dispersing) a shock (noise and vibration) applied to a floor of a building, and a floor construction structure for a building including the same.

[0008] In addition, an object of the present invention is to provide a floor construction structure for a building which has high thermal conductivity due to an improved heating structure and thus can reduce energy consumption.

Technical Solving Method

[0009] According to a first aspect of the present invention, there is provided a concrete panel for constructing a floor of a building, the concrete panel including: a base plate; a partition wall which protrudes from an upper portion of the base plate in a lattice structure or a honeycombed structure; a filling cell which is formed by the partition wall and has a filling material embedded therein; and a reinforcing core which is embedded in the concrete panel, wherein a penetrating hole is formed to allow a tension wire to be inserted therethrough to fasten to a neighbor concrete panel in one or more directions selected from a horizontal direction and a vertical direction.

[0010] The partition wall may include a plurality of horizontal walls protruding in a lengthwise direction of the base plate, and a plurality of vertical walls protruding in a widthwise direction of the base plate. According to an exemplary embodiment of the present invention, one or more selected from a metal mesh and a metal porous plate may be embedded in the base plate as a reinforcing core, one or more selected from a reinforcing bar and a truss girder may be embedded in the vertical wall as a reinforcing core, and a truss girder may be embedded in the horizontal wall as a reinforcing core.

[0011] In addition, according to a second aspect of the present invention, there is provided a shock absorbing unit for constructing a floor of a building, the shock absorbing unit including: a first substrate installed on a floor structure; a plurality of support rods installed on the first substrate; a buffering member which has elasticity and allows the support rod to be inserted therein; and a second substrate installed on the buffering member, wherein the second substrate has a guide hole formed thereon to allow an upper end of the support rod to be inserted therethrough.

[0012] According to an exemplary embodiment of the present invention, the first substrate and the second substrate may include support portions formed on surfaces thereof in contact with the buffering member. In addition, according to an exemplary embodiment of the present invention, the shock absorbing unit may further include a height adjustment member installed on one or more portions selected from a portion between the first substrate and the buffering member and a portion between the second substrate and the buffering member. According to an exemplary embodiment of the present invention, the buffering member may include an elastic body which is formed by stacking a plurality of conical hat members.

[0013] In addition, according to a third aspect of the present invention, there is provided a floor construction structure for a building including a concrete panel according to the first aspect of the present invention.

[0014] According to an exemplary embodiment of the present invention, the floor construction structure for the building may include: a concrete panel according to the first aspect of the present invention; a plurality of shock absorb-

ing units installed on the concrete panel; a thermally conductive metal plate installed on the shock absorbing unit; a heat insulator installed on the concrete panel; and a heating pipe installed between the heat insulator and the thermally conductive metal plate, wherein a filling material is embedded in a filling cell of the concrete panel.

[0015] In addition, according to a fourth aspect of the present invention, there is provided a floor construction structure for a building including a shock absorbing unit according to the second aspect of the present invention.

[0016] According to an exemplary embodiment of the present invention, the floor construction structure for the building may include: a floor structure; a shock absorbing unit installed on the floor structure according to the second aspect of the present invention; a thermally conductive metal plate installed on the shock absorbing unit; a heat insulator installed on the floor structure; and a heating pipe installed between the heat insulator and the thermally conductive metal plate.

Advantageous Effect

[0017] According to the present invention as described above, noise and vibration caused by a shock can be effectively absorbed and exhausted (dispersed), and thus the excellent inter-floor sound insulation property can be achieved. In addition, according to the present invention, thermal conductivity is excellent due to the improved heating structured as described above, and thus there is an effect of reducing energy consumption.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. 1 is a perspective view of a concrete panel for constructing a floor of a building according to a first embodiment of the present invention;

[0019] FIG. 2 is a cross section view of the concrete panel for constructing the floor of the building according to the first embodiment of the present invention, and is a cross section configuration diagram taken along line A-A of FIG. 1;

[0020] FIG. 3 is a cross section view of the concrete panel for constructing the floor of the building according to the first embodiment of the present invention, and is a cross section configuration diagram taken along line B-B of FIG. 1;

[0021] FIGS. 4 to 8 are views showing various examples of a truss girder used in the present invention;

[0022] FIG. 9 is a perspective view of a concrete panel for constructing a floor of a building according to a second embodiment of the present invention;

[0023] FIG. 10 is a perspective view of a concrete panel for constructing a floor of a building according to a third embodiment of the present invention;

[0024] FIG. 11 is a view to illustrate a method for producing a concrete panel for constructing a floor of a building according to the present invention;

[0025] FIG. 12 is a perspective view showing an example of a molding frame for forming a filling cell;

[0026] FIG. 13 is a perspective view showing another embodiment of a mold;

[0027] FIG. 14 is a perspective view showing another example of the molding frame for forming the filling cell;

[0028] FIG. 15 is a cross section configuration diagram to illustrate a process of installing a concrete panel for constructing a floor of a building according to the present invention;

[0029] FIG. 16 is a cross section configuration diagram of a floor construction structure according to a first embodiment of the present invention;

[0030] FIG. 17 is a cross section configuration diagram of a floor construction structure according to a second embodiment of the present invention;

[0031] FIG. 18 is an exploded perspective view showing a first embodiment of a shock absorbing unit according to the present invention;

[0032] FIG. 19 is a cross section configuration diagram showing an embodiment of a buffering member forming the shock absorbing unit according to the present invention;

[0033] FIG. 20 is a cross section configuration diagram showing a first embodiment of the shock absorbing unit according to the present invention;

[0034] FIG. 21 is a cross section configuration diagram showing a second embodiment of the shock absorbing unit according to the present invention; and

[0035] FIG. 22 is a cross section configuration diagram of a main part of a floor construction structure according to a third embodiment of the present invention.

BEST MODE FOR EMBODYING THE INVENTION

[0036] The term “and/or” used in the present specification is used to imply one or more components of the components enumerated before and after this term. In addition, the terms “first,” “second,” “one side,” and “the other side” used in the present specification is used to distinguish one component from other elements, and the components are not limited by these terms.

[0037] The expressions “formed on,” “formed on the upper portion (upper side),” “formed on the lower portion (lower side),” “installed on,” “installed on the upper portion (upper side),” “installed on the lower portion (lower side),” or the like used in the present specification imply not only that corresponding components are stacked (installed) one on the other in direct contact with each other, but also that another component is further formed (installed) between the corresponding components. For example, the expression “formed (installed) on” implies that a second component is formed (installed) on a first component in direct contact with the first component, and also implies that a third component is further formed (installed) between the first component and the second component.

[0038] In addition, the terms “connecting,” “installing,” “coupling,” “fastening,” or the like used in the present specification imply that two components are removably (attachably and detachably) connected with each other and also imply an integral structure. Specifically, the terms “connecting,” “installing,” “coupling,” “fastening,” or the like used in the present specification imply that two components are attachably and detachably connected with each other through a forced-fitting method (interference fitting method); a fitting method using a groove and a protrusion; and a fastening method using a fastening member such as a screw, a bolt, a piece, a rivet, or the like, and also imply that two components are connected with each other by welding, using an adhesive, cast-in-placing cement or mortar, or integral molding, and then cannot be detached from each

other. In addition, the term “installing” implies that two components are stacked (seated) one on the other without an extra coupling force.

[0039] Hereinafter, the present invention will be described in detail with reference to the accompanying drawings. The accompanying drawings illustrate exemplary embodiments of the present invention and are provided to assist in a comprehensive understanding of the present invention. In the accompanying drawings, thickness may be enlarged to clearly express each layer and each area, and the scope of the present invention should not be limited by thickness, size, and ratio illustrated in the drawings. In the following description, detailed descriptions of well-known functions or configurations will be omitted.

[0040] According to a first aspect of the present invention, there is provided a concrete panel 100 for constructing a floor of a building, which is constructed on a floor of a building to effectively absorb and exhaust (disperse) noise and vibration applied to an upper layer. The concrete panel 100 according to the present invention is used as a structure forming a floor foundation of a building.

[0041] In addition, according to a second aspect of the present invention, there is provided a shock absorbing unit 200 for constructing a floor of a building, which is installed on a floor of a building to effectively absorb and buffer (exhaust) a shock applied to the floor.

[0042] In addition, according to a third aspect of the present invention, there is provided a floor construction structure for a building, which includes the concrete panel 100 according to the first aspect of the present invention.

[0043] In addition, according to a fourth aspect of the present invention, there is provided a floor construction structure for a building, which includes the shock absorbing unit 200 according to the second aspect of the present invention.

[0044] In describing exemplary embodiments of the present invention hereinafter, the concrete panel 100 and the shock absorbing unit 200 according to the present invention will be described by describing the floor construction structure for the building according to the present invention.

[0045] The floor construction structure for the building according to the present invention includes at least the concrete panel 100 of the present invention, which will be described below according to exemplary embodiments. According to another exemplary embodiment, the floor construction structure for the building according to the present invention includes at least a floor structure and a plurality of shock absorbing units 200 installed on the floor structure.

[0046] In the present invention, the floor structure is not specifically limited if it can support the shock absorbing unit 200. Specifically, it is preferable that the floor structure provides a support surface on which the shock absorbing unit 200 is arranged and installed. The floor structure may be an existing concrete slab, for example. In addition, the floor structure may include the concrete panel 100 of the present invention, which will be described below. In describing the present invention, an embodiment in which the floor structure is selected from the concrete panel 100 of the present invention will be described by way of an example.

[0047] FIGS. 1 to 3 illustrate a concrete panel 100 according to a first embodiment of present invention. FIGS. 4 to 8

illustrate various examples of a truss girder 90 as an example of a reinforcing core which is embedded in the concrete panel 100.

[0048] The concrete panel 100 according to the present invention forms a floor foundation (floor structure) of a building. For example, the concrete panel 100 is substituted for an existing concrete slab. In the present invention, the size (length, width, and/or thickness) of the concrete panel 100 is not limited. According to the size (scale) of the building and/or the size of the concrete panel 100, a single concrete panel 100 may form the floor of the building or two or more concrete panels 100 may be fastened and assembled to each other to form the floor of the building. According to an example, the concrete panel 100 may have such a size that two or more concrete panels 100 form a certain one floor by being fastened to each other in consideration of conveyance and installing works.

[0049] Referring to FIG. 1, the concrete panel 100, which is a rectangular parallelepiped, has a plate shape, for example. In addition, the concrete panel 100 may include a base plate 10, a partition wall 20 protruding from the upper portion of the base plate 10, and a plurality of filling cells 30 formed by the partition wall 20.

[0050] The base plate 10 has a plate shape of a rectangular parallelepiped shape, for example. The partition wall 20 is integrally formed with the base plate 10 by extending and protruding from the upper portion of the base plate 10. The base plate 10 and the partition wall 20 may be made of concrete and may be integrally formed with each other simultaneously by cast-in-placing and curing concrete through a mold.

[0051] The partition wall 20 may have a lattice structure and/or a honeycombed structure. In the present invention, the lattice structure includes a grid structure in which the partition wall 20 is formed in a lengthwise direction (horizontal direction) and a widthwise direction (vertical direction) of the concrete panel 100 and is arranged in a rectangular shape, and a waffle structure in which the partition wall 200 is formed in an oblique direction and arranged in a diamond shape (or a parallelogram shape). In the present invention, the honeycombed structure is honeycombed and includes a pentagonal shape, a hexagonal shape, an octagonal shape, and/or a circular shape. In the drawing, the partition wall 20 is formed in the lattice structure. Specifically, as shown in FIG. 1, the partition wall 20 includes a plurality of horizontal walls 22 protruding in the lengthwise direction (horizontal direction) of the base plate 10, and a plurality of vertical walls 24 protruding in the widthwise direction (vertical direction) of the base plate 10, and the horizontal wall 22 and the vertical wall 24 are perpendicular to each other and thus form the lattice structure of the rectangular shape.

[0052] The filling cell 30 has a groove shape which is formed on the base plate 10 as shown in the drawing. The filling cell 30 is formed by the partition wall 20. The filling cell 30 is provided in plural number, and specifically, is a space partitioned by the plurality of horizontal walls 22 and the plurality of vertical walls 24. The filling cell 30 includes filling material 150 (see FIGS. 16 and 17) embedded therein.

[0053] The filling material 150 is installed for the sake of a heat insulation property and/or a sound insulation property, and has a plurality of pores. For example, the filling material 150 may be selected from bubble concrete and/or synthetic resin foamed foam. More specifically, the filling material

150 may be autoclaved lightweight concrete which is formed by cast-in-place and curing concrete dough (dough of sand and cement) to form bubbles by a physical operation (for example, injecting air), or may be selected from synthetic resin foamed foam which is formed by blowing a synthetic resin composition (a mixture of synthetic resin and a blowing agent). The synthetic resin foamed foam may be polystyrene foam, polyurethane foam, polyethylene foam, and/or polypropylene foam. In addition, the filling material **150** may be selected from glass wool, mineral wool, rock wool, fiber assemblies (cotton), or the like, and, according to circumstances, may be formed of one or more selected from a synthetic resin foamed chip, sand (silica), filling powder, stone powder, perlite, foamed perlite, vermiculite, foamed vermiculite, wood powder (sawdust), grinded chaff and rice straw (finely grinded), or the like. Due to the presence of the filling material **150** described above, noise and vibration applied to an upper layer can be effectively absorbed and blocked and also lightness can be provided to the concrete panel **100**. In addition, the heat insulation property can be ensured by the filling material **150**.

[0054] The number of filling cells **30** is not limited. For example, the filling cells **30** may be arranged in three (3) to twenty (20) rows in the horizontal direction (lengthwise direction) and arranged in two (2) to fifteen (15) rows in the vertical direction (width direction). In FIG. 1, the filling cells **30** are arranged in eight (8) rows in the horizontal direction (lengthwise direction) and in four (4) rows in the vertical direction (widthwise direction), such that 32 filling cells in total are formed.

[0055] In addition, according to an exemplary embodiment of the present invention, the concrete panel **100** may include a penetrating hole **40**. A plurality of penetrating holes **40** may be formed in one or more directions selected from the horizontal direction (lengthwise direction) and the vertical direction (widthwise direction) of the concrete panel **100**. It is preferable that the penetrating hole **40** is formed in at least the vertical direction (widthwise direction) of the concrete panel **100**. In the drawing, the penetrating hole **40** is formed in the vertical direction (widthwise direction) of the concrete panel **100** and is illustrated as being formed in the base plate **10**. In constructing a floor foundation of a building, the penetrating hole **40** is usefully used when the floor is constructed by fastening the plurality of concrete panels **100** to each other according to the present invention. Specifically, a tension wire **181** (see FIG. 15) for fastening neighbor concrete panels **100** may be inserted into the penetrating hole **40**, thereby strengthening an assembly force between the concrete panels **100**.

[0056] According to a preferred embodiment, the concrete panel **100** may include a reinforcing core. The reinforcing core may be made of material which can improve the strength of the concrete panel **100**, and may be embedded in the concrete panel **100**. The reinforcing core may be selected from a metal mesh, a metal porous plate, a reinforcing bar, a truss girder, and/or a fiber sheet. The reinforcing core may be embedded in the base plate **10** and/or the partition wall **20** of the concrete panel **100**.

[0057] FIG. 2 shows a cross section taken along line A-A of FIG. 1 and FIG. 3 shows a cross section taken along line B-B of FIG. 1. Referring to FIGS. 2 and 3, according to an exemplary embodiment of the present invention, one or more selected from a metal mesh **70**, a metal porous plate, and a fiber sheet may be embedded in the base plate **10** as

a reinforcing core. In addition, referring to FIGS. 2 and 3, one or more selected from a reinforcing bar **80** (see FIG. 2) and/or a truss girder **90** (see FIG. 3) may be embedded in the partition wall **20**. In one example, the reinforcing bar **80** may be embedded in the vertical wall **24** of the partition wall **20** and the truss girder **90** may be embedded in the horizontal wall **22**. The truss girder **90** has a three-dimensional structure in which three or more main bars **92** are wire-connected with one another, and is useful to reinforce the strength of the concrete panel **100**.

[0058] FIGS. 4 to 8 illustrate various examples of the truss girder **90** which is usefully used in the present invention as a reinforcing core. Referring to FIGS. 4 to 8, the truss girder **90** has a three-dimensional structure which includes at least three main bars **92**, and a steel wire **94** for connecting the main bars **92**. In this case, the main bar **92** and the steel wire **94** may use a steel pipe, a reinforcing bar, and/or a wire, and the wire **94** may have a diameter smaller than that of the main bar **92**.

[0059] The truss girder **90** may have three-dimensional structures of various shapes according to the number and arrangement of the main bars **92**. FIGS. 4 and 5 show the truss girder **90** formed in a triangular structure having three main bars **92**, and FIG. 6 shows a structure in which four main bars **92** are connected with one another by the steel wire **94** in an X shape. In addition, FIG. 7 illustrates the truss girder **90** having a rectangular cross section, and FIG. 8 illustrates the truss girder **90** having a trapezoidal cross section. The truss girder **90** having the three-dimensional structure as described above improves the support strength and the tensile strength of the concrete panel **100A**, thereby supporting a load effectively.

[0060] According to a preferred embodiment, the truss girder **90** may be selected from the three-dimensional structure as shown in FIG. 4. Referring to FIG. 4, the truss girder **90** may include the plurality of main bars **92** and the steel wire **94** connecting the plurality of main bars **92**. The steel wire **94** may have a structure in which the steel wire **94** is bent to connect the plurality of main bars **92**. The truss girder **90** in this structure is very effective in reinforcing the support strength and the tensile strength of the concrete panel **100A**. In this case, FIG. 4 illustrates the truss girder **90** which includes three main bars **92** and two steel wires **94**. As shown in FIG. 4, each of the steel wires **94** connects two main bars **92** and is bent at a bending portion **94a** and consecutively connects the main bars **92**. In addition, the steel wire **94** may be connected with the main bar **92** at the bending portion **94a** by welding or wire-connecting.

[0061] FIG. 9 illustrates a concrete panel **100** according to a second embodiment of the present invention. Referring to FIG. 9, according to the second embodiment of the present invention, the concrete panel **100** may include an insert **50** formed on the side surface thereof. As shown in FIG. 9, one side of the insert **50** is embedded in the side surface of the concrete panel **100** and the other side is exposed to the outside. The insert **50** is used to connect to a reinforcing bar **F** installed in a wall **W** (see FIG. 15) of a building. In this case, the insert **50** and the reinforcing bar **F** are firmly connected with each other by welding, for example. The concrete panel **100** can have a secure coupling force with respect to the wall **W** of the building due to the presence of the insert **50**.

[0062] In addition, referring to FIG. 9, according to another exemplary embodiment of the present invention, the

concrete panel 100 may include a hook member 60 installed on the side surface thereof. As shown in FIG. 9, one side of the hook member 60 is embedded in the side surface of the concrete panel 100 and the other side is exposed to the outside. The hook member 60 is used to convey or install the concrete panel 100. Specifically, when the concrete panel 100 is conveyed or installed, the hook member 60 may be held or a conveyance device such as a crane may be connected to the hook member 60. Accordingly, the hook member 60 may make it easy to convey or install the concrete panel 100. In addition, according to one embodiment, the hook member 60 may be removed after use. That is, after the work of conveying or installing the concrete panel 100 is finished, the hook member 60 may be separated and removed from the concrete panel 100.

[0063] FIG. 10 illustrates a concrete panel 100 according to a third embodiment of the present invention. Referring to FIG. 10, a reinforcing part 35 may be formed in the filling cell 30. In this case, the reinforcing part 35 may be disposed in the center of the filling cell 30, and may be made of concrete and integrally formed with the base plate 10 by protruding therefrom as concrete. In addition, the height of the reinforcing part 35 may be equal to the height of the partition wall 20. Specifically, the reinforcing part 35 may be integrally formed with the base plate 10 at the same time of forming the base plate 10 and the partition wall 20 by cast-in-placing and curing concrete through a mold. For example, the load-carrying capacity of the concrete panel 100 can be reinforced by the reinforcing part 35. Specifically, the reinforcing part 35 may reinforce the load-carrying capacity of the concrete panel 100 by supporting a load applied from the upper side of the filling cell 30.

[0064] The concrete panel 100 of the present invention described above can firmly and simply construct the floor of the building. That is, the concrete panel 100 is strong from the perspective of its structure. Specifically, the concrete panel 100 includes the base plate 10, and has strong bearing capacity due to the presence of the partition wall 20 of the lattice structure and/or honeycombed structure protruding from the base plate 10. In addition, an excellent sound insulation property can be obtained and lightness can be provided. Specifically, the plurality of filling cells 30 are formed between the partition walls 20, so that the lightness can be guaranteed, and the filling material 150 of the porous structure for absorbing and exhausting (dispersing) noise and vibration is embedded in the filling cell 30, so that the excellent sound insulation property can be obtained. Since the density of the filling material 150 is low due to the porous structure, the concrete panel 100 has lightness. In addition, in constructing a floor of a building, the floor foundation of the building can be constructed by fastening the concrete panels 100 through the tension wire 181 without requiring a related-art operation such as installing a mold and cast-in-placing concrete. Therefore, the floor construction work can be simply performed.

[0065] The concrete panel 100 may be produced (formed) in various methods. According to an exemplary embodiment, the concrete panel 100 may be produced in the following method. FIG. 11 is a view to illustrate a method for producing the concrete panel 100. FIG. 12 illustrates a molding frame 120 for forming the filling cell 30.

[0066] Referring to FIGS. 11 and 12, the concrete panel 100 may be produced by a process which includes: a first step of installing a reinforcing core in a mold 110; a second

step of installing a molding frame 120 to form the filling cell 30 on the reinforcing core; and a third step of cast-in-placing concrete in the mold 110 and curing the concrete.

[0067] The first step of installing the reinforcing core may install one or more reinforcing core selected from the metal mesh 70, the metal porous plate, the reinforcing bar 80, the truss girder 90, and the fiber sheet as described above. In one example, the metal mesh 70 may be installed in the mold 110 first and the reinforcing bar 80 and the truss girder 90 may be installed on the upper portion of the metal mesh 70. In this case, the reinforcing bar 80 may be installed in the vertical direction (widthwise direction) to be embedded in the vertical wall 24, and the truss girder 90 may be installed in the horizontal direction (lengthwise direction) to be embedded in the horizontal wall 22. In addition, the reinforcing cores, that is, the metal mesh 70, the reinforcing bar 80, and the truss girder 90 may be wire-connected with one another. In the present invention, the wire-connecting refers to weaving elements using a wire such as a steel wire.

[0068] In addition, the process of producing the concrete panel 100 may further include a fourth step of installing a hollow tube 140 in the mold 110. The hollow tube 140 is to form the penetrating hole 40 and is removed after concrete is cured. The hollow tube 140 is not specifically limited if it is hollow inside, and for example, may be selected from a metal tube or a synthetic resin tube. The fourth step of installing the hollow tube 140 may be performed between the first step and the second step or between the second step and the third step.

[0069] The mold 110 includes a bottom plate 112 and four wall portions 113 formed on the side surfaces of the bottom plate 112. In this case, at least one of the four wall portions 113 may be removable so as to make it easy to remove the concrete panel 100. In addition, a penetrating hole 114 may be formed on the wall portion 113 of the mold 110 to allow the hollow tube 140 to penetrate therethrough. In addition, an insertion hole (not shown) may be formed on the wall portion 113 of the mold 110 to embed the insert 50 and the hook member 60 therein as described above.

[0070] The molding frame 120 is to form the filling cell 30 and includes a cell forming frame 123 having a shape corresponding to at least the filling cell 30. In this case, the cell forming frame 123 may have various shapes corresponding to the filling cell 30. For example, the cell forming frame 123 may have various shapes such as a triangular shape, a rectangular shape, a pentagonal shape, a hexagonal shape, a diamond shape, and/or a circular shape. In addition, by installing the cell forming frame 123, the filling cell 30 may be formed and simultaneously the partition wall 20 of the lattice structure or honeycombed structure is formed as described above.

[0071] According to one embodiment, the molding frame 120 may include a plurality of cell forming frames 123 having a shape corresponding to the filling cell 30, for forming the filling cells 30, and a connection frame 125 connecting the plurality of cell forming frames 123. In addition, as shown in FIG. 12, fastening holes 125a may be formed at the both ends of the connection frame 125 to have a fastening instrument such as a bolt or the like inserted therethrough. Accordingly, when the molding frame 120 is installed in the mold 110, the both ends of the connection frame 125 are seated on the wall portions 113 of the mold 110 and then the molding frame 120 is fastened to the mold 110 by means of the fastening instrument such as a bolt

through the fastening holes **125a**, so that the molding frame **120** can be firmly fixed to the mold **110**.

[0072] FIG. 13 illustrates another embodiment of the mold **110**. Referring to FIG. 13, according to another embodiment, the concrete panel **100** may be produced by a process which includes the steps of: installing the molding frame **120** on the bottom plate **112** of the mold **110**; installing the reinforcing core on the molding frame **120**; and cast-in-placing and curing concrete in the mold **110**. That is, the concrete panel **100** shown in FIG. 1 may be produced upside down. In this case, the molding frame **120** includes a plurality of cell forming frames **123** having a shape corresponding to at least the filling cell **30**. Specifically, the plurality of cell forming frames **123** may be arranged on the bottom plate **112** of the mold **110** at predetermined intervals as the molding frame **120**, and then the reinforcing bar may be installed and the concrete may be cast-in-placed and cured.

[0073] In addition, FIG. 14 illustrates another example of the molding frame **120**. When the molding frame **120** as shown in FIG. 14 is used, the concrete panel **100** may be produced as shown in FIG. 10. Referring to FIG. 14, according to another example, the molding frame **120** includes a plurality of cell forming frames **123** for forming the filling cell **30**; and a connection frame **125** for connecting the plurality of cell forming frames **123**. A concrete embedding hole **123a** may be formed on the cell forming frame **123**. The concrete embedding hole **123a** may be formed in the center of the cell forming frame **123**. When concrete is cast-in-placed, the concrete is cast-in-placed in the concrete embedding hole **123a**, thereby forming the reinforcing part **35** as described above.

[0074] Hereinafter, detailed embodiments of a floor construction structure according to the present invention will be described.

[0075] The floor construction structure according to the present invention includes one or two or more concrete panels **100** as described above. FIGS. 15 to 17 are cross section configuration diagrams to illustrate a floor construction structure according to the present invention. FIG. 15 is a cross section configuration diagram to illustrate a process of installing the concrete panel **100**, and FIG. 16 is a cross section configuration diagram of a floor construction structure according to a first embodiment. FIG. 17 is a cross section configuration diagram of a floor construction structure according to a second embodiment of the present invention.

[0076] Referring to FIG. 15, a wall **W** of a building may be constructed through a mold **C** in a typical method or may be constructed by a precast concrete (PC) construction method through an assembly block. FIG. 15 illustrates constructing through the mold **C**. Specifically, in order to construct the wall **W**, an internal mold **C** and an external mold **C** are installed. A plurality of reinforcing bars **F** are installed between the internal mold **C** and the external mold **C**, and then are wire-connected with one another. Thereafter, the wall **W** is constructed by cast-in-placing concrete between the internal mold **C** and the external mold **C** and curing the concrete. In this case, the concrete panel **100** is installed between the left wall **W** and the right wall **W** to construct a floor. For example, two or more concrete panels **100** are installed to be flush with each other. According to circumstances, a horizontal holding plate **191** for supporting the plurality of concrete panels **100** to be flush with each other, and a support frame **192** for supporting the horizontal

holding plate **191** may be installed. In this case, as shown in FIG. 15, the horizontal holding plate **191** may be installed on the lower portion of the concrete panel **100** and the support frame **192** may be installed on the lower side of the horizontal holding plate **191** and supported.

[0077] The plurality of concrete panels **100** are fastened to each other through the tension wire **181**. Specifically, the penetrating hole **40** is formed on the concrete panel **100** as described above. The tension wire **181** is inserted into the penetrating hole **40** and then is fastened by applying a tension to any one side of the tension wire **181**. That is, as shown in FIG. 15, one end of the tension wire **181** is fixed to one side of the left concrete panel **100** (the left side of FIG. 15) by a fixing member **182** such as a tension cone, and is finished. In addition, when the other end of the tension wire **181** is stretched by using a tension device **185** at one side of the right concrete panel **100** (the right side of FIG. 15) and a strong tension is applied, and then the tension wire **181** is fixed to the reinforcing bar **F**, the plurality of concrete panels **100** may be firmly fastened. In this case, hydraulic equipment may be connected to the tension device **185** to apply a strong tension. In the present invention, the tension wire **181** is not limited to if it has appropriate strength. For example, a reinforcing bar may be used and a plurality of steel wires which are twisted may be used. The ends of the tension wire **181** may be firmly fastened to the reinforcing bar **F** embedded in the wall **W** by welding or the like. After the plurality of concrete panels **100** are fastened to each other through the tension wire **181** as described above, the insert **50** installed on the side surface of the concrete panel **100** is fastened to the reinforcing bar **F** of the wall **W** by welding or by using a separate fastening instrument, so that a securer coupling force can be provided.

[0078] The above-described process of installing the concrete panel **100** is applied when second or third or higher floors of the building are constructed. When the bottom floor of the building is constructed, the installation structure of the horizontal holding plate **191** and the support frame **192** described above may be omitted. In addition, the concrete panel **100** constructed as described above may be a floor for a resident living in the upstairs and may be a ceiling for a resident living in the downstairs.

[0079] Referring to FIGS. 16 and 17, the floor construction structure according to the present invention includes the concrete panel **100** installed in the above-described structure and a thermally conductive metal plate **500** which is formed above the concrete panel **100** and spaced from the concrete panel **100**. In this case, the concrete panel **100** and the thermally conductive metal plate **500** are spaced from each other by a predetermined distance by a shock absorbing unit **200**. In addition, a heat insulator **300** and a heating pipe **400** are installed in sequence from the bottom between the concrete panel **100** and the thermally conductive metal plate **500**.

[0080] More specifically, the floor construction structure according to the present invention includes the concrete panel **100** as a floor structure, a plurality of shock absorbing units **200** installed on the concrete panel **100**, the thermally conductive metal plate **500** installed on the shock absorbing units **200**, the heat insulator **300** installed on the concrete panel **100**, and the heating pipe **400** installed between the heat insulator **300** and the thermally conductive metal plate **500**. In this case, the shock absorbing unit **200** may be installed in direct contact with the top surface of the concrete

panel **100** (see FIG. **16**) or may be installed in direct contact with the top surface of the heat insulator **300** (see FIG. **17**).

[0081] Referring to FIG. **16**, the shock absorbing unit **200** may be installed in direct contact with the top surface of the concrete panel **100**, and the heat insulator **300** may be installed in direct contact with the concrete panel **100** in the proximity of the shock absorbing unit **200**. In addition, referring to FIG. **17**, the shock absorbing unit **200** may be installed in direct contact with the top surface of the heat insulator **300**. Specifically, the heat insulator **300** may be installed in direct contact with the top surface of the concrete panel **100** and the shock absorbing unit **200** may be installed in direct contact with the top surface of the heat insulator **300**. FIGS. **16** and **17** show the floor construction structure to which the concrete panel **100** shown in FIG. **10** is applied as the concrete panel **100**.

[0082] In this case, the filling cell **30** is formed in the concrete panel **100** and the filling material **150** is embedded in the filling cell **30** as described above. The filling material **150** may be embedded in at least the filling cell **30**, and according to another embodiment of the present invention, the filling material **150** may be formed, forming layers of predetermined thickness between the partition wall **20** and the heat insulator **300** and/or between the reinforcing part **35** and the heat insulator **300**. In addition, packing material may be filled in an empty space **S** provided between the heating pipes **400**, or according to another embodiment, the empty space **S** may be maintained as it is as an air layer. The packing material is provided for the sake of the heat insulation property and/or the sound insulation property, and a typical insulator may be used or the filling material **150** may be used as described above.

[0083] The shock absorbing unit **200** may be installed between the concrete panel **100** and the thermally conductive metal plate **500** to space the concrete panel **100** and the thermally conductive metal plate **500** from each other by a predetermined distance. In addition, the shock absorbing unit **200** spaces the thermally conductive metal plate **500** and also absorbs and buffers a shock applied to the upper layer, thereby effectively blocking noise and vibration. In this case, the shock absorbing unit **200** may be fixed to the partition wall **20** of the concrete panel **100**. According to another exemplary embodiment, the shock absorbing unit **200** may be installed in the filling cell **30** and installed on the upper portion of the filling material **150**. In this case, the filling material **150** may be selected from compressed synthetic resin foamed foam (for example, compressed polystyrene foam) to support the shock absorbing unit **200**.

[0084] The shock absorbing unit **200** is not specifically limited if it can absorb and buffer a shock applied from the upper portion, but preferably, is selected from the shock absorbing units **200** described below.

[0085] FIGS. **18** to **21** illustrate embodiments of the shock absorbing unit **200** according to the present invention.

[0086] Referring to FIG. **18**, the shock absorbing unit **200** according to the present invention includes: a first substrate **210**; a support rod **220** installed on the first substrate **210**; an elastic buffering member **230** installed to allow the support rod **220** to be inserted therein; and a second substrate **240** installed on the buffering member **230**. In this case, the shock absorbing unit **200** according to the present invention includes a plurality of support rods **220** for the sake of stability. The shock absorbing unit **200** configured as

described above can block noise and vibration by effectively absorbing and buffering a shock applied from the upper portion.

[0087] Each of the elements forming the shock absorbing unit **200** according to the present invention may be made by any suitable material such as metal and/or plastic, but such material is not specifically limited thereto. Hereinafter, an exemplary embodiment of each of the elements forming the shock absorbing unit **200** according to the present invention will be described.

[0088] The first substrate **210** is formed in a plate shape such as a circular shape or a polygonal shape (rectangular shape or the like) and is installed on the floor structure of the building. The floor structure may be selected from the concrete panel **100** according to the present invention as described above. In this case, the first substrate **210** may be installed and fixed on the concrete panel **100**. Specifically, the first substrate **210** may be installed and fixed on the partition wall **20** and/or the reinforcing part **35** of the concrete panel **100** or may be installed in the filling cell **30**.

[0089] The first substrate **210** may be fixed to the concrete panel **100** by means of an anchor bolt **142** (see FIG. **16**) in one example. To achieve this, the first substrate **210** may have a bolt hole **210a** formed thereon to allow the anchor bolt **142** to be inserted therein. More specifically, the first substrate **210** may have one or more bolt holes **210a** formed thereon, and anchor insertion material **144** is embedded in the partition wall **20** and/or the reinforcing part **35** of the concrete panel **100**, such that the anchor bolt **142** penetrates through the bolt hole **210a** and then is fastened to the anchor insertion material **144**, and thus the first substrate **210** can be fixed to the concrete panel **100**.

[0090] As described above, the plurality of support rods **220** are provided to provide stability. That is, the plurality of support rods **220** may be installed on the first substrate **210**. For example, three to six support rods **220** may be installed on the first substrate **210**, and, in the drawing, four support rods **220** are arranged and installed at predetermined intervals. The support rod **220** may have various shapes such as a cylindrical shape or a polyprism shape.

[0091] The buffering member **230** has elasticity and allows the support rod **220** to be inserted therein to provide a buffering force to absorb a shock. The buffering member **230** is not limited if it has elasticity. When a shock is applied from the upper portion of the shock absorbing unit **200**, it is preferable that the contracted length of the buffering member **230** is about 0.1 mm to 4 mm. More specifically, when a shock is applied from the upper portion (upper layer), the buffering member **230** is contracted (the shock is buffered). In this case, it is preferable that the buffering member **230** has a contracting force (buffering force) of about 0.1 mm to 4 mm by an impact load.

[0092] For example, on the assumption that the total length (height) of the buffering member **230** before a shock is applied is about 5 cm (=50 mm) (initial length=about 5 cm), the buffering member **230** may be contracted by about 0.1 mm to 4 mm due to the impact load applied from the upper portion, and the length (height) after the buffering member **230** is contracted is about 46 mm to 49.9 mm. In this case, when the contracted length (contracting force) is less than 0.1 mm, the shock absorbing function (buffering function) may be insignificant. When the contracted length (contracting force) exceeds 4 mm and thus the buffering member **230** is excessively contracted, the contraction may

make people feel buffer (contraction) shaking and the excessive contraction is not preferable. In consideration of this, it is preferable that the contracted length of the buffering member **230** is 0.5 mm to 3.5 mm or 1 mm to 3 mm. When the shock is buffered in this range, an excellent shock absorbing function (buffering function) can be provided and people is not made to feel the shaking. Therefore, this contraction range is preferable. In this case, the impact load is an arbitrary impact load that is applied from the upper portion after the floor is constructed, and is not specifically limited. In one example, the impact load may be a load that can be applied when a person weighing 100 kg jumps about 30 cm from the bottom. In the present invention, it is preferable that the buffering member **230** has a contracting force of the above-described range, and may include a coil spring (spring structure) and/or a plurality of conical hat members **235**.

[0093] According to a preferred embodiment, the buffering member **230** is selected from the plurality of conical hat members **235**. FIG. **19** illustrate a cross section configuration diagram of the buffering member **230** including the plurality of conical hat members **235** as a preferred embodiment of the buffering member **230**.

[0094] Referring to FIG. **19**, the buffering member **230** may be an elastic body which is formed by stacking the plurality of conical hat members **235**. The conical hat member **235** may be an elastic metal member or an elastic plastic member, and may be made of metallic material such as carbon steel, stainless steel (SUS), aluminum alloy steel, and steel.

[0095] A buffering hole **235a** is formed in the center of the conical hat member **235** and the support rod **220** is inserted into the buffering hole **235a**. More specifically, the conical hat member **235** includes the buffering hole **235a** formed on the center thereof to allow the support rod **220** to be inserted therein, and an elastic disc **235b** formed in a conical hat shape in a circumferential direction with reference to the buffering hole **235b**. In this case, the elastic disc **235b** of the conical hat shape is inclined by a predetermined angle (θ) from a horizontal reference line (L) as shown in FIG. **19**, thereby having the conical hat shape. The elastic disc **235b** is not specifically limited, but may be inclined to have an angle of about 2 to 45 degrees from the horizontal reference line (L).

[0096] The buffering member **230** may be formed by stacking the plurality of conical hat members **235**. Referring to FIG. **19**, two conical hat members **235** are stacked in opposite directions, thereby forming a single elastic body set, and one or two or more elastic body sets may be stacked, thereby forming the buffering member **230**. In FIG. **19**, two conical hat member **235** stacked in opposite directions form a single elastic body set, and the four elastic body sets are stacked one on another, such that eight conical hat members **235** in total are stacked, thereby forming the buffering member **230**. Accordingly, when a shock is applied from the upper portion, the conical hat member **235**, that is, the elastic disc **235b** of the conical hat shape inclined by the predetermined angle (θ), is extended (is spread), thereby absorbing and buffering the shock. The conical hat member **235** may absorb (buffer) the shock in a more stable manner than the coil spring, and this provides a firm structure and is preferable for the present invention.

[0097] Referring to FIG. **18**, the second substrate **240** is installed on the buffering member **230** described above to

support the thermally conductive metal plate **500**. In this case, the second substrate **240** has a circular or a polygonal (rectangular) plate shape, and has a guide hole **245** formed thereon. That is, the guide hole **245** is formed on the second substrate **240** to allow the upper end **221** of the support rod **220** to be inserted therein. The guide hole **245** is provided in plural number and the number of guide holes **245** is the same as the number of support rods **220**. For example, when four support rods **220** are provided as show in FIG. **18**, the number of guide holes **245** may be four. Accordingly, when a shock is applied from the upper side, the second substrate **240** may move up and down along the support rods **220**.

[0098] In addition, referring to FIG. **20**, the upper end **221** of the support rod **220** is inserted into the guide hole **245** of the first substrate **240**, but it is preferable that the upper end **221** of the support rod **220** is inserted to have a step (d). Specifically, it is preferable that the upper end **221** of the support rod **220** is located with a step (d) of a predetermined distance from the end **245a** of the guide hole **245**. For example, when a strong shock is applied to the upper portion of the second substrate **240**, the buffering member **230** is contracted and thus the upper end **221** of the support rod **220** leaves out of the guide hole **245**, thereby pressing the thermally conductive metal plate **500** formed thereon. The step (d) can prevent this phenomenon. That is, when the strong shock is applied to the second substrate **240**, the step (d) forms an extra entrance path for the end **221**, thereby preventing the upper end **221** of the support rod **220** and the thermally conductive metal plate **500** from being brought into contact with each other. For example, the step (d) may be formed by a distance of 0.2 mm to 6 mm. In another example, the step (d) may be formed by a distance of 0.5 mm to 4 mm. Specifically, when the shock is applied, the upper end **221** of the support rod **220** may move inside the guide hole **245** within a range of 0.2 mm to 6 mm (or a range of 0.5 mm to 4 mm).

[0099] Referring to FIGS. **18** and **20**, according to an exemplary embodiment of the present invention, the shock absorbing unit **200** according to the present invention may further include a height adjustment member **250**. The height adjustment member **250** may be installed one or more portions selected from a portion between the first substrate **210** and the buffering member **230** and a portion between the second substrate **240** and the buffering member **230**. The height adjustment member **250** may be used to make the shock absorbing units **200** flush with each other.

[0100] The shock absorbing unit **200** according to the present invention may be installed on a floor of a building in plural number, and according to circumstances, the floor of the building may not be level. In this case, the shock absorbing units **200** may be made to be flush with each other through the height adjustment member **250**. The height adjustment member **250** may be formed in a ring shape and allow the support rod **220** to be press-fitted therein. To achieve this, the height adjustment member **250** has a press-fit hole **255** formed on the center thereof to allow the support rod **220** to be press-fitted therein. In one example, one or two or more height adjustment members **250** may be provided. The number of height adjustment members **250** used may be determined according to a height deviation. That is, the appropriate number of height adjustment members **250** may be installed between the first substrate **210** and the buffering member **230** and/or between the second sub-

strate **240** and the buffering member **230** according to a height deviation between the shock absorbing units **200**, thereby adjusting the height.

[0101] FIG. **21** illustrates another embodiments of the shock absorbing unit **220** according to the present invention.

[0102] Referring to FIG. **21**, support portions **212** and **242** may be formed on the surfaces of the first substrate **210** and the second substrate **240** which are in contact with the buffering member **230**. That is, the first support portion **210** may be formed on the upper surface of the first substrate **210**, and the second support portion **242** may be formed on the lower surface of the second substrate **240**. In addition, the support portions **212** and **242** may be integrally formed with the first substrate **210** and the second substrate **240**, respectively. In addition, the support portions **212** and **242** have a right shape and may have the same outer diameter as that of the conical hat member **235** forming the buffering member **230**. In this case, the second support portion **242** formed on the second substrate **240** has a communication hole which fluidly communicates with the guide hole **245**, and the upper end of the support rod **220** is inserted into the communication hole.

[0103] The buffering member **230** may be stably brought into close contact with the first substrate **210** and the second substrate **240** by the above-described support portions **212** and **242**, and the support portions **212** and **242** may perform the function of adjusting the height according to circumstances. Additionally, the second support portion **242** formed on the second substrate **242** may extend the length of the guide hole **245** and thus can stably guide the upper end **221** of the support rod **220**. More specifically, the communication hole is formed on the second support portion **242** as described above and thus the length of the guide hole **245** formed on the second substrate **240** can be extended. Accordingly, the upper end **221** of the support rod **220** can be effectively prevented from leaving out of the guide hole **245** of the second substrate **240**.

[0104] Referring to FIGS. **16** and **17**, the heat insulator **300** in the present invention is not specifically limited if it has a heat insulation property, and any insulator that is typically used in the related field may be used. In addition, the heat insulator **300** may have a sound insulation property as well as the heat insulation property. For example, the heat insulator **300** may be selected from, but not limited to, synthetic resin foam (polystyrene foam, polyurethane foam, polyethylene foam, polypropylene foam, or the like), iso pink (which is compressed synthetic resin foam, and includes compressed polyethylene foam, compressed polypropylene foam as well as compressed Styrofoam), gypsum board, glass wool, mineral wool, rock wool, fiber assemblies (cotton or the like).

[0105] Referring to FIGS. **16** and **17**, the thermally conductive metal plate **500** is not specifically limited if it is a metal plate having thermal conductivity. For example, the thermally conductive metal plate **500** may be formed of monometallic material selected from iron (Fe), copper (Cu), and aluminum (Al), or an alloy thereof. The thermally conductive metal plate **500** may be selected from a steel plate in consideration of a price, or may be selected from an aluminum plate or an iron-aluminum alloy plate in consideration of weight and thermal conductivity.

[0106] In addition, according to the present invention as described above, the heating pipe **400** is installed between the heat insulator **300** and the thermally conductive metal

plate **500**. In this case, the heating pipe **400** may be installed in closest contact with the lower surface of the thermally conductive metal plate **500**. Heat generated from the heating pipe **400** increases and is transferred to the thermally conductive metal plate **500**.

[0107] In this case, the present invention can implement an effective heating effect in comparison to a related-art method. That is, when a heating pipe is embedded and installed in finishing mortar as in the related-art method, the finishing mortar has low thermal conductivity and has a low heating effect in comparison to energy consumption. However, when the thermally conductive metal plate **500** is installed according to the present invention as described above and the heating pipe **400** is installed under the thermally conductive metal plate **500**, the thermal conductivity can be effectively enhanced. More specifically, the metal plate **500** having very high thermal conductivity in comparison to the finishing mortar effectively conducts and discharges heat, and thus can realize a high heating effect with low energy consumption. In addition, the heat insulator **300** is installed under the heating pipe **400** and thus most of the heat of the heating pipe **400** can be transferred upwardly by heat insulation.

[0108] In addition, according to another embodiment of the present invention, the floor construction structure according to the present invention may further include a buffering pad **450**. Specifically, as shown in FIGS. **16** and **17**, the buffering pad **450** may be installed on a contact interface between the shock absorbing unit **200** and the thermally conductive metal plate **500**. The buffering pad **450** is to buffer a shock between the shock absorbing unit **200** and the thermally conductive metal plate **500**, and for example, may be made of rubber, synthetic resin, fiber, or the like.

[0109] FIG. **22** illustrates a configuration diagram of a main part of the floor construction structure according to a third embodiment of the present invention.

[0110] In the present invention, the floor structure may be a panel assembly in which the plurality of concrete panels **100** are fastened to each other as described above, or may be selected from an existing concrete slab (S) as described above. FIG. **22** illustrates an existing normal concrete slab (S) which is applied as a floor structure. The concrete slab (S) may be constructed through a mold as in the normal method.

[0111] Referring to FIG. **22**, the shock absorbing unit **200** may be fixed on the concrete slab (S) by means of the anchor bolt **142**. Specifically, the anchor insertion material **144** is embedded in the concrete slab (S) and the anchor bolt **142** is made to penetrate through the bolt hole **210a** of the first substrate **210**. Next, by fastening the anchor bolt **142** to the anchor insertion material **144**, the shock absorbing unit **200** may be fixed and installed on the concrete slab (S). Accordingly, according to another embodiment of the present invention, the floor construction structure includes the concrete slab (S), the plurality of shock absorbing units **200** installed on the concrete slab (S), the thermally conductive metal plate **500** installed on the shock absorbing units **200**, the heat insulator **300** installed on the concrete slab (S), and the heating pipe **400** installed between the heat insulator **300** and the thermally conductive metal plate **500**.

[0112] In addition, the floor construction structure according to the present invention may further include other components in addition to the above-described components.

For example, finishing material may be installed on the upper portion of the thermally conductive metal plate **500**. The finishing material may be selected from typically used floor finishing material. The finishing material may be selected from a print decoration sheet, linoleum, tile, natural slate (marble), mock marble (a marbled synthetic resin sheet), and/or a red clay plate.

[0113] In addition, the floor construction structure according to the present invention may further include various functional layers in addition to the finishing material. For example, a red clay layer, a deodorization layer, a sterilization layer, a far infrared radiation layer, and/or an extra sound insulation layer may be selectively formed.

[0114] According to the present invention as described above, noise and vibration can be effectively absorbed and exhausted (dispersed) as described above, and thus the excellent inter-floor sound insulation property can be achieved, and a floor of a building can be simply and firmly constructed. In addition, according to the present invention, thermal conductivity is excellent due to the improved heating structured as described above, and thus energy consumption (an expense of heating) can be reduced.

1. A concrete panel for constructing a floor of a building, the concrete panel comprising:

- a base plate;
 - a partition wall which protrudes from an upper portion of the base plate in a lattice structure or a honeycombed structure;
 - a filling cell which is formed by the partition wall and has a filling material embedded therein; and
 - a reinforcing core which is embedded in the concrete panel; and
- wherein a penetrating hole is formed to allow a tension wire to be inserted therethrough to fasten to a neighbor concrete panel in one or more directions selected from a horizontal direction and a vertical direction, and
- wherein the partition wall comprises a plurality of horizontal walls protruding in a lengthwise direction of the base plate, and a plurality of vertical walls protruding in a widthwise direction of the base plate.

2. The concrete panel of claim **1**, wherein one or more selected from a metal mesh and a metal porous plate is embedded in the base plate as a reinforcing core,

- wherein one or more selected from a reinforcing bar and a truss girder is embedded in the vertical wall as a reinforcing core, and
- wherein a truss girder is embedded in the horizontal wall as a reinforcing core.

3. The concrete panel of claim **2**, wherein the truss girder comprises a plurality of main bars and a steel wire which connects the plurality of main bars, and

- wherein the steel wire is bent and connects the plurality of main bars.

4. A floor construction structure for a building, comprising:

- a concrete panel according to claim **1**;
 - a plurality of shock absorbing units installed on the concrete panel;
 - a thermally conductive metal plate installed on the shock absorbing unit;
 - a heat insulator installed on the concrete panel; and
 - a heating pipe installed between the heat insulator and the thermally conductive metal plate, and
- wherein a filling material is embedded in a filing cell of the concrete panel.

5. The floor construction structure of claim **4**, wherein a buffering pad is installed on a contact interface between the shock absorbing unit and the thermally conductive metal plate.

6. The floor construction structure of claim **4**, comprising a plurality of concrete panels, and

wherein the plurality of concrete panels are fastened to each other through a tension wire.

7. The floor construction structure of claim **4**, wherein the shock absorbing unit comprises:

- a first substrate installed on the concrete panel;
 - a plurality of support rods installed on the first substrate;
 - a buffering member which has elasticity and allows the support rod to be inserted therein; and
 - a second substrate installed on the buffering member, and
- wherein the second substrate has a guide hole formed thereon to allow an upper end of the support rod to be inserted therethrough.

8. The floor construction structure of claim **7**, wherein the first substrate and the second substrate comprise support portions formed on surfaces thereof in contact with the buffering member.

9. The floor construction structure of claim **7**, wherein the shock absorbing unit further comprises a height adjustment member installed on one or more portions selected from a portion between the first substrate and the buffering member and a portion between the second substrate and the buffering member.

10. The floor construction structure of claim **7**, wherein the buffering member is an elastic body which is formed by stacking a plurality of conical hat members.

11. The floor construction structure of claim **7**, wherein the upper end of the support rod is inserted into the guide hole of the second substrate and is disposed with a step of a predetermined distance from an upper end of the guide hole.

12. A floor construction structure for a building, comprising:

- a concrete panel according to claim **2**;
 - a plurality of shock absorbing units installed on the concrete panel;
 - a thermally conductive metal plate installed on the shock absorbing unit;
 - a heat insulator installed on the concrete panel; and
 - a heating pipe installed between the heat insulator and the thermally conductive metal plate, and
- wherein a filling material is embedded in a filing cell of the concrete panel.

13. The floor construction structure of claim **12**, wherein a buffering pad is installed on a contact interface between the shock absorbing unit and the thermally conductive metal plate.

14. The floor construction structure of claim **12**, comprising a plurality of concrete panels, and

wherein the plurality of concrete panels are fastened to each other through a tension wire.

15. The floor construction structure of claim **12**, wherein the shock absorbing unit comprises:

- a first substrate installed on the concrete panel;
 - a plurality of support rods installed on the first substrate;
 - a buffering member which has elasticity and allows the support rod to be inserted therein; and
 - a second substrate installed on the buffering member, and
- wherein the second substrate has a guide hole formed thereon to allow an upper end of the support rod to be inserted therethrough.

16. A floor construction structure for a building, comprising:

- a concrete panel according to claim 3;
 - a plurality of shock absorbing units installed on the concrete panel;
 - a thermally conductive metal plate installed on the shock absorbing unit;
 - a heat insulator installed on the concrete panel; and
 - a heating pipe installed between the heat insulator and the thermally conductive metal plate, and
- wherein a filling material is embedded in a filling cell of the concrete panel.

17. The floor construction structure of claim 16, wherein a buffering pad is installed on a contact interface between the shock absorbing unit and the thermally conductive metal plate.

18. The floor construction structure of claim 16, comprising a plurality of concrete panels, and

wherein the plurality of concrete panels are fastened to each other through a tension wire.

19. The floor construction structure of claim 16, wherein the shock absorbing unit comprises:

- a first substrate installed on the concrete panel;
 - a plurality of support rods installed on the first substrate;
 - a buffering member which has elasticity and allows the support rod to be inserted thereinto; and
 - a second substrate installed on the buffering member, and
- wherein the second substrate has a guide hole formed thereon to allow an upper end of the support rod to be inserted therethrough.

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