

Aug. 1, 1961

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2,994,112

ACOUSTICAL INSULATION PANELING SYSTEM

Filed March 30, 1956

4 Sheets-Sheet 1

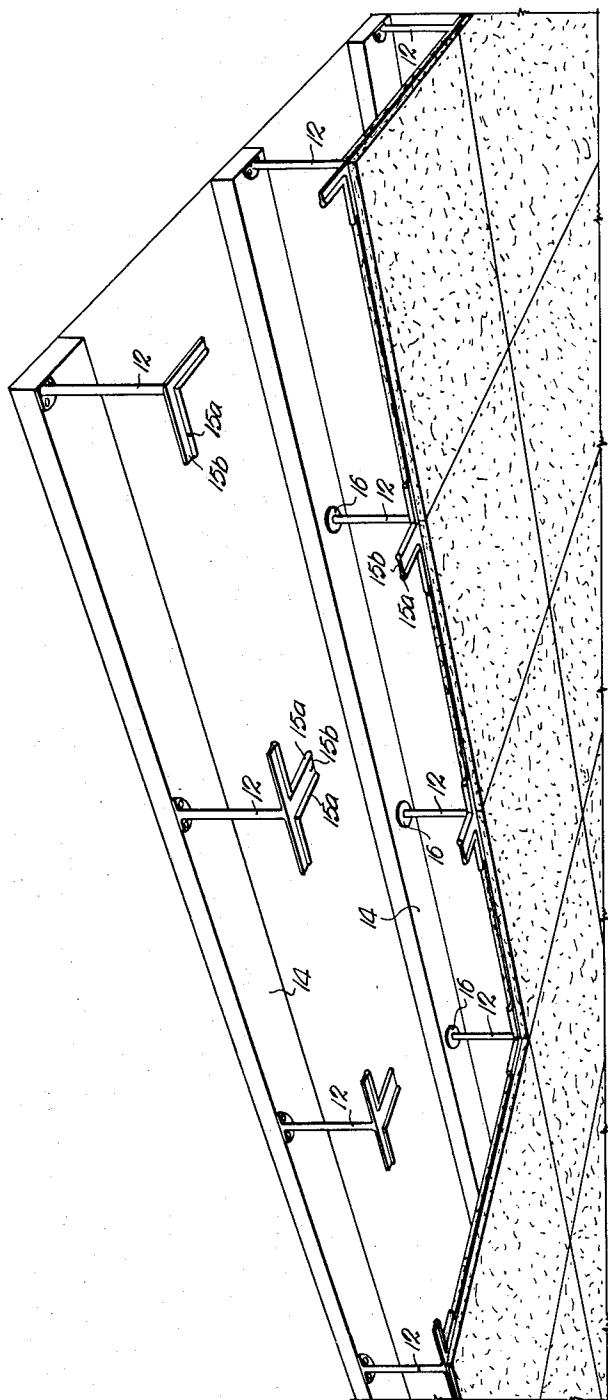


Fig. 2.

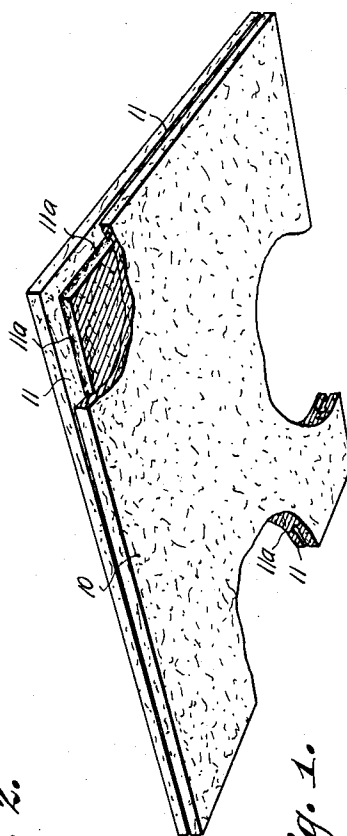


Fig. 1.

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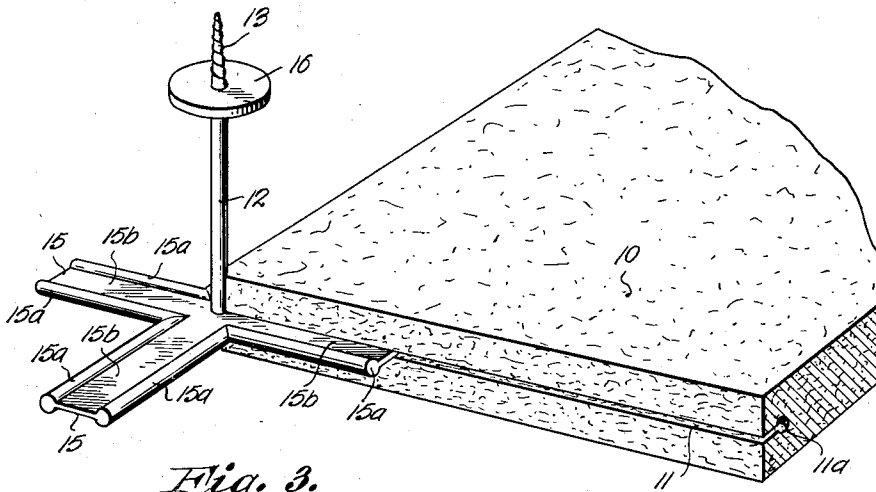


Fig. 3.

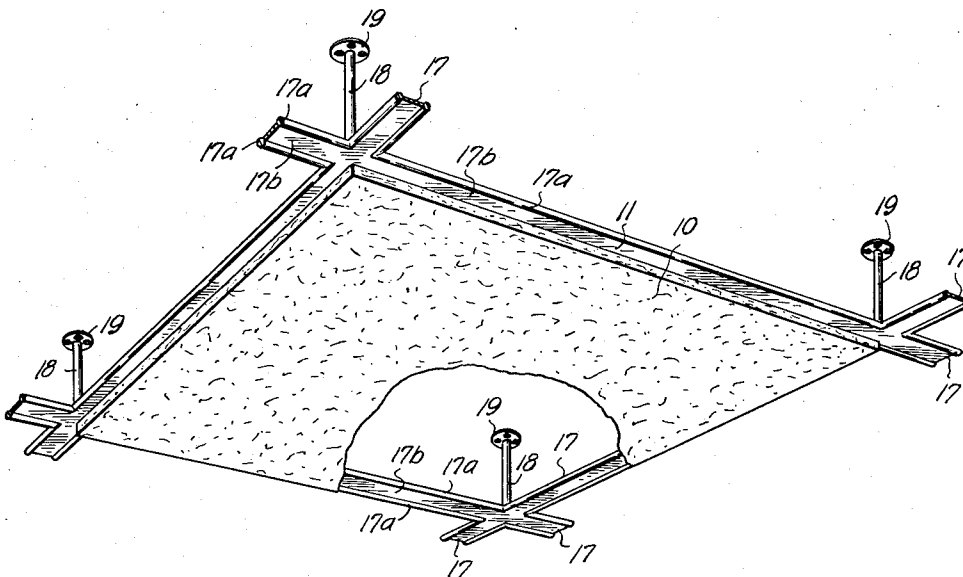


Fig. 4.

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4 Sheets-Sheet 3

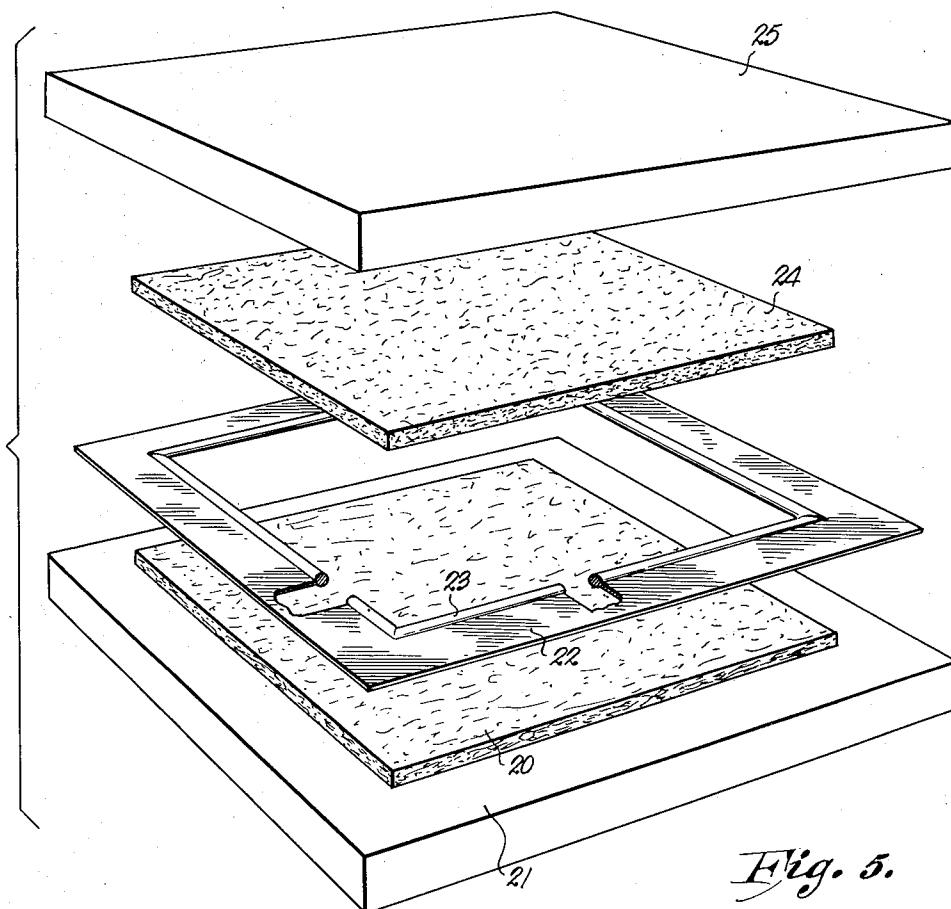


Fig. 5.

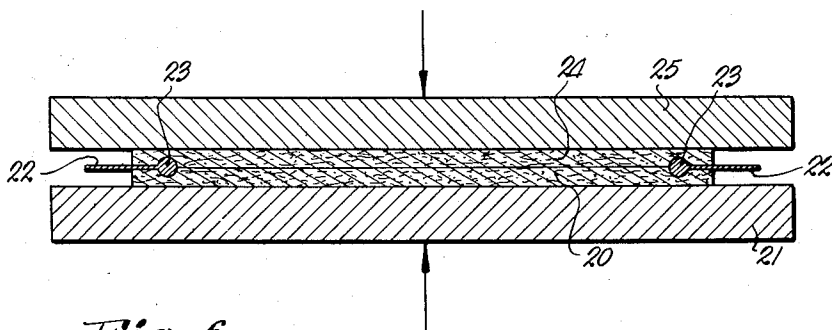


Fig. 6.

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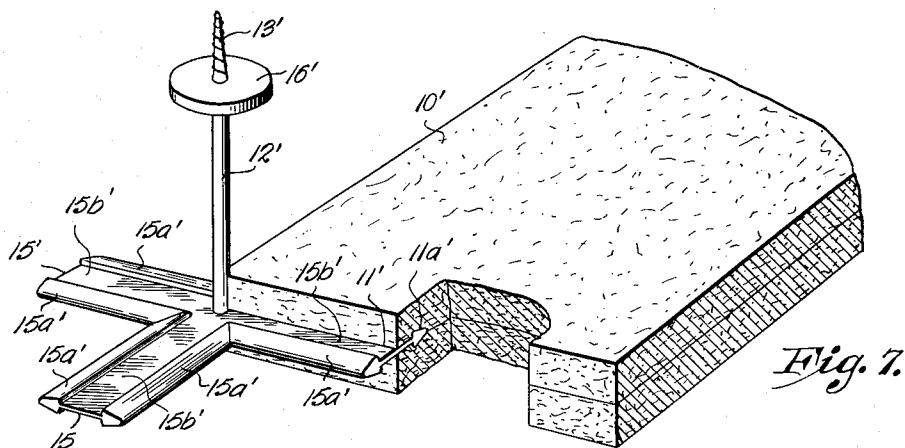


Fig. 7.

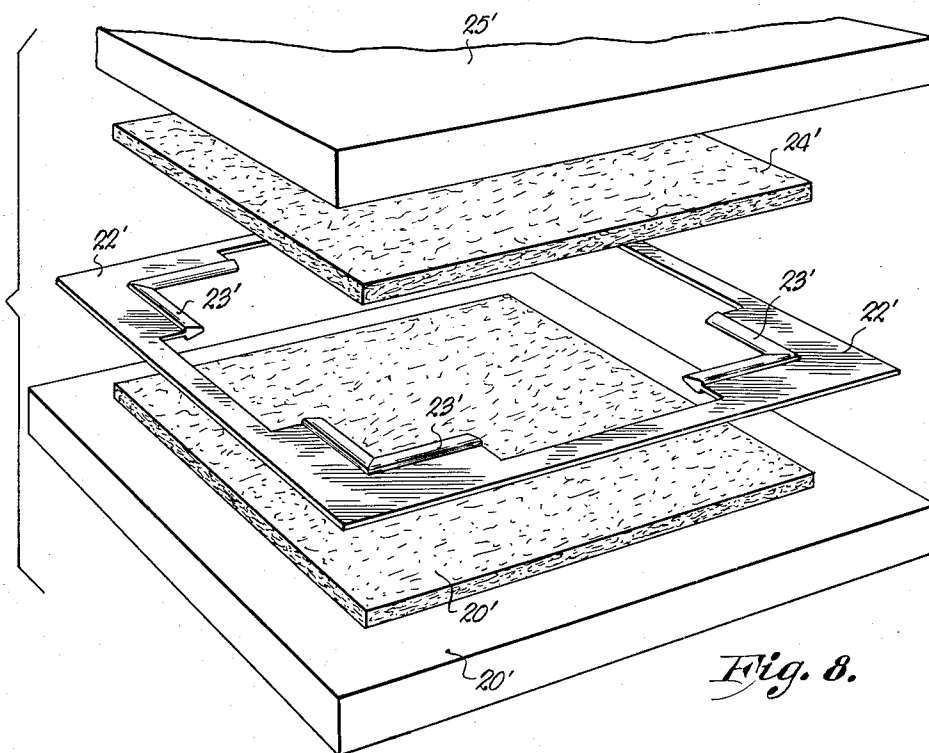


Fig. 8.

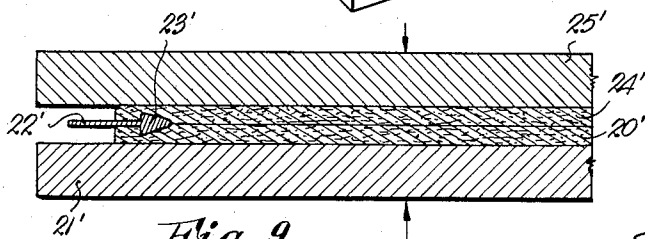


Fig. 9.

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ACOUSTICAL INSULATION PANELING SYSTEM
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4 Claims. (Cl. 20—4)

This invention relates to the suspension of acoustical insulation panels and refers more particularly to a suspended acoustical panel system employing deformable, yet semirigid acoustical tiles therein.

This application is a continuation-in-part of my co-pending application, Serial No. 544,183, entitled "Acoustical Insulation Paneling System," filed November 1, 1955.

Conventional acoustical insulation panel boards or tiles are generally rigid, nonresilient and noncompressible pieces. Even in the instances when a fibrous mat, such as a glass fiber mat bonded with a plastic resin, has been employed, such mats have been of similar character, employing stiff, heavy glass fibers and comprising relatively high density compositions with a brittle, punky structure. Conventional wall boards or insulating panels must be mounted essentially like any rigid construction element relative the wall surface which is desired to be insulated. Thus, if they are to be applied directly to a wall surface, adhesive or securing means applied individually to each panel must be employed. If it is desired to space such conventional acoustical panels relative or away from the wall surface ("drop ceiling" suspension systems), elaborate frameworks are necessitated, said frames requiring individual fixation of the separate tiles thereto by conventional securing means. Drop ceiling suspension systems are desirable in that they require no finished ceiling under them between the tiles and ceiling service elements as ducts, conduits, wires, etc., may be installed and, finally, acoustical tile with air space behind it absorbs sound more efficiently than tile fixed to a hard surface.

In my application, Serial No. 544,183, mentioned above, of which this application is a continuation-in-part, resilient insulating panels with cooperating mounting means engaging semicylindrical grooves in the edges of the panels are shown. This construction is operative but has certain drawbacks. Thus, the relatively shallow semicylindrical grooves in the edge of the mat engageable by cylindrical crow's feet on spacing arms in some instances do not offer as positive support as may be desired. Particularly this is the case where individual panels of relatively large area are used and more weight must be carried by the crow's feet. Thus it becomes desirable to provide a better construction for the paneling grooves and engaging crow's feet to support such larger area panels while still permitting the snap-on panel mounting feature. Also, where a greater distortion of the panels is required to mount them on the spacing arm crow feet, it is possible to obtain a positive compression on all panels, thus resulting in a more uniform and smooth face to the whole paneling system while also permitting more frictional support of the panels by themselves.

Another problem that arose relative the constructions shown in my original application was that while the semicylindrical grooves as shown therein could be produced by squeezing in portions of the mold against the edges of a single piece of mat to be molded to form the grooves, it was relatively difficult to avoid wrinkling near the edges of the major faces, that is, the top and bottom faces of the tile or panel piece. In such a method of forming the tiles, the mat would be completely contained within the mold, the major faces being between plates or mold platens with the edges formed by framing portions of the

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mold on all four edges. In such case a single piece of mat or preform was used as the charge into the mold. Thus, it became desirable to provide a method of molding the tiles which would easily produce the grooved edges without wrinkling the major faces of the tiles so that a system of the tiles would make a smooth, unbroken paneled face. Furthermore, when it became clear that it was desirable to provide deeper grooves in the edges of the mat than the semicylindrical ones shown in my original application and, especially, when it was desired to form the grooves of different thicknesses at varying depths in the mat it was obvious that the old molding technique was inadequate to perform the desired task. Therefore, it became necessary to provide a method of molding acoustical panels wherein relatively deep grooves could be formed in the edges of the tile without wrinkling or distortion of the major faces of the tile and also grooves of varying thickness at varying depths therein.

Therefore, an object of the present invention is to provide an acoustical paneling system employing a plurality of resilient, yet semirigid insulating tiles therein and cooperating suspending means for the tiles with which the tiles are engaged by deformation of the physical structure of the tiles themselves.

Another object of the present invention is to provide an acoustical paneling system employing a plurality of resilient fiber mat acoustical panels and suspending means for spacing the panels relative a wall surface, the suspending means engaging the edges of the acoustical mats by virtue of the deformability and resilience of the mats themselves and not requiring any additional mechanical attachment therebetween.

Another object of the invention is to provide an acoustical paneling system employing a plurality of resilient fibrous mats and suspending means for spacing said mats relative a wall surface which engage only the edges of said mats, the suspension means being entirely hidden from view by the mats they support.

Another object of the invention is to provide an acoustical paneling system comprising insulating tiles and suspending means therefor of a character which permit the selection of tiles of any desired size by varying the spacing of the suspension means relative themselves and wherein miscellaneous shaped and sized tiles may be employed to fit wall areas of the same character.

Another object of the invention is to provide an acoustical paneling system comprising a plurality of resilient, deformable, yet semirigid insulating tiles and suspension means therefor, wherein the character of the engagement between the insulating panels and the suspension means permits the employment of suspension means of a minimum size and wherein a plurality of the acoustical tiles are engaged by and suspended relative a single suspension element.

Another object of the invention is to provide an acoustical paneling system suitable for employment as a drop ceiling suspension system which employs essentially fire resistant tile thereby permitting compliance with recent changes in fire codes requiring such materials.

Another object of the invention is to provide an acoustical paneling system employing a plurality of resilient, yet shape-retaining fibrous mats and suspending means for spacing said mats relative a wall surface wherein grooves are formed in the edges of the mats to be engaged by the suspending means, the grooves having portions therein of greater thickness and portions therein of lesser depth to engage correspondingly shaped portions of the suspension means whereby to provide very sure and stable mounting of the tiles relative the suspension means.

Another object of the invention is to provide grooved tiles engageable by suspension means, the grooves having

parts of varying thickness to engage portions of varying thickness on the suspension means, the suspension means either being separate members separately engageable with a wall surface or a unitary grid construction mountable on the wall surface as a unit.

Another object of the invention is to provide a method of molding the paneling tiles having grooves in the edges thereof with or without portions of the grooves being of varying thickness to engage suspension means of variable thickness, which method of molding will provide the grooved tiles as desired without any distortion of the edges or faces thereof which permits the provision of a paneling system of smooth, undistorted face.

Other and further objects of the invention will appear in the course of the following description.

In the drawings, which form a part of the instant specification and are to be read in conjunction therewith, embodiments of the invention are shown and, in the various views, like numerals are employed to indicate like parts.

FIG. 1 is a perspective view of an acoustical tile having deep grooves of varying thickness for various depths thereof suitable for use in an acoustical paneling system embodying the invention.

FIG. 2 is a bottom perspective view of a plurality of the inventive mounting elements to be employed with a grooved tile as in FIG. 1 in the preferred form of the invention positioned relative ceiling furring strips.

FIG. 3 is a perspective view of a single one of the inventive suspension means employed in the preferred form of the acoustical paneling system engaged with a single acoustical insulating tile having deep variable thickness grooves suitable for use in the inventive paneling system.

FIG. 4 is a bottom perspective view of a modification of the inventive paneling system showing a modified grid suspension means engaged by an acoustical tile having deep grooves of varying thickness suitable for use therewith in the practice of the modified form of the invention.

FIG. 5 is a schematic exploded perspective view of the apparatus employed in the inventive method of molding the acoustical tiles employed in the inventive paneling system.

FIG. 6 is a side sectional view of a stage in the inventive molding method using apparatus of FIG. 5.

FIG. 7 is a view identical to that of FIG. 3 except the ceiling suspension means employed therein has spline portions in the groove engaging feet thereof of triangular form in cross section rather than cylindrical form as in FIG. 3, the triangular spline portions engaging grooves in the mat having the deeper portions thereof formed also triangular in cross section to receive and engage the spline portions.

FIG. 8 is a view identical to that of FIG. 5 except the framing member (the central piece in the figure) employed to give form to the grooves in the finished mat has the groove forming portions thereof limited in extent and shape to form grooves only for the modification of the suspension means shown in FIG. 7 as opposed to those of FIGS. 3 and 4.

FIG. 9 is a partial side sectional view of a stage in the inventive molding method using the apparatus of FIG. 8.

The invention comprises an acoustical paneling system made up of a plurality of resilient, deformable, yet semi-rigid insulating tiles and suspension means for positioning the tiles relative wall surfaces, the system in combination providing a continuous panel of acoustical insulation. Two modifications of the invention are shown in the figures. The general nature of the acoustical panels suitable for use in the inventive system will be first described and the specific modifications of the invention as embodied in the suspension means and the interengagement of the tiles therewith.

The acoustical panels for insulating tiles which may be employed in the inventive paneling system must be resilient and deformable, yet essentially semirigid in character.

Functionally, this description means that the tile must be deformable relative itself to decrease its dimension in any direction and yet be of sufficient rigidity and resilience to snap back to its original shape after the deforming force is removed and, when returned to that shape, retain it even when being suspended only by the edges thereof.

I have discovered that a resilient fibrous mat may be fabricated to these specifications. Such a mat is preferably composed of glass fibers having an average diameter of less than ten microns, and preferably about four microns randomly oriented in the mat. Glass fibers of the character described may be bonded together with a plastic, preferably thermosetting, resin to form this mat. A number of plastics are suitable for such a binder including phenol condensation products, melamine resins, urea-formaldehyde resins, urea-melamine resins and vinyl chloride acetate resins. Such a binder is preferably employed in a ratio of 15 to 35% by weight of the thermal insulation or 17 to 55% by weight based on the weight of the glass fibers. The fibers and binder, when bonded together to compose the mat, should form a mat having a density in the range of two to five pounds per cubic foot.

FIG. 1 shows an acoustical insulation tile 10 formed from such a mat and having grooves formed in the edge thereof. The grooves have the portion thereof nearest the edge of the mat of relatively lesser thickness and the internal portions thereof away from the edges of the mat of relatively greater thickness. These portions are respectively indicated at 11 and 11a. The grooves are employed to engage suspending means of a character to be described. The grooves may be varied in position and length on the edges of the mat relative one of the types of suspending means to be described, but the form shown in FIG. 1 having grooves completely circumferential on the edges of the mat is adaptable to all of the forms of suspension means disclosed in the specification. Such grooves 11 and 11a may be formed in the edge of the mat by an inventive method of molding the mat which will be later described. The deeper portions 11a of the grooves should be formed according to the shape of the suspension means employed. Thus the portions 11a of FIG. 1 are cylindrical but may be molded triangular, square, etc.

Since drop ceiling installations are rapidly superseding the old type of acoustical tile adhered to a finished ceiling, it is important to note that fire code regulations require all tile used in drop ceilings to be of a fireproof nature. Tile that would burn does so much more readily and violently if there is an air space behind it. The tile disclosed is fireproof and meets the fire code requirements in addition to possessing the qualities set forth.

FIGS. 2, 3 and 7 illustrate the preferred form of the acoustical tile suspension means having spacing arms 12 with screw portion 13 at the upper end thereof engageable with wall surfaces or furring strips 14 to be laid on wall surfaces and a plurality of acoustical tile groove engaging feet 15. Feet 15 are fixed radially to the outer ends of spacing arms 12. The width of feet 15 is preferably equal to twice the depth of the acoustical tile grooves 11. Acoustical tiles as are shown in FIG. 1 with continuous grooves in the outside edges thereof may be employed with the preferred modification of the suspending means. In this case, the groove engaging feet 15 only engage the corner portions of the grooves. Alternatively, tiles 10 may be formed for this type of suspension means having grooves 11 positioned only adjacent the corners of the tiles and of a length essentially equal to the length of the groove engaging feet 15. The groove engaging feet have spline portions 15a and flat pieces 15b therebetween. The form of the spline pieces is identical with that of the form of the inner portions of the grooves 11a so that the portions 11a will snugly fit around the spline portions 15a. The depth of the tile groove portions 11 is equal to one-half the width of the flat portions 15b on the crow foot arms. It should be noted that the spline pieces of the crow feet may be any

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shape desired in cross section (that is, cylindrical, triangular, square, etc.) to offer the maximum frictional engagement. FIG. 7 (the figure being numbered with primes to distinguish from FIG. 3) illustrates the triangular form of the spline portions with the thickened part or base of the triangle adjacent the edge of the grooves. The deeper portions 11a of the grooves in this form are, of course, molded congruent to the form of the spline pieces. Since the mat is resilient there is no problem of inserting the grooves over the spline portions.

Acoustical tile suspending means of this preferred modification may be employed having only three or two radial feet 15 and with half-section feet 15 or half or quarter-section arms 12 to form the end and side pieces of a panel wall system, as is shown in FIG. 2. Such end and side pieces generally employ pointed rather than screw tips of arms 12. Depth washers 16 may be employed to regulate the extension of the spacing arms 12 from the wall surface and thereby to provide equal spacing distances for each suspension means. As may be readily seen by looking at FIG. 2, a suspension means of the preferred type may be engaged by only one acoustical tile (corner suspension), two acoustical tiles (edge suspending means) or four acoustical tiles (central support). As previously noted, the end and side suspension means may be formed in half and quarter-section as shown in FIG. 1 so, when tiles are fitted into the groove engaging feet of the entire set of suspension elements, all of the groove engaging feet are completely hidden from view by the essentially continuous panel surface. Alternatively, wall molding strips may be employed to retain and support the edges of the tiles at the panel boundaries. (Not shown.)

In operation, wood furring strips 14 may or may not be attached to the ceiling or wall surfaces and are spaced properly relative one another. Spacing arms 12, preferably having depth washers 16 thereon, are then screwed or driven into the wall surface or furring strips 14 or may previously be attached to the latter before mounting on the wall. The groove engaging feet 15 may or may not be detachable from the spacing arms 12 for easier mounting thereof. The distance between the spacing arms 12 of separate suspension means depends upon the length and width of the acoustical tiles. It may be readily seen that odd shaped or nonrectangular pieces may be employed by varying the attachment of the spacing arms 12 to the wall surface or the angles of the groove engaging feet 15 relative one another on the arm 12. After the suspension means have been attached to the wall surface, the acoustical tiles are deformed so that the grooves 11 thereof may be engaged by the groove engaging feet 15. Note that it is practically necessary to deform the tile in at least two directions, therefore requiring quite a great deal of resiliency in the tile itself. When the tiles have all been engaged on the feet 15, a smooth, continuous, self-supporting acoustical panel has been provided completely covering the suspension means. The great depth of the grooves in the panels necessitates extreme compression of the panels in the mounting process and also permits employment of panels of a size which provide positive compression among the panels thereby further sealing the lines of contact of the individual panels and aiding in producing a continuous face of the total panel system.

FIG. 4 illustrates an acoustical tile of the form shown in FIG. 1 mounted on a second modification of the suspending means. Here a plurality of engaging arms 17 form a grid of preferably rectangular partitions. The engaging arms 17 in cross section have spline section 17a and flat section 17b joining the spline sections. The spline sections 17b and flat sections 17a function the same as in the preferred modification of mounting arm to engage the thicker and thinner portions of the grooves 11 and 11a, the spline sections 17b being variable in form as splines 15a to engage grooves 11a of like variable

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form. Here a plurality of engaging arms 17 form a grid of preferably rectangular partitions. The arms 17 are suspended, preferably at their intersections, by spacing legs 18 having wall engaging plates 19 thereon. The engaging arms 17 shown are positioned centrally of the grid, but, as in the previous modification, the side and corner arms of the total grid frame may have only three or two arms 17 meeting at a junction respectively and the side and end arms 17 and spacing legs 18 may be in half-section to permit complete enclosure thereof by the engaging grooves 11 of tiles 10. In a variation (not shown) it is also contemplated that no outside bounding arm 17 ring the grid, but, instead, wall moldings be employed to support the boundary tiles. It should also be noted that it is not necessary to have spacing legs 18 at each arm 17 junction as the provision of a few regularly spaced relative the total grid will suffice.

In operation, the grid arms 17 are suspended by legs 18 from a wall surface or furring strips 14 attached to wall surfaces. It is, of course, not necessary that the grid partitions be rectangular in shape but only that the form of the tiles be congruent with the form of the partitions. After the grid is positioned relative the wall surface, the partitions between the engaging arms 17 are filled by deforming grooved tiles 10 to engage the arms 17 with the grooves 11 thereof. When all the partitions have been filled, an essentially continuous acoustical paneling system will have been provided.

In both modifications of the inventive acoustical paneling system, the panel tiles may be removed from and replaced into the suspension means at will. This feature permits of access to the space above the tiles wherein heating, ventilating, and air conditioning ducts, electrical conduits for lighting or other purposes are normally disposed; thus making such equipment accessible. It further permits of the removal of the tile from the suspension means for cleaning or resurfacing and restoration to place in the suspension system without any disturbance of the elements of the latter.

FIGS. 5, 6, 8 and 9 illustrate the inventive method of forming the panels employed in the inventive acoustical insulation paneling system. The showings of FIG. 5, 6, 8 and 9 are essentially schematic. FIGS. 8 and 9 are identical to FIGS. 5 and 6 save in that the form of the inner groove molding portions are triangular in cross section and limited in extent to mold grooves adapted only for use with suspension elements of the forms of FIG. 3 and FIG. 7. The numbers in FIGS. 8 and 9 are primed to distinguish from FIGS. 5 and 6.

The method comprises the steps of (1) laying a half thickness of green uncured mat 20 on the bottom platen 21 of a mold, (2) laying a framing member 22 on the green mat half-thickness 20, the framing member having a cutout portion therein so shaped as to define the areas of the tile edge in which grooves are to be formed (the framing member in FIG. 5 having enlarged inner circumferential portion 23 to form the enlarged inner portions of the grooves in the mat), (3) then placing a second half-thickness of green uncured mat 24 on top of the framing member 22, and (4) closing the upper platen 25 of the mold on the assembly under such conditions of heat and pressure as to cure the mat and form a finished panel of the desired density and resilience with edge grooves of the desired form.

Stated in other words, the method comprises molding wall panel tiles with grooved edges wherein a hollow center framing member 22 is placed between two half-thicknesses of green, uncured mat 20 and 24 and mold halves 21 and 25, then compressing the two mat thicknesses around the framing member under such conditions of pressure and temperature as to cure the mat and fuse the thicknesses thereof to the desired density with grooves in the edges thereof.

Since the showings of FIGS. 5, 6, 8 and 9 are schematic, the means for moving the mold halves toward and

away from one another are not shown nor are the heating connections to the mold halves shown. Such heating connections may be electrical lines to resistance elements in the mold platens or fluid flow lines (steam, hot air, etc.) of conventional type.

It is evident that the framing member may be of any desired form relative the mat sections. Thus the framing member may be without the enlarged inner rim 23, thereby to form only regular grooves in the edges of the mat. Also, the enlarged portions 23 may be merely of a length equal to the length of the crow's feet in the paneling suspension system (see FIG. 8). The only structural requirement of the framing member is that it be formed with a central cutout portion of lesser area than the area of the green mat section so that the framing member will overlie the edges of the mat to some extent in the molding process to form the grooves therein. The preferred form of framing member is shown in FIG. 5. The effect of the use of such a frame member is to establish a parting line within the green stock half-way through the thickness of the mat, so that the crowding of the stock during the molding operation is in a direction normal to the major faces of the mat rather than normal to the edges. This technique becomes of greater importance as the suspending means crow's feet are enlarged for greater positive support. With this molding method wrinkles may be completely avoided in the formation of the mat. It is obvious, of course, that the two pieces of mat knit together in the curing operation to form a unitary panel.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are obvious and which are inherent to the invention.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter hereinabove set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. In a panel system including a plurality of arrayed, suspension elements fixed to a surface, each suspension element including spacing means communicating with the surface and positioning a plurality of feet substantially radial to the spacing means away from said surface, the radial feet of adjacent suspension elements defining between themselves a plurality of adjacent, connected primary spaces forming together a single secondary space, said primary spaces each having at least a portion of its boundary defined by said feet, and a plurality of semi-rigid resilient, deformable, yet shape retaining tiles, each of said tiles grooved in the edge thereof and engaging with said grooved edges radial feet of the elements defining one of said primary spaces, each tile of such size relative to the primary space into which it is inserted that each said tile necessarily deformed and yielded in a plurality of dimensions whereby the grooved portions in the edge thereof engaged and snapped over the radial feet defining said space, each tile of sufficient rigidity that it returned to and maintains its original form after being snapped over the feet despite the fact that it is supported

only from the edges thereof, the improvement which comprises the portions of the grooves in the tiles away from the tile edges of greater thickness in cross section and the portions of the grooves in the tiles adjacent the edges thereof of lesser thickness in cross section, the radial feet of the elements each having a central portion of lesser thickness in cross section and an outer portion on one edge thereof of greater thickness in cross section, each tile of sufficient strength and resilience that the peripheral lesser thickness groove portions thereof expanded whereby to pass the greater thickness foot portions therethrough, yet returned to shape thereafter and grip the lesser thickness foot portions.

2. An accoustical paneling system as in claim 1 wherein the tile grooves engage with the feet in such manner as to completely enclose the latter.

3. In a panel system including a substantially flat grid of support elements defining a plurality of at least substantially enclosed spaces, each of said spaces having at least a portion of its boundary enclosed by support elements, and a plurality of semi-rigid, resilient, deformable, yet shape retaining tiles, each of said tiles having grooved portions in the edge thereof and engaging with said grooved portions the support elements bounding one of said spaces, each tile of such size relative to the space it is inserted into that the tile deformed and yielded in a plurality of dimensions whereby the grooved portions in the edge thereof engaged the support elements defining said space, each said tile of sufficient rigidity that it returned to and maintains its original form after being inserted in the grid despite being supported only by the edges thereof, and means for attaching said grid to a surface so as to space said grid away therefrom, the improvement which comprises the interior portions of the grooves in the tile edges of greater thickness in cross section and the exterior portions of the grooves of lesser thickness in cross section, each support element having a central portion of lesser thickness in cross section and an edge portion of greater thickness in cross section whereby to match and engage the tile grooves, each tile of such strength and resilience that the peripheral lesser thickness groove portions thereof expanded whereby to pass the greater thickness foot portions therethrough, yet returned to shape thereafter and grip the lesser thickness foot portions.

4. An accoustical paneling system as in claim 3 wherein said tile grooves are engaged with the said grid support elements in such manner as to completely enclose and hide the latter.

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