Sept. 6, 1966 M. J. KODARAS 3,270,475

IMPACT NOISE ISOLATION FLOOR CONSTRUCTION

Filed Sept. 19, 1963 2 Sheets-Sheet 1

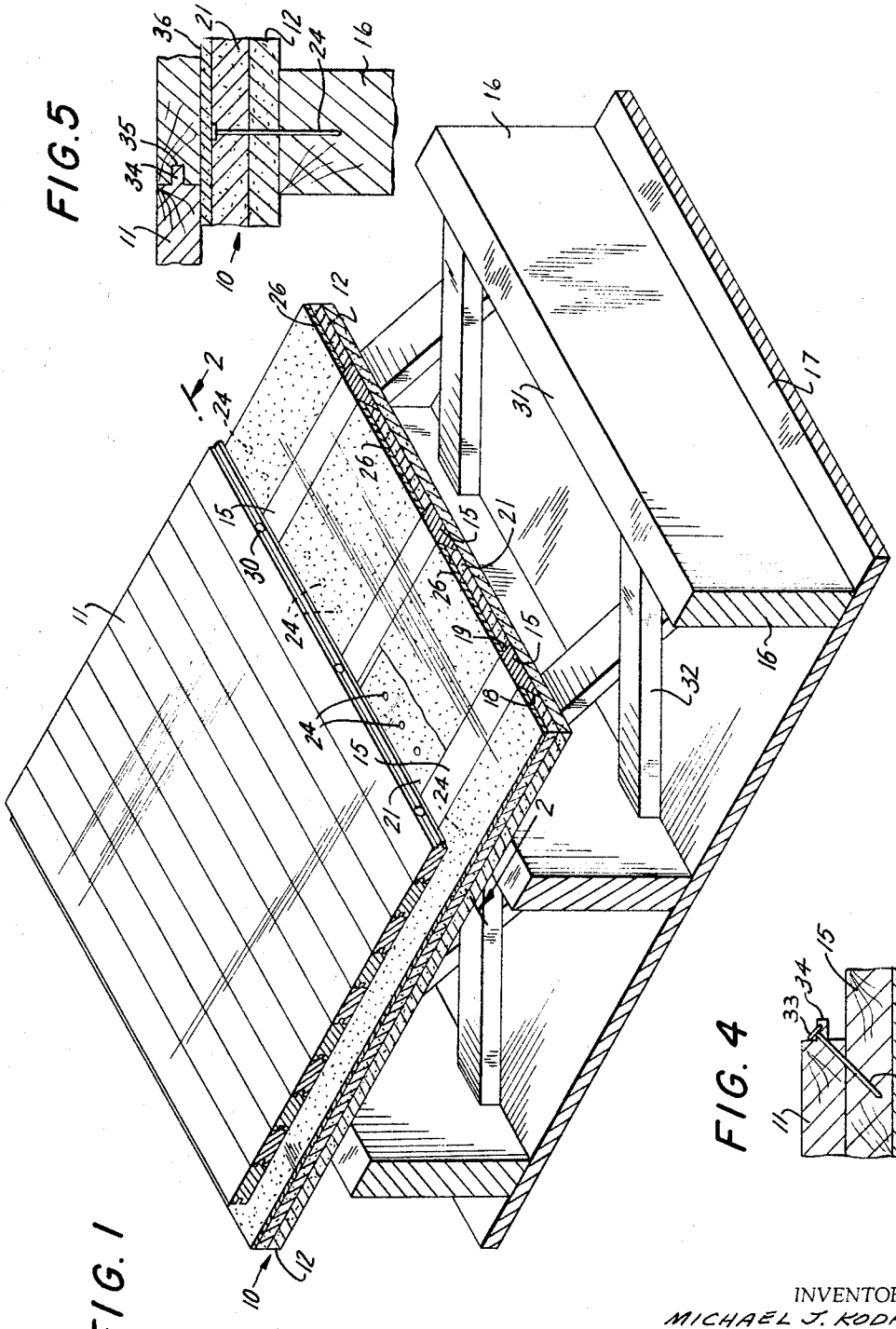


FIG. 1

FIG. 5

FIG. 4

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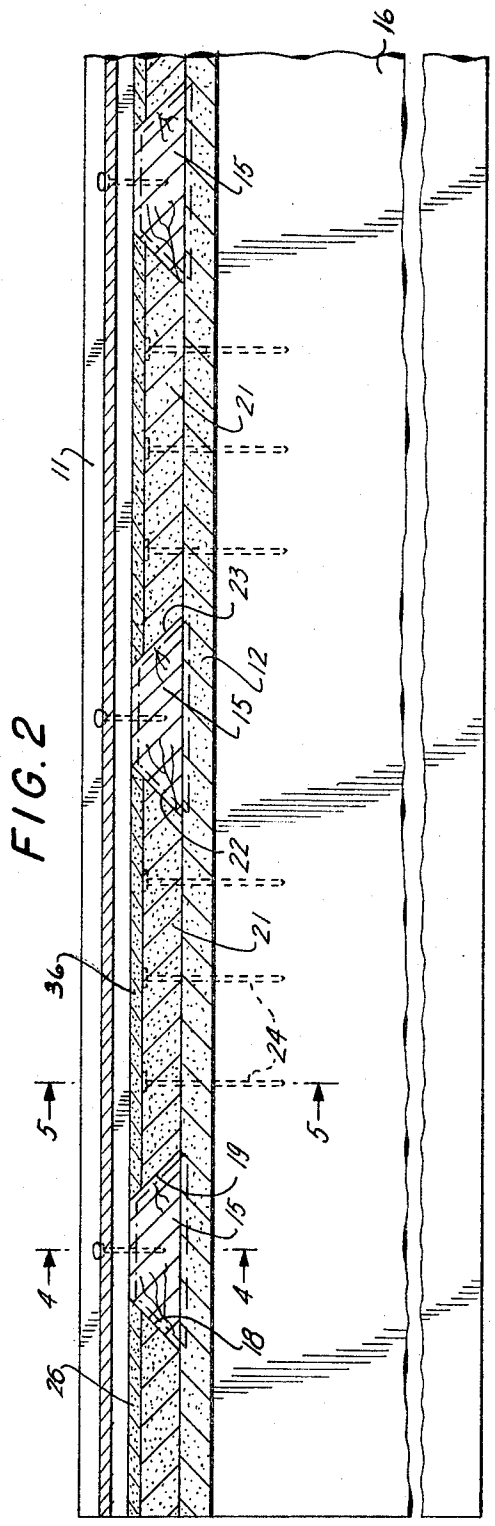


FIG. 2

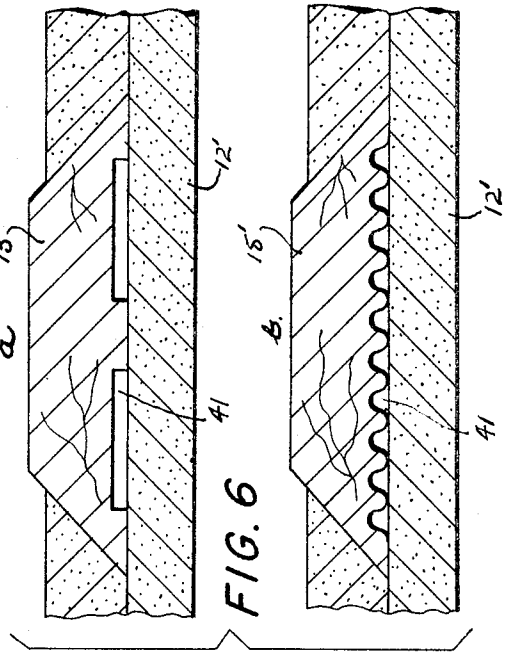


FIG. 6

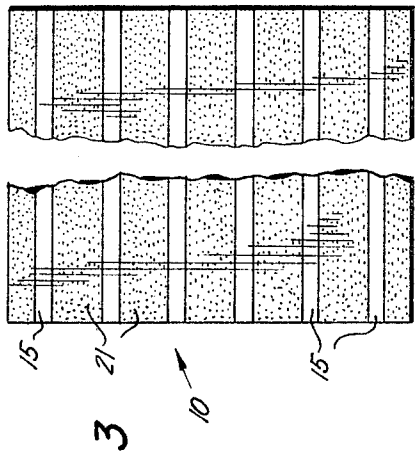


FIG. 3

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3,270,475

Patented Sept. 6, 1966

3,270,475

IMPACT NOISE ISOLATION FLOOR CONSTRUCTION

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Filed Sept. 19, 1963, Ser. No. 310,030
1 Claim. (Cl. 52—480)

This invention relates to the art of floor construction and more particularly to a sub-floor construction which serves to minimize the transmission therethrough of impact noise.

As conducive to an understanding of the invention, it is noted that it is desirable in most building construction to isolate one floor from another in order to minimize impact noise transmission through the floor to the room immediately below for example, such as is caused by hard heels, dropping of objects and other impact noises.

Where impact noise reduction techniques are employed which require specially skilled technicians for the installation thereof and require the use of individual, separately handled layers of acoustical material, the time and cost of the installation is materially increased which is economically unsound.

Where the resultant finished floor is not positively supported and is able to shift or is soft or "bouncy," the finished floor is not commercially suitable.

It is accordingly among the objects of the invention to provide an impact noise isolation floor construction that is relatively simple to install without the need of specialized techniques and hence may be installed by the workman who installs the conventional floor of a room, and which will substatnially minimize impact noise transmission from floor to floor, yet will provide a firm floor that is not soft or bouncy and will provide substantially the same feel to the occupant as a conventional floor construction and the installation of which adds relatively little time or cost over that of a conventional floor construction.

Another object of the invention is to provide a prefabricated sub-floor panel which may readily be constructed and which may readily be handled and installed without the need for specialized tools or skills to provide a high degree of impact noise isolation from floor to floor and which will have the requisite structural strength to support the usual loads applied to a conventional floor.

According to the invention, in constructing a floor, in accordance with the teachings of this invention, the primary floor support, be is concrete slab, or a joist construction of wood, steel, concrete or the like, is covered with a sub-floor panel comprising a relatively soft low density cushioning layer of sheet material such as wood fibers, fiber glass, rock wool fibers or the like with a density in a range between .5 to 6 pounds per cubic foot. Positioned on the cushioning layer is a plurality of spaced parallel nailing strips of conventional type, namely, wood. Arranged to lie between the nailing strips on the top surface of the cushioning layer are spacer strips of a relatively higher density and which also may be of wood fibers, fiber glass, rock wool or the like having a density in a range between 6 and 25 pounds per cubic foot. The side edges of the relatively high density spaced strips are arranged in abutment with the nailing strips and are preferably interlocked therewith. An additional damping layer of extremely low density material having a density in a range between ⅛ and 1 pound per cubic foot may be arranged over the relatively high density material immediately beneath the flooring which is secured to the nailing strips.

It is preferred that the cushioning layer, the nailing strips and the spacer strips be prefabricated into assembled laminated panels by the use of conventional adhesives. Thereafter, in use, the assembled panels are laid over the primary floor support to act as a sub-floor for the flooring material which is secured to the nailing strips by the utilization of conventional flooring techniques. It will be understood that the nailing strips are spaced apart a distance such as to permit securement thereto of the floor components, be they tiles, wood strips, or the like. The flooring material is fastened to the nailing strips in conventional fashion either by nailing, or by the use of adhesives in the case of floor tiles. As will become hereafter apparent, any shock load imparted to the floor will be transmitted from the floor to the nailing strip, but will be damped before transmission to the primary floor support by virtue of the relatively low desnity material between the primary floor support and the nailing strip, and by virtue of the relatively higher density material adjacent the nailing strips which isolate the nails, or other securing members from the flooring and the primary floor support.

In the accompanying drawings in which are shown one or more of various possible embodiments of the several features of the invention,

FIG. 1 is a perspective view of a wood joist floor construction incorporating an impact noise isolation sub-floor embodying the invention and showing a conventional strip floor applied thereto.

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1,

FIG. 3 is a top plan view with a center portion broken away of the sub-floor panel employed in FIG. 1,

FIG. 4 is a sectional view taken along line 4—4 of FIG. 2 showing the floor strips secured to the mailing strips,

FIG. 5 is a sectional view taken along line 5—5 of FIG. 2 illustrating the proposed method of securement of the impact noise isolating sub-floor to the primary floor supporting joists, and

FIGS. 6*a* and 6*b* represent modifications of the nailing strip to effect a reduction of contact area of the nailing strip with the relatively soft cushion layer so as to increase the unit load on the soft material and the resultant deflection produced by the load on the floor to enhance impact noise reduction.

Referring now to the drawings, in the illustrative embodiment of the invention shown in FIGS. 1 to 5, the impact noise isolation sub-floor **10** shown incorporated in a conventional wood joist building construction in which wooden strips **11** in side by side relation serve as the finished floor of the room.

As shown in the drawings, the sub-floor **10** is formed from a plurality of rectangular panels, each of laminar construction of any size suitable for ready handling, such as panels 4' by 8' or 3' by 7'.

Each panel **10** has a base layer **12** formed of a sheet of relatively soft, low density cushioning material such as wood fibers, fiber glass, rock wool fibers or the like. The precise density of the base layer **12** is dependent upon the degree of isolation required, the weight of the flooring supported thereby and the weight of other construction placed upon the portion of the base layer **12** that carries the load. However, densities in the order of .5 to 6 pounds per cubic foot have been found commercially desirable, it being preferred that the base layer deflect from 1/16 inch to 3/16 inch when subject to load.

Extending longitudinally of the base layer **12** and preferably secured thereto as by gluing are a plurality of spaced parallel nailing strips **15**, illustrative ¾ inch thick, preferably formed of hard wood and which are used to provide a secure nailing member to which the finished floor strips **11** may be secured without providing a direct path of impact noise transmission to the wood joists **16** and the ceiling **17** attached to the joists **16**.

The nailing strips 15 may be of any suitable shape, but illustratively are formed with opposed outwardly beveled edges 18 and 19 as best shown in FIGS. 1 and 2, so that they are substantially trapezoidal in cross section.

Extending longitudinally of the base layer 12 between the nailing strips 15 and secured to the base layer 12 as by gluing, are a plurality of spacer strips 21 each formed of a relatively high density sheet material which also may be of wood fibers, fiber glass, rock wool fibers or the like. The density range of the spacer strips is desirably between 6 to 25 pounds per cubic foot.

The side edges of the spacer strips 21 preferably engage the nailing strips 15 and to this end are illustratively joined with opposed inwardly beveled edges 22, 23 which engage the beveled edges 18, 19 of the nailing strips 21 and retain the latter against the base layer 12.

The spacer strips serve to strengthen the sub-floor 10 so as to facilitate ready handling thereof; they serve to act as a retainer for the nailing strips 15 and also to isolate the nails 24 used to fasten the sub-floor 10 to the wood joists 16 as will be hereinafter described.

As is shown in FIG. 2 the spacer strips are illustratively ⅝ inch in thickness so that a space of ⅛ inch will be provided between the top surface of the spacer strips 21 and the top surface of the nailing strips 15.

In constructing the floor, the panels 10 are positioned on the top surface 31 of the joists 16 which are reinforced by bridging strips 32 in conventional manner. Nails 24 are driven through the relatively high density spacer strips 21 into the joists 16 as shown in FIGS. 1, 2 and 5.

The nails 24 are set flush with or below the surface of the spacer strips 21 during installation to avoid "short-circuiting" of the construction in the event a heavy load forces the undersurface of the finished flooring 11 against the spacer strips 21.

The flooring which has been illustrtively shown as conventional wood strip flooring 11, is secured to the panel 10 by the use of conventional nailing techniques in which nails 33 are driven at an angle through the longitudinal tongues 34 along one side of each flooring strip 11 which seats in a corresponding longitudinal groove 35 in the adjacent strip 11.

If desired, additional isolation may be provided where thin floors are employed by filling the space between the top of the spacer strips 21 and the top of the nailing strips 15 with a damping layer 36 of soft compressible material of the above type over which the floor strips 11 extend, said layer being of thickness in the order of ⅛ of an inch.

It is of course to be understood that the panels 10 could also be employed in a building construction where a concrete slab provides the primary floor support. In such case instead of the nails 24 which are driven into the wood joists 16, suitable fastening means would be used of conventional type to fasten the panels 10 to the concrete slab. Thereafter, the wooden strips 11 would be secured to the nailing strips 15 in the manner previously described with respect to the wood joists construction.

With the construction shown in FIGS. 1 to 5, it will be noted that any impact load imparted to the floor 11 is transmitted to the nailing strips 15 and then will be absorbed by the relatively soft base layer 12. As the nails 33 which secure the flooring strips 11 to the nailing strips 15 are completely isolated from the joists 16, there is no direct transmission of energy to the joists and hence to the ceiling 17 therebelow, but such impact noise will be absorbed by said base layer 12 which will deflect or compact in response to the application of the load thereabove.

As the base layer 12 is secured to the joists 16 by nails 24 which are isolated from the wood floor strips 11, there will be no direct transfer or energy from such strips 11 to the joists 16.

More particularly, the impact of a hard shoe heel such as a woman's heel, on the finished floor 11, will be transmitted to the nailing strip 15 which, resting on the cushioning layer 12, will deflect such layer to absorb a major portion of the impact energy before it can be transmitted through the joists 16 to the large radiating ceiling surface 17.

Should a very heavy load such as a piano be placed on the floor surface 11, the construction remains structurally sound and acoustically efficient because of the deflection of the soft cushioning layer 12 is limited to approximately the ⅛ inch vertical distance that the nailing strips project above the surface of the relatively dense spacer strips 21.

As soon as such deflection of the cushioning layer 12 exceeds ⅛ inch, the load will automatically be transferred to the spacer strips 21 which have a very much larger bearing surface with respect to layer 12 under load. Thus the weight of the heavy object will be distributed over a large area which will provide a firm support that will not be too soft for walking.

It is noted that the degree of isolation efficiency of the sub-floor is dependent in part upon the amount of deflection of the soft base layer 12. Thus, the larger the deflection, the greater the efficiency, within the limitation that the final floor construction must be structurally safe and not too soft for walking or supporting a load.

It is apparent that the amount of deflection of the base layer 12 will vary as a function of its density and resilience and also as a function of the area of the base layer 12 that is loaded by contact of the undersurface of the nailing strips and the tops of the wood joists 16 that run at right angles to the nailing strips 15.

Where the density and resiliency of the base layer 12 cannot be reduced sufficiently to achieve a desired degree of isolation efficiency, the contact area of the undersurface of the nailing strips 15 can be reduced.

Thus, as shown in FIGS. 6*a* and 6*b*, for example, the undersurface of the nailing strip 15′ can have a plurality of longitudinal grooves 41 therein defining relatively narrow lands 42 which engage the base layer 12′ to reduce the contact area of such undersurface thereby increasing the amount of deflection of the base layer.

It is apparent that such reduced contact area may be employed with the construction shown in FIG. 6 in which the primary floor is a concrete slab.

It is apparent that with the use of the sub-floor panels above described, an impact noise floor construction may be provided which may readily be installed without the need for special equipment and which efficiently minimizes impact noise.

As many changes could be made in the above constructions, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claim, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

A prefabricated impact noise isolation sub-floor panel adapted to be secured to a building structure and to carry wood strip flooring, comprising a cushioning layer of relatively low density material and of dimensions substantially equal to that of the panel size, a plurality of nailing strips of rigid material arranged over said cushioning layer and bonded thereto in spaced parallel relation, a plurality of spacer strips of relatively higher density material than said cushioning layer arranged respectively between said nailing strips, and spacing said nailing strips one from the other, said nailing strips being formed with outwardly inclined beveled edges and said spacer strips being formed with inwardly inclined beveled edges coacting with the associated edges of said nailing strips,

the tops of said nailing strips extending beyond the top of said spacer strips and a dampening layer of compressible material arranged over said spacer strips between said nailing strips, whereby when conventional wood strip flooring is secured to the panel by nails driven into the nailing strips, and the spacer strips of the panels are secured to the building structure, any impact load imparted to the wood strip flooring will be absorbed by said cushioning layer, and as the nails which secure the flooring strips to the nailing strips are isolated by the spacer strips from the building structure, there will be no direct transmission of noise to the building structure.

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