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ROOF DECK STRUCTURE

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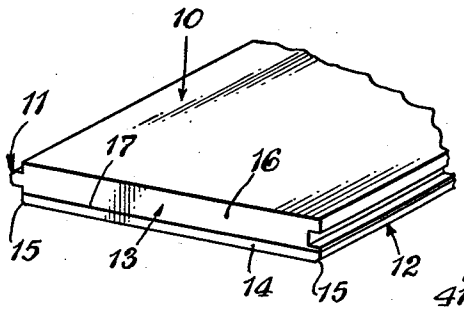

Fig. 1

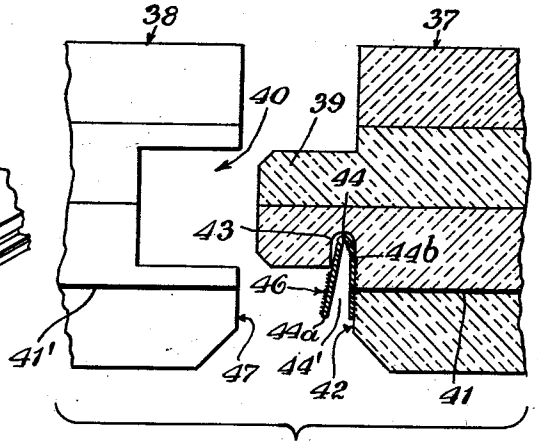

Fig. 3

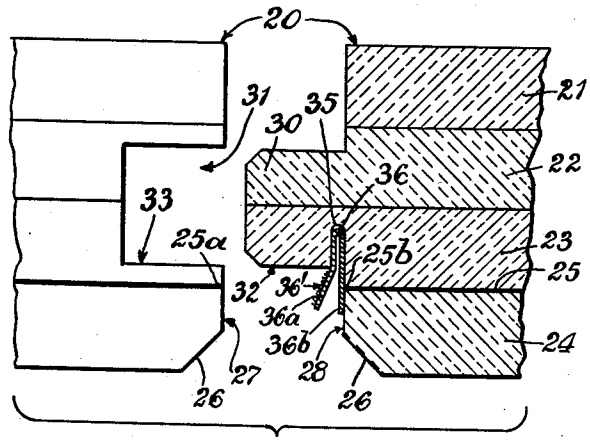

Fig. 2

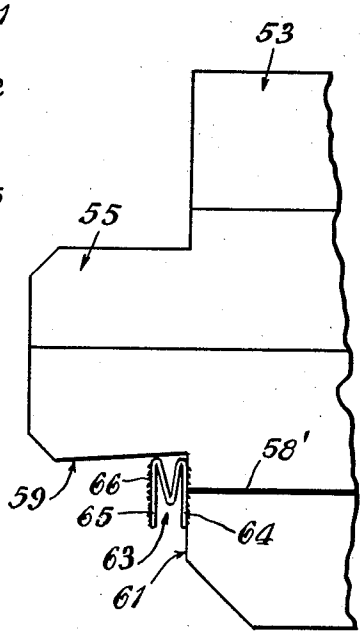

Fig. 5

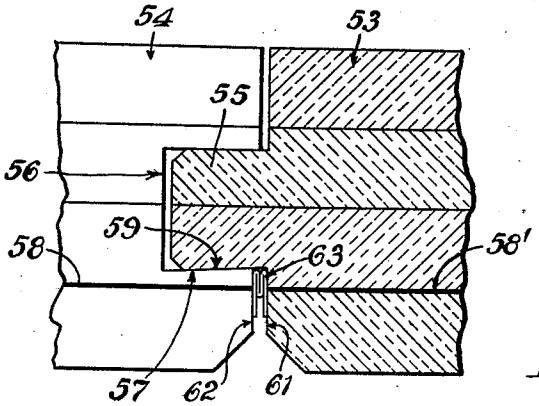

Fig. 4

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ROOF DECK STRUCTURE

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The present invention relates to roof deck structures and in particular to units for assembly to provide a roof deck presenting resistance to the transmission of moisture vapor.

It is commonplace to provide roof-deck units with tongue-and-groove for interfitting. It is also common to provide roof-deck units in rectangular panel form which incorporate a moisture barrier over the panel area.

The present invention is directed to roof-decks and units or panels which may be assembled to provide an exposed interior face as a ceiling, which incorporate at the interior of the panels a moisture barrier and which carry or which may receive moisture-barrier means effective within the tongue-and-groove joint of adjacent units in the assembly.

The units for the present invention are also thermal insulators having adequate strength to serve as structural members when spanning conventionally spaced beams or rafters. As such, they are laminated panels including at least one lamina of structural insulation board. Such a board is represented by a felted wood fiber sheet approximately one-half inch thick at 17 lbs. density per cu. ft. Preferably, however, the panel includes a plurality of such boards as the laminae thereof, and its principal body material may be composed entirely of such boards.

The unit also includes at least one layer or lamina which is a moisture vapor barrier, which need not be thermally insulating, which may be sheet material or a layer of suitable material such as asphalt, or which may be sheet material adhesively united to an adjacent body lamina with adhesive which may or may not be a moisture vapor barrier substance.

In order for the unit to provide in the roof assembly an interior ceiling of desired character, the face lamina for the interior is provided as material capable of original and repeated decoration, and adapted to provide beveled grooves at the joint for decorative effect. Accordingly, such interior face lamina is a fibrous layer, and preferably, a layer of thermal insulation board.

A vapor barrier layer or lamina is more efficient as its location in the unit is closer to the warm interior side of the assembly of units. Consequently, in the present invention, the barrier layer or lamina is placed next to the fibrous interior face layer.

The matching tongue-and-groove of a unit are consequently located beyond the barrier lamina and toward the cold side of the assembly. Thus, in an assembly, the edges of the barriers of matched units oppose each other within a joint.

The present invention contemplates the incorporation of moisture vapor barrier means within the joint, in union with said edges of the barrier and so extended into the joint as to provide a seal between the tongue-and-groove. This may be accomplished in numerous ways as exemplified in the drawings, in which:

FIG. 1 is a perspective fragmentary view having one end of a unit to illustrate the general contour thereof.

FIG. 2 shows fragmentary enlarged views of two units of FIG. 1 in position to be joined, one being in end elevation and the other in cross-section because of staggering units in an assembly.

FIG. 3 is a view similar to that of FIG. 2 showing a modified seal.

FIG. 4 is a view similar to FIGS. 2 and 3, but with the units joined and with a modified tongue-and-groove to effect a seal.

FIG. 5 is an enlarged end view of the right-hand unit of FIG. 4 to show in detail the character of the seal.

It is to be understood that the forms shown in the drawings are for the purpose of illustration, and are not to be considered as limiting the invention short of its scope as expressed in the appended claims.

FIG. 1 shows a unit 10 of suitable dimensions such as 8 feet long, 2 feet wide and 2 inches thick, having on the long sides a tongued edge 11 and a grooved edge 12, and on the ends flat sides 13 for a butt joint. End 13 shows a ceiling-forming face layer 14 with its long edges 15 beveled, an insulating portion 16, and a vapor barrier layer 17. The structure as shown in FIG. 1 may be additionally modified in several ways, either in the unit per se, or in the assembly of units.

In FIG. 2 joining edges of the panel are shown which may be considered as the edges 11 and 12 of a single unit 20 as designated in FIG. 1. The body of the unit is preferably composed of four layers of fiber insulation board designated 21, 22, 23 and 24, adhesively united. Especially, the layers 23 and 24 have a moisture barrier interfacial layer 25. The barrier layer may be a suitably heavy layer of wax or asphalt or other mastic material capable of maintaining layer 24 integral in the unit, or it may be a sheet such as asphalted paper or metal foil adhesively united to the adjacent layers 23 and 24 as by asphalt.

The "ceiling" layer 24 is shown beveled at 26 entirely on the ceiling side of the barrier layer 25, whereby the barrier edges 25*a* and 25*b* are exposed in the perpendicular walls 27 and 28, formed by the edges of layers 23 and 24.

The matching tongue 30 and groove 31 are shown as formed in the layers 22 and 23, being rectangular in cross-section as shown. The tongue has a wall 32 facing the ceiling side and the groove has a matching wall 33. These walls 32 and 33 are shown parallel to the barrier layer 25 and they may slide slightly on each other as the units expand and contract, primarily due to change in moisture content, thus causing to a degree "opening" of the joint.

To prevent the passage of moisture vapor through the joint, and especially as it opens, the joint is provided with barrier means always connecting the edges 25*a* and 25*b* of the barrier layer 25 as the walls move relatively.

The barrier means may be provided in numerous ways. One way is to use barrier means having a fixed portion and a movable portion so that the latter may move with the two units. This is preferably accomplished by using a folded tape of which the opposing leaves within the fold are free to move apart, and of which leaves the exposed faces in two joined units are united to the edges of the barrier layer. The tape may be variously incorporated in the structure.

In FIG. 2 the tongue 30 is recessed as shown at 35 to receive a folded edge 36 of a tape of barrier material having a ribbon-form leaf 36*b* adhesively secured at least to the edge 25*b* of the barrier layer 25 and preferably secured over the entire wall 28 and the extension of said wall into the recess 35. The other ribbon-form leaf 36*a* extends freely from said recess 35 in an unmatched unit, but in position when matched to be adhesively united to the edge 25*a* of the barrier layer and preferably also to the wall 27. Thus, as the two units move relatively to each other, the joint remains sealed by the folded tape, which opens and closes with the movement at the joint.

The tape may be formed by barrier sheet material such as polyethylene, or metal foil, or of non-barrier material such as paper, on which a coat of barrier material has been applied, such as wax, or asphalt, or polyethylene. It is preferred that the adhesive used to mount the tape be of the pressure-sensitive type, so that on the job of

assembling units, the pressure of assembly effects the adhesion. It is also preferred that the tongued edge of the unit be supplied to the user with a tape secured to the unit, which tape has pressure-sensitive adhesive **36'** exposed and directed toward the grooved edge. By mounting the tape in advance on the tongued edge, it is partially protected by the tongue.

In FIG. 2 the recess **35** is narrow permitting little if any opening of the fold within the recess.

In FIG. 3, a recess is shown which is wider than the thickness of the folded tape, whereby the fold may open within the recess, as may be desirable when an exceptionally wide opening of the joint is possible.

In FIG. 3 similar units are shown and generally designated **37** and **38**, with respective tongue **39** and groove **40**, and the barrier layer designated **41** and **41'**. The wall **42** having the exposed edge of barrier layer **41** is extended to form a wide recess **43** in the tongue. To the wall **42** and its extension into the tongue is secured the leaf **44*b*** of a folded barrier tape **44**, the facing surfaces of which in the gap **44'** are mutually non-adhesive so as to separate freely. The opposite leaf **44*a*** is free to swing in the recess **43** and its outer face is provided with pressure-sensitive adhesive indicated by stippling **46**. The grooved edge of panel **38** has wall **47** exposing the edge of barrier layer **41'**, so that in joining units **37** and **38**, wall **47** unites with adhesive **46** to close the joint, and as the joint may open the leafs **44*a*** and **44*b*** separate, but maintain a sealed joint.

FIG. 4 shows a modification of tongue-and-groove pertinent to the present invention. Two matching units **53** and **54** with respective tongue **55** and groove **56** are in position already joined. The groove **56** tapers outwardly having a channel side wall **57** slightly inclined from a position parallel to the barrier layer **58** and **58'**. Tongue **55** is tapered inwardly having a wall **59** matching wall **57**, thereby providing a tongue thicker at its outer end than the opening width of the groove, the differential being coordinated to the compressibility of the body material to permit insertion of the tongue and then its expansion to fitting position. On shrinkage from the natural fitting position, the units separate and the walls **57** and **59** press more tightly together, thus ensuring a tight joint. The opposing walls **61** and **62**, respectively, exposing the edges of the barrier layer designated **58'** and **58** are shown vapor sealed across the gap by means **63**, appearing only as a mass in FIG. 4, but detailed in enlarged FIG. 5. FIG. 5 shows the tongued edge unit **53** in its condition prior to joining it as shown in FIG. 4. The sealing means **63** is shown as an accordion-pleated tape **63**, with two folds, preferably directed toward the tongue, with its inside faces mutually non-adhesive, with the outer face of its leaf **64** united to wall **61** and the edge of barrier layer **58'**, and with the outer face of leaf **65** supplied with pressure-sensitive adhesive **66**, to attach itself to opposing wall **62** of the grooved edge of unit **54** and to the edge of barrier layer **58**. The pleated tape avoids weakening the tongue by a recess, and permits a wide opening of the joint with no danger of tearing the tape from original positions.

Although the invention is shown as applied to but two parallel sides of the rectangular unit, it is to be understood that the remaining two sides may be similarly tongued and grooved and likewise treated for sealing. But, as a practical matter, the butt ends of the unit are secured, as by nails or other means to parallel supporting members so that butt joints lie over supporting members and remain fixed. These joints are sealed with suitable sealer at the time of installation, to provide a barrier-sealed butt joint. The danger of joint-opening occurs in the matched joints at the regions between supporting beams or rafters, whereby practical considerations require the barrier-sealed joints only in two side edges as illustrated.

I claim:

1. A structural insulating roof-deck unit adapted for assembly with like units, said unit comprising a laminated panel of uniform thickness, a first lamina at one face being fibrous insulating board adapted for use as the interior of the roof, an internal moisture vapor barrier in lamina form inwardly from said first lamina, said barrier lamina providing resistance to the transmission of moisture vapor through the unit, at least one lamina inwardly from both said first lamina and said barrier lamina being fibrous insulating board, said unit being rectangular and having two opposite sides formed respectively with complementary tongue and groove each located at a region inwardly from said first lamina and said barrier lamina, all the edges of the barrier lamina being coincident with the edges of the laminae adjacent thereto, said tongue and said groove having complementary interface-forming walls substantially parallel to the facial extent of the unit for permitting movement at a joint between the unit and a like unit in an assembly of such units, said movement resulting from dimensional instability of said fibrous insulating board, said unit having additional vapor barrier means carried by the unit in the corner space below the tongue and along that portion of the edge face between the tongue and said face of the unit, said additional barrier means being a folded tape providing resistance to the transmission of moisture vapor through it, a first one of two extreme leaves of the folded tape being secured across the edge of said barrier lamina at said corner space and secured to the edge faces of the laminae adjacent said edge, and the other extreme leaf being movable toward and away from said first leaf and being provided on its outer face with pressure-sensitive adhesive.

2. A structural unit according to claim 1 in which the tongue has a recess opening toward the barrier lamina and in which the folded edge of said additional barrier means lies in said recess.

3. A structural insulating roof-deck unit adapted for assembly with like units, said unit comprising a laminated panel of uniform thickness, a first lamina at one face being fibrous insulating board adapted for use as the interior of the roof, an internal moisture vapor barrier in lamina form inwardly from said first lamina, said barrier lamina providing resistance to the transmission of moisture vapor through the unit, at least one lamina inwardly from both said first lamina and said barrier lamina being fibrous insulating board, said unit being rectangular and having two opposite sides formed respectively with complementary portions for overlapping at a joint between the unit and a like unit in an assembly of such units, said portions being each located at a region inwardly from both said first lamina and said barrier lamina, all the dges of said barrier layer being coincident with the edges of the laminae adjacent thereto, one of said portions projecting beyond the neighboring edge of said barrier lamina, said overlapping portions being such that in a said joint between two such units the opening of the joint may expand and contract as a result of the dimensional instability of said fibrous insulating board, said unit having additional vapor barrier means carried by the unit in the corner space below said projecting portion and along that portion of the edge face of the unit between said projecting portion and said face of the unit, said additional barrier means being a folded tape providing resistance to the transmission of moisture vapor through it, a first one of two extreme leaves of the folded tape being secured across the edge of said barrier lamina and to the edge faces of the laminae adjacent said barrier lamina, and the other extreme leaf being movable toward and away from said first leaf and being provided on its outer face with pressure-sensitive adhesive.

4. A structural unit according to claim 3 in which said projecting portion has a recess opening toward the

barrier lamina and in which the folded edge of said additional barrier means lies in said recess.

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