FIRE-RETARDANT WOOD ROOF ASSEMBLY

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ABSTRACT

A fire-retardant wood roof assembly is comprised of three layers: an outer layer of fire-retardant wooden shingles or shakes, an inner layer of wood or a subdeck that is formed of a plurality of adjacent wooden members, and a continuous interlayer of a series of sheets of steel foil. The sheets of steel foil nearest the upper longitudinal edge of each member of the inner layer extend over a portion of the top surface thereof, bend downwardly to conform to the upper longitudinal edge of each member, fill the space between each member and each next upper adjacent member, bend towards each next upper adjacent member to conform to the lower longitudinal edge of each next upper adjacent member and cover a portion of the bottom surface of each next upper adjacent member. The series of sheets of steel foil protect the inner layer of wood from exposure to the flame and air, dissipate heat from the top surface of such members should the outer layer of fire-retardant shingles or shakes become exposed to flame, and seal the space between the adjacent wooden members. Consequently, ignition of the top surface of the inner layer of wood from a flame above the wood roof assembly is prevented.

7 Claims, 5 Drawing Figures
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1 FIRE-RETARDANT WOOD ROOF ASSEMBLY
CROSS REFERENCE TO RELATED APPLICATIONS
This application is a continuation-in-part of our copending application, Ser. No. 741,625, filed July 1, 1968, entitled "Fire-Retardant Wood Roof Assembly" now U.S. Pat. No. 3,538,666.

BACKGROUND OF THE INVENTION

1. Field of the Invention
This invention relates to improvements in a fire-retardant wood roof assembly.

Architects are now using wooden shingles and shakes in medium-to-high-priced housing for producing beautiful homes which bring out the warmth and the natural beauty of the wood which synthetic materials do not and cannot achieve. The use of fire-retardant wooden shingles or shakes in housing, however, is restricted to areas of sparse population and to areas where the threat of forest fires and brush fires is minimal. It has been observed that sparks and the like from such fires may ignite the wooden roofs of adjacent dwellings even though the wooden roofs are constructed of fire-retardant shingles or shakes. The ignition of the subdeck is attributable to several deficiencies in presently existing fire-retardant wooden roof designs. For example, over a period of time, fire-retardant wooden shingles or shakes loose their fire-retardant characteristics due to constant weathering which tends to leach the fire-retardant chemicals from the wood. When the fire-retardant chemicals have been leached from the wood, the wooden roofs are more prone to ignition by sparks and the like. Moreover, it has been observed that when fire-retardant wooden shingles or shakes are exposed to flame they char and tend to shrink, thereby exposing the inner layer of wood or the subdeck to flame. It is, therefore, not surprising that fire insurance underwriters do not approve fire-retardant wooden shingles or shakes in areas of dense population and of dense undergrowth.

2. Description of the Prior Art
Research has been conducted toward the development of better compositions and methods for rendering wood fire-retardant. For example, U.S. Pat. No. 3,160,515 describes the impregnation of wood with a solution containing organophosphorus compounds, and U.S. Pat. No. 3,159,503 describes the impregnation of wood with a solution of dicyandime and phosphoric acid which solution contains a carefully controlled minor portion of formaldehyde. These two compositions represent significant advances because these compositions are non-leachable from the wood and, therefore, render wood fire-retardant for a longer period of time than heretofore known. Notwithstanding the development of these new non-leachable compositions and methods of rendering wood fire-retardant, wooden shingles or shakes that have been rendered fire-retardant may crack over a period of time due to weathering or they may shrink if exposed to flame. In either case, if a flame be present for some reason, the wooden subdeck becomes exposed to the flame and can be ignited thereby.

An approach to the handling of the problem of possible exposure to flame is disclosed in our copending application, Ser. No. 741,625, filed July 1, 1968, entitled "Fire-Retardant Wood Roof Assembly" now U.S. Pat. No. 3,538,666. A continuous interlayer of steel foil is placed between the inner layer of wood or subdeck comprised of rightly abutting wooden members and the outer layers of fire-retardant shingles or shakes. The system of application, Ser. No. 741,625, now U.S. Pat. No. 3,538,666, significantly improves the fire-retardant characteristics of a wooden roof assembly. It has been observed, however, that upon the exposure of a portion of such a roof assembly to a flame from above, heat at this location is transferred to the top surface of the underlying subdeck or inner layer of wood. Because the joints where the members of the subdeck abut are not airtight, the oxygen leaks through the joints of the abutting wooden members of the subdeck. When the temperature at the top surface of the inner layer becomes high enough this oxygen permits the inner layer to ignite and burn.

We have now found an improvement to our invention of the above-mentioned copending application which overcomes the localized heating problem and renders a fire-retardant wooden roof assembly more fire-retardant by dissipating heat from the upper surface of the subdeck and by providing a seal between the wooden members of the subdeck.

SUMMARY OF THE INVENTION
In accordance with the invention, in a fire-retardant wood roof assembly wherein a continuous interlayer of steel foil is interposed between an outer layer of fire-retardant wooden shingles or shakes and an inner layer of wood or subdeck that is formed of a plurality of adjacent wooden members, the improvement comprises a sheet of steel foil extending over a portion of the top surface of one member, bending downwardly to conform to one of the edges of such member, filling the space between such member and the next upper adjacent member, bending towards the next upper adjacent member to conform to the edge of the next upper adjacent member and covering a portion of the bottom surface of the next upper adjacent member. The sheet of steel foil, therefore, protects the inner layer of wood from exposure to flame, dissipates heat from the top surface of such member should the outer layer of fire-retardant shingles or shakes become exposed to flame, and seals the space between the adjacent wooden members. Consequently, possible ignition of the top surface of the inner layer of wood is prevented.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partially cut away perspective view of one embodiment of a wooden roof deck assembly constructed in accordance with the invention;
FIG. 2 is a plan view of the wooden roof deck assembly of FIG. 1;
FIG. 3 is a fragmentary cross sectional view of the roof deck of FIG. 2;
FIG. 4 is a fragmentary cross sectional view of another embodiment of the present invention; and
FIG. 5 is a fragmentary cross sectional view of still another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The dwelling house as illustrated in FIG. 1 has s wooden roof 11 comprised of an outer layer of wooden fire-retardant shingles or shakes 13, a series of sheets 15 of steel foil, and a wooden subdeck or an inner layer of wood 17 that is formed of a plurality of adjacent wooden members 21.

The outer layer of wooden shingles or shakes 13 are composed of wood that has been rendered fire-retardant with chemicals. The fire-retardant wooden shingles or shakes 13 should be substantially non-leachable since the effects of rain and the like tend to leach from the wooden shingles or shakes 13 the fire-retardant chemicals impregnated therein. A variety of compounds for rendering the wooden shingles or shakes fire-retardant are available to those skilled in the art. Such compounds usually contain certain non-oxidizing ingredients. Suitable fire-retardant shingles or shakes 13 are commercially available from Koppers Company, Inc. under the trademark of NON-COM Exterior Treated Shakes or Shingles.

In accordance with the invention, either fire-retardant shingles or shakes may be used for the outer layer, the distinction between shakes and shingles being one of thickness and of manufacture. For example a shingle is a generally rectangular member usually tapered in one direction from about one-sixth inch thickness at one edge to about three-eighths to one-fourth inch in thickness at the other opposite edge; conventionally, both planar surfaces or faces of the shingle have been sawn. On the other hand, the shake is a thicker shingle being
tapered in one direction from about one-eighth inch at one edge to 1 inch or more at the other opposite edge; conventional performance of one surface or face of the shake has been sown and the other surface or face has been formed by splitting a single wooden shake into two parts so its surface is rough. A shake is usually installed with the rough face exposed so as to achieve the desired rustic appearance.

The subdeck 17 comprises a plurality of adjacent wooden members 21 which may be constructed of conventional wood material, such as, for example, planks or plywood sheets 21 that are placed adjacent with one another and that are nailed over rafters 19 as shown in FIG. 2. In FIGS. 2 and 3 the subdeck 17 is comprised of a plurality of adjacent plywood sheets 21, each sheet 21 having an upper longitudinal edge 23 and an opposite lower longitudinal edge 25, a left transverse edge 27 and a right transverse edge 29 as illustrated in FIG. 2, and a top surface 31 and a bottom surface 33. As illustrated in FIG. 2 the wooden members 21 are arranged in uniform rows, however, they may be staggered in their arrangement so that the joints formed by adjacent wooden members follow a discontinuous line.

In FIG. 3 illustrating a cross section of the novel wood roof of the invention, a series of first sheets 15a of steel foil, a second sheet 15b of steel foil, and a third sheet 15c of steel foil extend longitudinally (from left to right in FIG. 2) over the wooden members 21 of the inner layer of wood 17 and are disposed between the subdeck 17 and the fire-retardant wooden shakes or shingles 13.

As previously alluded to, the joints where the wooden members of a subdeck abut are not airtight. In the manufacture and planing of wooden members, such as, for example, planks or plywood sheets, the edges of the wooden members are not absolutely straight so that they can be tightly abutted together to provide an airtight joint. Also, workers in securing the wooden members to the rafters may not be careful enough to insure that the wooden members are tightly abutting. Moreover, it would be time-consuming and costly for workers to insure that the wooden members are airtightly abutting one another. Consequently, air and oxygen can pass from underneath the subdeck through the joints to support possible combustion at the top surface of the subdeck.

So, in accordance with the invention, the first sheet 15a extends longitudinally over a major portion of the top surface 31 of member 21a, as illustrated in FIG. 2 and 3. The second sheet 15b extends longitudinally over the upper portion of the top surface 31 of member 21a and is in an overlapping relationship to the first sheet 15a. Second sheet 15b bounds downwardly to conform to the upper longitudinal edge 23 of member 21a and fills the space between member 21a and the next upper adjacent member 21b. Then, sheet 15b bends toward member 21b to conform to the lower longitudinal edge 25 thereof and covers the lower portion of the bottom surface 33 of member 21b.

The third sheet 15c extends longitudinally over the lower portion of the top surface 31 of the adjacent member 21b and is in an overlapping relationship to the next upper first sheet 15a.

In the embodiment of FIG. 3 the entire top surface 31 of all of the wooden members 21a, 21b, 21c is coextensively covered with sheets of steel foil as previously described. As illustrated in the drawings, sheets 15 of steel foil have a width less than the length of each of the individual members 21 and a length greater than the individual members 21; however, for purposes of this invention such dimensions are not necessarily critical.

Preferably, the sheets of steel foil 15 are constructed of a low carbon steel having a protective film of a plastic, such as polyethylene, over both surfaces thereof to protect it from possible corrosion and the like. A preferred thickness of the sheets of steel foil are 2 mils in thickness while the preferred thickness of the plastic film is about 1 mil in thickness.

Thus, the sheets of steel foil coextensively covering the wooden members protect the subdeck or inner layer of wood from exposure to air and flame from above, and dissipate heat from the area of localized heating. The sheets of steel foil being disposed between the joints of abutting wooden members seal the space between wooden members to inhibit the passage of air and oxygen from underneath the roof assembly to the top surface of the subdeck or inner layer of wood. Also, heat is dissipated from the top surface of the subdeck to the bottom surface of the subdeck. Consequently, ignition of the top surface of the subdeck from a flame above the roof assembly is prevented.

Therefore, this invention is particularly useful in areas having a heavy population density and having a heavy growth of underbrush in which forest fires or brush fires are likely to occur. Moreover, this invention is useful with dwellings having fireplaces and chimneys as illustrated in FIG. 1. Sparks and the like emitted from the chimney 51 of FIG. 1 may land on the wood roof assembly of this invention without causing the ignition of the wooden roof.

In FIG. 4, illustrating another embodiment of the invention, a sheet 15b nearest the upper longitudinal edge 23 extends over a portion of the top surface 31 of the member 21a. Sheet 15b, similar to the sheet 15b of FIG. 3, bends downwardly to conform to the upper longitudinal edge 23 of member 21a and fills the space between member 21a and the next upper adjacent member 21b. Sheet 15b conforms to the lower longitudinal edge 25 of member 21b and covers a portion of the bottom surface 33 of member 21b. It will be noted that sheet 15b is similarly disposed between members 21b and 21c in FIG. 4.

Over sheets 15b a series of sheets 35 cover the entire top surface 31 of the members 21 as well as the first sheets 15a to provide a continuous covering of steel foil over the top surface.

In the embodiments of both FIGS. 3 and 4 it should be noted that sheets 15 extend longitudinally over members 21 from left to right as illustrated in FIG. 2. The sheets of steel foil 15 are flush with the left transverse edge 27 of the members 21 and extend beyond the right transverse edge 29 of the members 21 as illustrated in FIG. 2. All of the sheets 15 bend transversely and downwardly to conform to the right transverse edge 29 and to fill the space between member 21a and the lateral adjacent member 21d. All the sheets 15 bend towards the laterally adjacent member 21d to conform to the left transverse edge 27 of member 21d and to cover a portion of the bottom surface 33 of member 21d.

In the construction of our novel wooden roof assembly of FIGS. 2 and 3 a first wooden member 21a is secured to rafters 19 at the bottommost point of the roof. The first sheet 15a of steel foil is disposed over member 21a starting from the left transverse edge 27 thereof and extending longitudinally across member 21a beyond the right transverse edge 29; sheet 15a is turned transversely and downwardly to conform to the right transverse edge 29. The sheet 15a is flush with the lower longitudinal edge 25. This first sheet 15a of steel foil is secured to the top surface 31 of wooden member 21a by staples or the like.

Another first sheet 15a of steel foil is then similarly disposed over member 21a overlapping the previously applied sheet of steel foil 15a and extends from the left transverse edge 27 thereof to beyond the right transverse edge 29. This sheet 15a is also turned transversely and downwardly over the right transverse edge 29 and is likewise stapled to the top surface 31.

A second sheet 15b of steel foil is similarly applied over the remaining upper portion of the top surface 31 of member 21a, extending from the left transverse edge 27 to beyond the right transverse edge 29 and likewise is stapled to the top surface 31. The second sheet 15b is turned longitudinally and downwardly over the upper longitudinal edge 23 of member 21a. A second wooden member 21b that is upwardly adjacent to the first sheet 15b is then pressed against the upper longitudinal edge 23 of the first wooden member 21a. The remaining portion of second sheet 15b of steel foil is bent longitudinally and is conform to the lower longitudinal edge 25.
of the next upper adjacent member 21b to cover a portion of the bottom surface 33 of member 21b and stapled to the bottom surface 33. Similarly a laterally adjacent wooden member 21d is pressed against and overlaps a portion of the second sheet 15b of steel foil and covers the bottom portion of the top surface 31 of member 21b. The third sheet 15c of steel foil extends from the left transverse edge 27 of member 21b to beyond the right transverse edge 29 thereof and is bent transversely over the right transverse edge 29 of member 21b. The sheet 15c is likewise stapled to the top surface 31. This procedure is repeated until the entire roof has been covered with wooden members 21 and with the series of overlapping sheets 15 of steel foil which form a continuous interlayer of steel foil. After a few initial wooden members have been secured to the rafters 19 with their overlapping sheets 15 of steel foil, several rows of fire-retardant shingles or shakes 14 are applied starting at the lower longitudinal edge 25 and the left transverse edge 27 of the first wooden member 21a. The treated shingles or shakes 13 are disposed edge to edge in rows which overlap one another. Thus, workers may then rest on the wooden shingles or shakes as the remaining wooden members 21 and sheets 15 of steel foil are applied without damaging or puncturing the sheets of steel foil. When using treated shakes 13, it is preferred to include a waterproof, nonflammable interlayer 41 between the rows of shakes as illustrated in FIG. 5. The waterproof interlayer 41 is desirable when using shakes because shakes have a geometry which renders them more susceptible to penetration by rain and the like. Preferably, the waterproofing interlayer 41 comprises an asbestos felt material, such as, for example, Nicolet Asbestos Felt No. 411, which is an asbestos felt material interlaced with fiberglass of about one-thirty-second to one-sixtieth inch in thickness. While this invention and the drawings illustrate the series of overlapping sheets extending longitudinally across the wooden members from left to right in FIG. 2, it will be observed that the series of overlapping sheets could extend transversely over the wooden members from top to bottom in FIG. 2. Thus, our improvement on fire-retardant wood roof assemblies protects all of the inner layer of wood from exposure to flame, dissipates heat should the outer layer of fire-retardant shingles or shakes become exposed to flame, and seals the space between the adjacent wooden members. The construction of the wood roof assembly is simple. Unskilled workers may easily and conveniently apply the sheets of steel foil to the wooden members in accordance with the invention whereby the joints between the wooden members are sealed and the subdeck or inner layer of wood is coextensively covered with the steel foil. Thus, the ignition of the top surface of the inner layer of untreated wood is prevented rendering the improved roof assembly of our invention acceptable for use in areas of dense population and in densely wooded areas. What is claimed is:

1. In a fire-retardant wood roof assembly comprised of an outer layer of fire-retardant wooden shingles or shakes covering an inner layer of wood formed of a plurality of adjacent wooden members, each member having an upper longitudinal edge and a lower longitudinal edge and a left transverse edge and a right transverse edge wherein the improvement comprises:

a. a series of overlapping sheets of steel foil disposed between said inner and said outer layers;

b. the sheet nearest the upper longitudinal edge of one member extending over a portion of the top surface of said one member,

d. bending inwardly to conform to the upper longitudinal edge of such member and to fill the space between such member and the next upper adjacent member;

e. bending to the right transverse edge 29 of the next upper adjacent member to conform to the lower longitudinal edge of the next upper adjacent member and to cover a portion of the bottom surface of said next upper adjacent member.

2. The improvement of claim 1 wherein said sheets of steel foil have a width less than the width of each of said members but a length greater than each of said members.

3. The improvement of claim 1 wherein all of said sheets are bent transversely and downwardly over the transverse edge of such member to fill the space between such member and the next laterally adjacent member, are bent transversely toward said next laterally adjacent member, and cover a portion of the bottom surface of said next laterally adjacent member.

4. In a fire-retardant wood roof assembly comprised of an outer layer of fire-retardant shingles or shakes covering an inner layer of wood formed of a plurality of adjacent generally rectangular wooden members, each member having longitudinal edges and transverse edges wherein the improvement comprises:

a. a series of longitudinally overlapping sheets of steel foil being disposed between said inner and outer layers; said sheets have a width less than the width of each of said members;

b. all of said sheets bending transversely and downwardly over at least one of the transverse edges of each member to fill the space between the adjacent transverse edges of each member and its respective adjacent member; and

c. the sheet nearest one of the longitudinal edges of each member bending longitudinally and downwardly over at least one of the longitudinal edges of each member to fill the space between the adjacent longitudinal edges of each member and its respective adjacent member.

5. The assembly of claim 4 wherein the sheets of steel foil are interposed between said outer layer and said inner layer by a. applying a series of sheets in a longitudinal overlapping relationship over one member;

b. bending all of said sheets transversely and downwardly over one of the transverse edges of said member;

c. pressing the transverse edge of an adjacent member against said transversely bent sheets;

d. bending longitudinally and downwardly the sheet nearest one of the longitudinal edges of said member over said longitudinal edge of said member;

e. pressing the longitudinal edge of another laterally adjacent member against said longitudinally bent sheet.

6. In a fire-retardant wood roof assembly comprised of an outer layer of fire-retardant wooden shingles or shakes covering an inner layer of wood formed of a plurality of adjacent wooden members; each of said members having a top surface and a bottom surface with an upper longitudinal edge meeting said top and bottom surfaces and with an opposite lower longitudinal edge meeting said top and bottom surfaces wherein the improvement comprises:

a. first, second and third sheets of steel foil being disposed between said inner and outer layer;

b. said first sheet extending longitudinally over a major portion of the top surface of one member;

c. said second sheet extending longitudinally over the upper portion of the top surface of said one member and being in an overlapping relationship to the next lower first sheet; said second sheet:

i. bending downwardly to conform to the upper longitudinal edge of said one member and to fill the space between said one member and the next upper adjacent member, and

ii. bending toward said next upper adjacent member to conform to the lower longitudinal edge of said next upper adjacent member and to cover a portion of the bottom surface of said next upper adjacent member, and
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7. The assembly of claim 6 wherein the sheets of steel foil are interposed between said outer layer and said inner layer by comprising:
   a. covering the major portion of the top surface of one member with a series of first sheets of steel foil in an overlapping relationship;
   b. covering the upper portion of the top surface of one member with a second sheet of steel foil in an overlapping relationship to said first sheet;
   c. bending downward said second sheet to conform to the upper longitudinal edge of said one member;
   d. pressing the lower longitudinal edge of the next upper adjacent member against said second sheet;
   e. conforming the remainder of said second sheet to the bottom surface of said next adjacent member; and
   f. covering the lower portion of the top surface of said next adjacent member with a third sheet of steel foil in an overlapping relationship to said second sheet.

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