

[54] **ROOFING PANELS WITH JOINING MEANS**

[75] Inventor: **Robert L. Turek**, Phoenix, Ariz.

[73] Assignee: **Evans Products Company**, Portland, Oreg.

[22] Filed: **June 17, 1974**

[21] Appl. No.: **479,765**

Related U.S. Application Data

[60] Division of Ser. No. 296,142, Oct. 10, 1972, abandoned, which is a continuation-in-part of Ser. No. 235,331, March 16, 1972.

[52] **U.S. Cl.** **52/546; 52/309; 52/313; 52/314; 52/520; 52/533; 52/547; 52/555**

[51] **Int. Cl.²** ... **E04D 1/34; E04D 1/28; E04D 1/20; E04D 1/26**

[58] **Field of Search** **52/538, 309, 541, 313, 52/551, 314, 547, 316, 546, 533, 554, 534, 555, 519, 536, 520, 527**

[56] **References Cited**

UNITED STATES PATENTS

1,063,674	6/1913	Freund.....	52/533 X
3,173,229	3/1965	Weber.....	52/547
3,261,136	7/1966	Abner et al.....	52/546 X
3,419,455	12/1968	Roberts.....	161/160 X
3,420,024	1/1969	Salvo.....	52/316
3,420,729	1/1969	Roberts.....	161/160 X
3,440,777	4/1969	Martin.....	52/551 X
3,605,369	9/1971	Merrill et al.....	52/560 X
3,608,261	9/1971	French et al.....	52/316
3,626,439	12/1971	Kneisel.....	52/533
3,643,394	2/1972	Johnson.....	52/314 X
3,688,458	9/1972	Inmon.....	52/309 X
3,754,366	8/1973	Jansson et al.....	52/555 X
3,760,546	9/1973	Martin et al.....	52/555
3,807,113	4/1974	Turner.....	52/546 X

FOREIGN PATENTS OR APPLICATIONS

1,424,309 11/1965 France..... 52/309

623,366	12/1935	Germany.....	52/536
732,346	4/1966	Canada.....	52/546
27,952	10/1955	Finland.....	52/536
76,665	4/1950	Norway.....	52/546
1,253,909	1/1961	France.....	52/536

Primary Examiner—Ernest R. Purser

Assistant Examiner—Leslie A. Braun

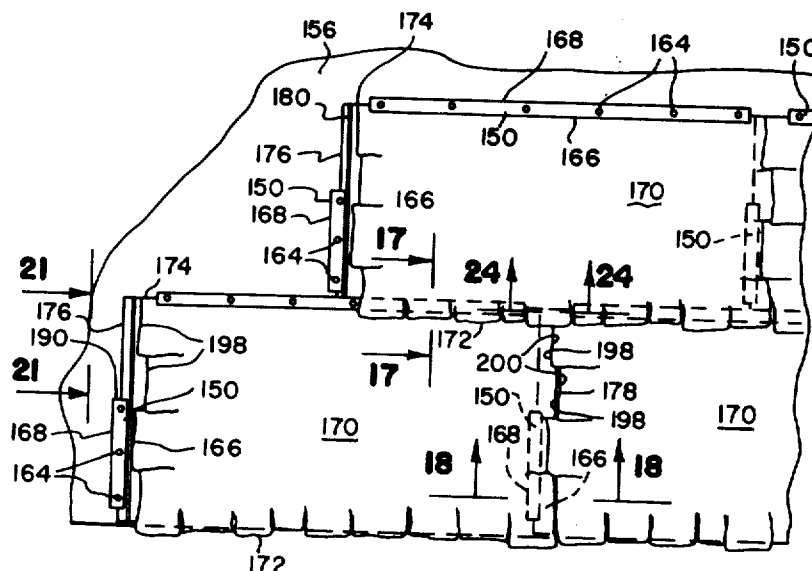
Attorney, Agent, or Firm—Robert E. Howard

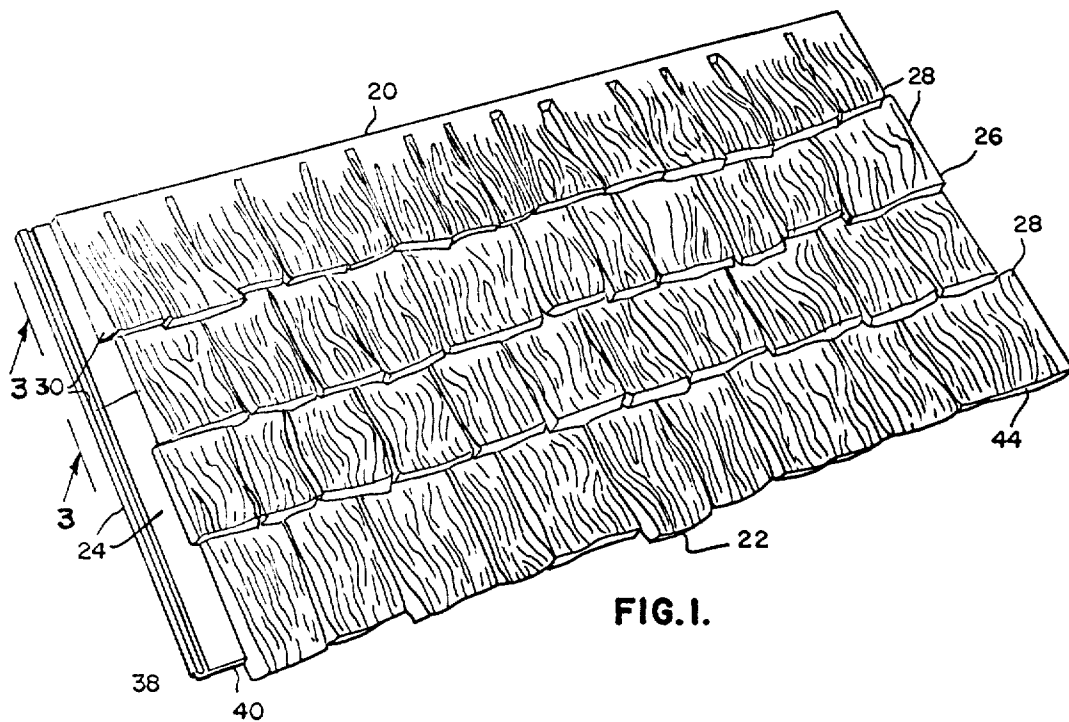
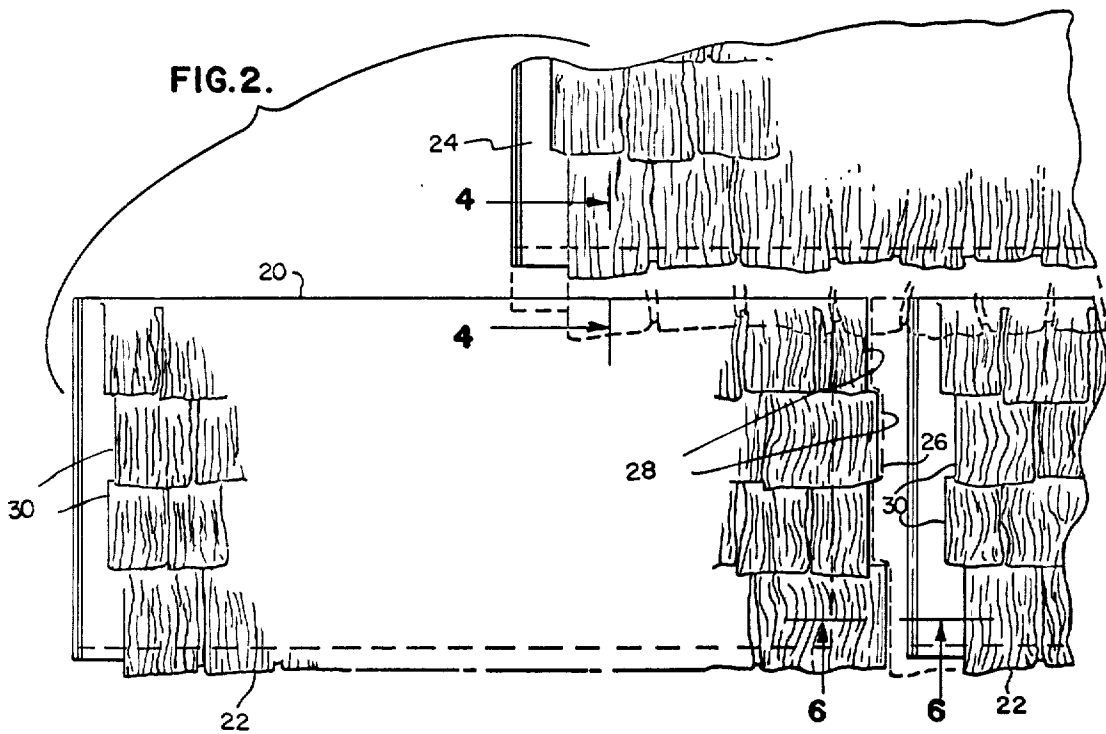
[57]

ABSTRACT

An aesthetic roofing panel or other aesthetic panel and method of producing it, comprising a substantially rigid panel shaped foam body having an upper surface which aesthetically simulates roofing configuration; and a weather resistant sheet of a shape conforming to said upper surface; said weather resistant sheet bonded to said upper surface of said body; a plurality of said roofing panels having edge portions adapted to overlap adjacent edges of adjacent ones of said panels to shed water thereover; connecting respective cooperable interlocking means of each panel and an interlocking strip on a roof structure, respectively, for readily and securely fixing said panels on said roof structure; the disclosure also including a novel method for producing said roofing panels, comprising the forming of a thin weather resistant sheet of material into an aesthetic roof or other surface simulating configuration and casting a substantially rigid foam body under pressure contiguous with and bonded to said formed weather-resistant sheet; further, the method includes the provision of an interlocking means on said foam body and the securing of an interlocking strip on a roof or other structure and the installation of said panels on said roof or other structure by interlocking said interlocking means with said panel or a plurality thereof.

7 Claims, 28 Drawing Figures





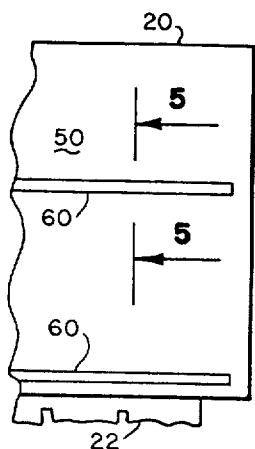


FIG. 3.

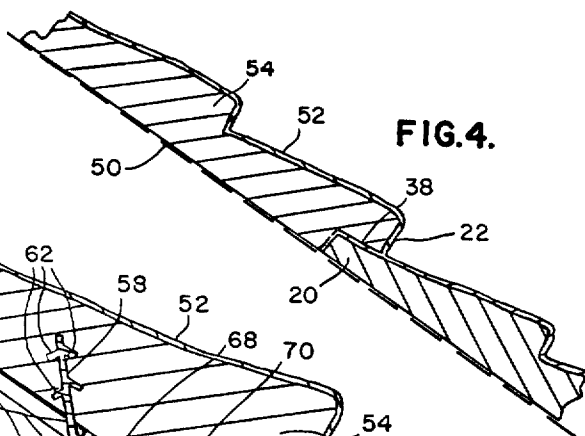


FIG. 4.

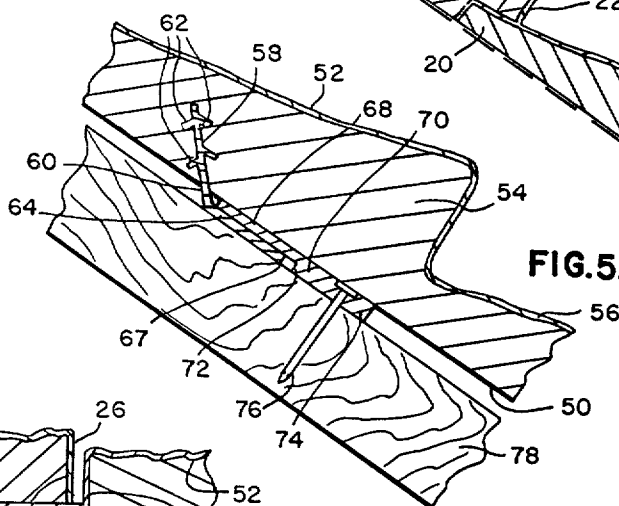


FIG. 5.

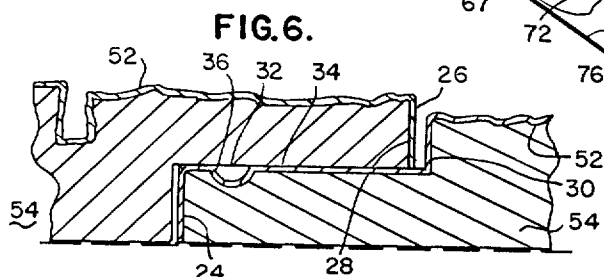


FIG. 6.

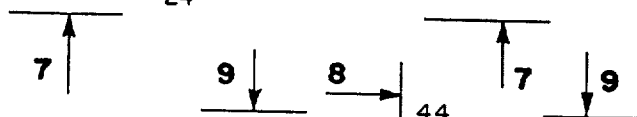
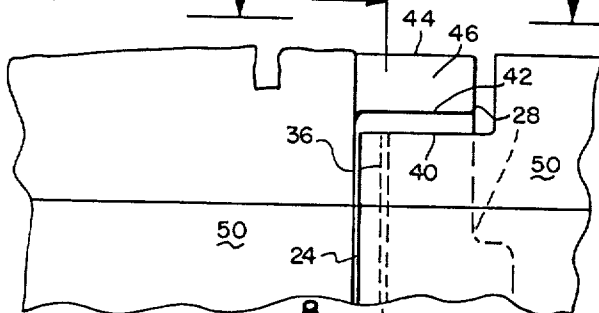


FIG. 7.

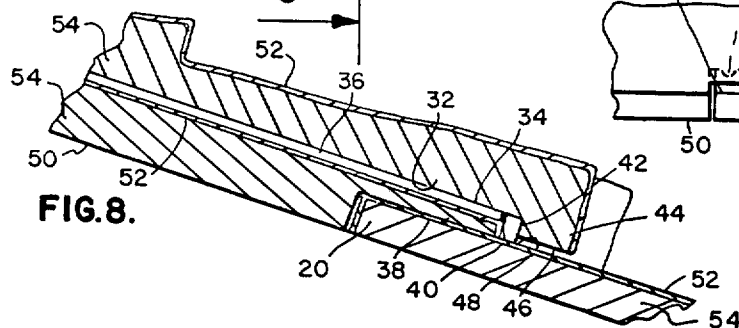


FIG. 8.

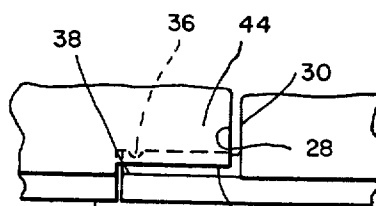


FIG. 9.

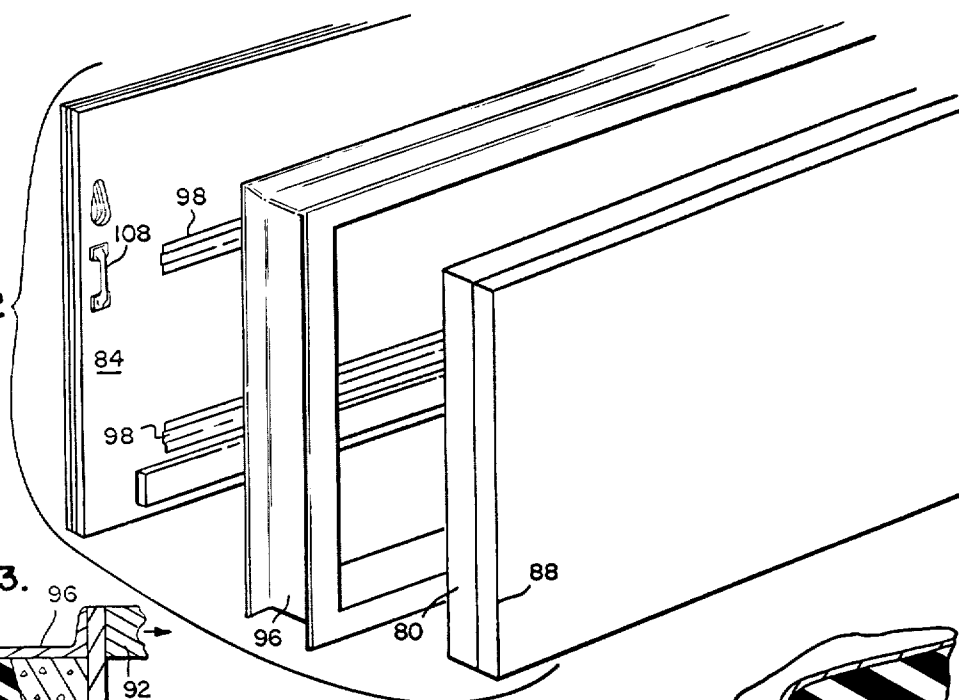


FIG.13.

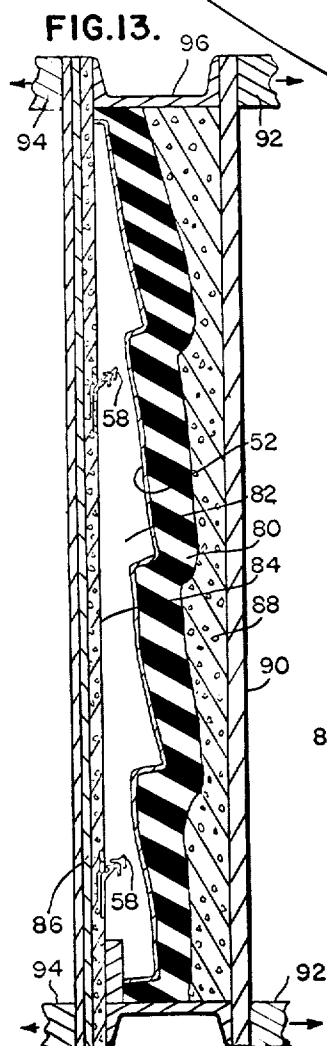
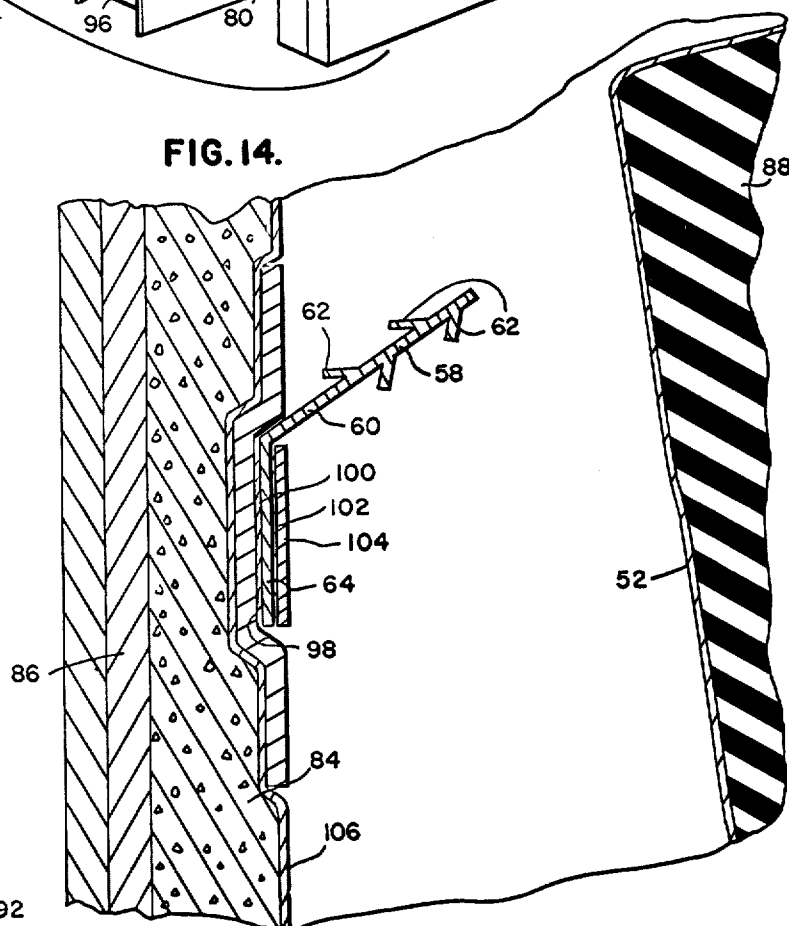
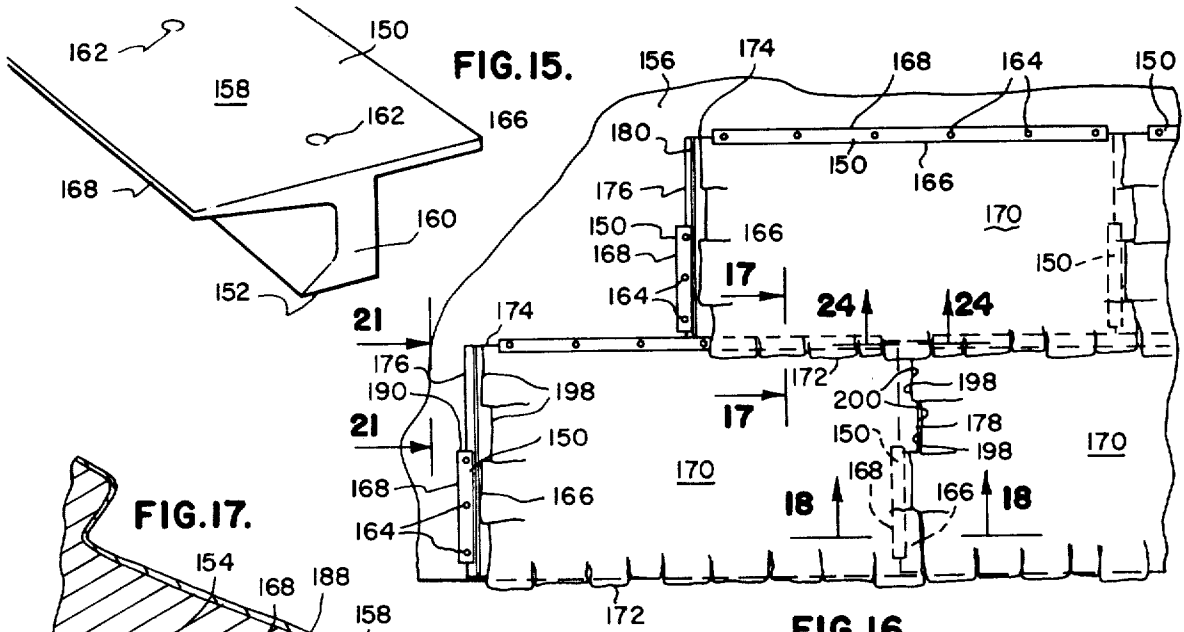
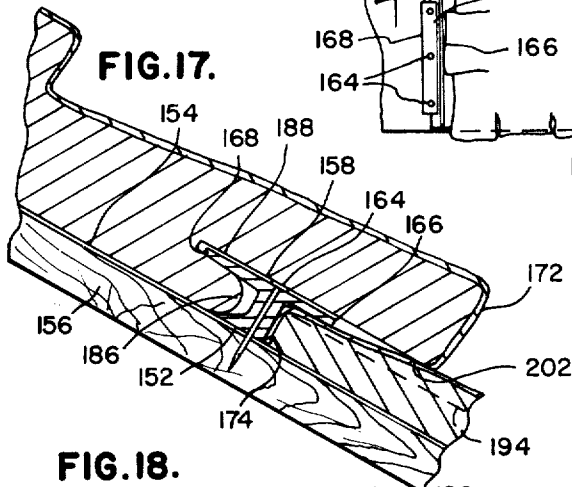
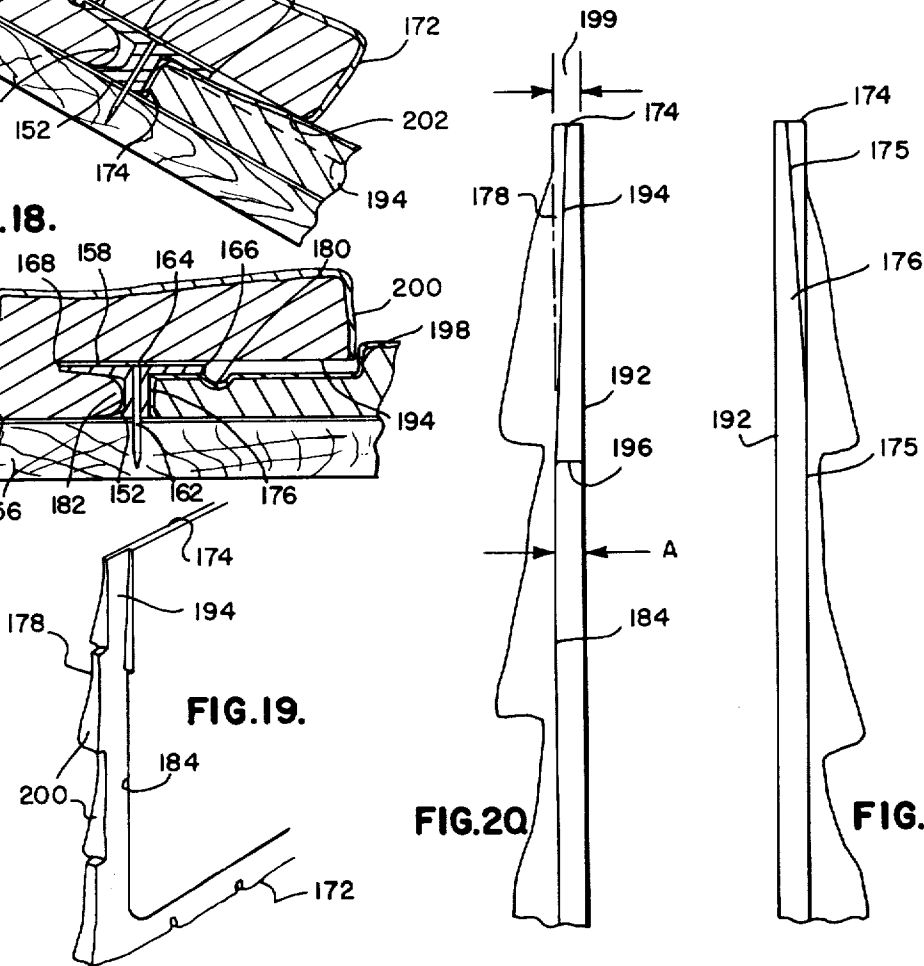


FIG. 14.





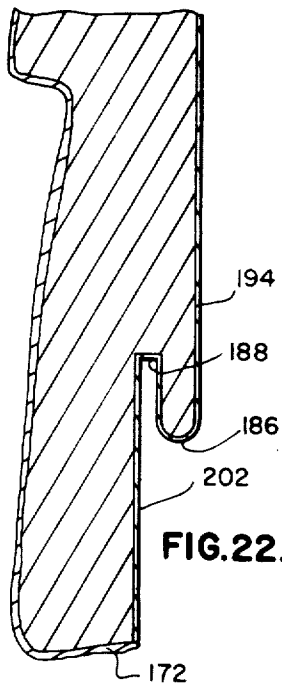


FIG. 22.

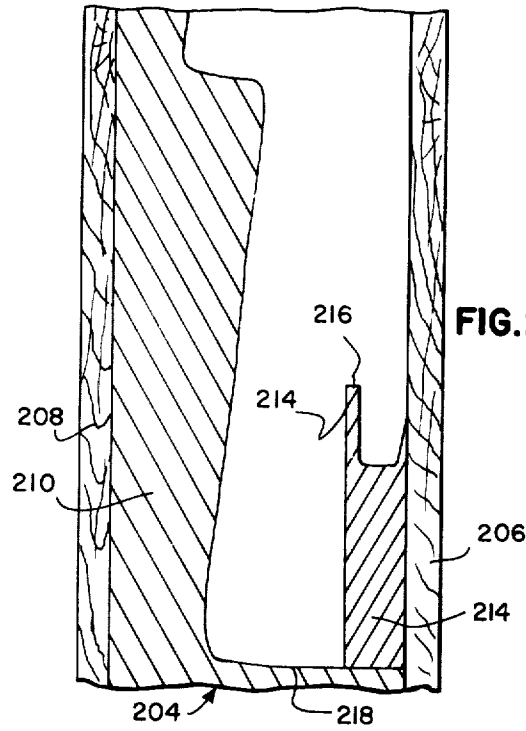


FIG. 23.

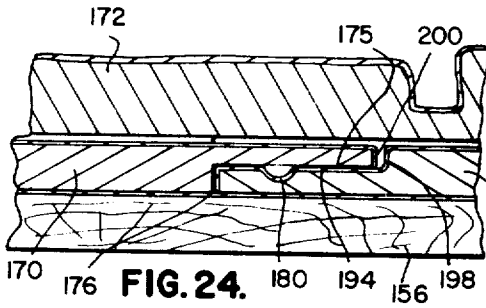


FIG. 24.

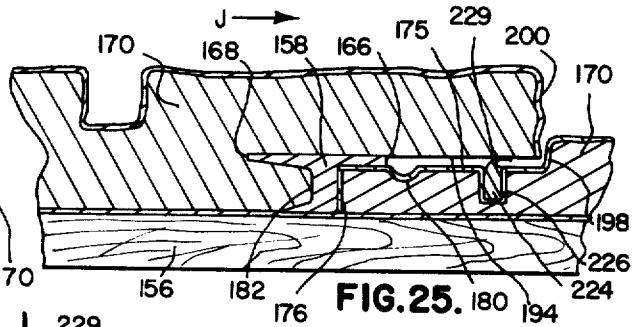


FIG. 25.

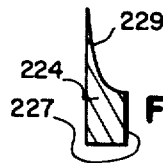


FIG. 26.

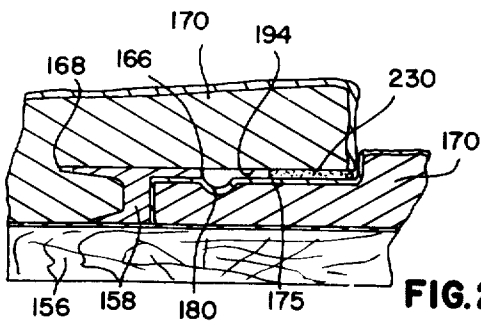


FIG. 27.

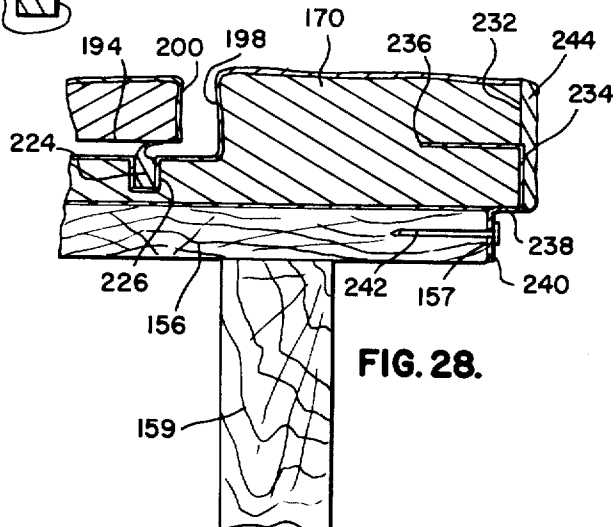


FIG. 28.

ROOFING PANELS WITH JOINING MEANS

This is a division of application Ser. No. 296,142 filed Oct. 10, 1972, now abandoned, which is a continuation-in-part of my copending application, Ser. No. 235,331, filed Mar. 16, 1972.

BACKGROUND OF THE INVENTION

A great variety of roofing has been used on buildings and it has been desirable to produce roofing which is mechanically durable as well as being weather resistant. Further, it has been desirable to produce roofing which is economical to manufacture and install as well as to maintain. The aesthetic features of cedar shakes as well as Spanish tile and many other roofing materials, are well established and are highly desirable. There has been a need for the production of an economical roofing structure which aesthetically simulates cedar shakes, Spanish tile, or other well known highly desirable roofing. Furthermore, there has been a need for the production of roofing which simulates the desirable roofing and yet which is relatively economical to produce and install.

Additionally, it has been recognized that roofing, when installed in large panels, may economically be placed on sheathing of a roof thereby saving considerable labor cost as compared to conventional asphalt shingles or the like. Additionally, there have been a variety of attempts to provide roofing materials which have substantial insulating capabilities as well as aesthetic features and economic practicality.

Heretofore, large roofing panels have been quite heavy and difficult to place on roof sheathing by manual labor.

Some prior art panels employ mineralized fiber boards produced under pressure with Portland cement and also utilizing concrete. These panels are so heavy that a laborer cannot individually handle them when they are produced in large sizes, as for example panels approaching 6 to 8 feet in length and 3 to 4 feet wide. It has been recognized that a suitable lightweight panel of such dimensions can be handled by a single laborer and readily placed on a roof so as to rapidly cover a large roof and thereby improve the overall economy of roofing a building.

Heretofore it has been expensive economically to produce aesthetic panels having aesthetic configuration and particularly various panels including doors or other aesthetic configuration.

SUMMARY OF THE INVENTION

The present invention relates to roofing panels which are quite large and may range from 6 to 8 feet in length and 3 to 4 feet in width, and these panels are produced of a substantially rigid foam such as polyurethane foam or the like, and are covered with a weather resistant sheet which is formed so as to aesthetically simulate roofing configuration such as thick hand split cedar shakes, Spanish tile, or other aesthetic roofing or surface configuration. The polyurethane foam is cast and bonded to the lower side of the formed weather resistant sheet, forming an integral panel which is very light and easily handled by a single laborer, and due to the insulating characteristics of the polyurethane foam the overall roofing insulation is greatly enhanced. Each panel is provided with overlapping edges adapted to overlap adjacent edges of an adjacent one of said panels and novel water drain grooves are disposed in un-

derlying overlapped portions of said panels along generally inclined edges thereof. The generally inclined edges of the panels are also provided with intermeshing irregularities which obscure the joinder of the panels with each other, and the configuration of the formed weather resistant sheet exactly simulates the aesthetic configuration of roofing such as cedar shakes or Spanish tile, since molds of actual roofing of this type are utilized to form said weather resistant sheets in accordance with a method of the invention.

A thin sheet of material, such as acrylic material, is formed in accordance with the method of the invention to aesthetically simulate roofing configuration. This sheet is placed in a conforming mold and polyurethane or other similar foam material is foamed in the mold while the mold is closed, thereby creating pressure in the mold for forcing the foam into all of the areas of the formed sheet, and the foam is bonded to the sheet of material so that it forms an integral structure wherein a foam body is provided with an upper weather resistant skin having an upper surface which aesthetically simulates a desired roofing configuration.

The invention comprises a variety of means for connecting and securing the roofing panels of the invention to roof structures such as wooden sheathing or the like. One means for securing the panels to the roof comprises interlocking members cast into the panels and having flanges projecting from the lower surfaces of the panels which interlock with second locking strips which are nailed to the roof or sheathing, both interlocking structures in connection with the panel and the sheathing, respectively, having flanges slidably engageable with each other to allow the panels to be readily and firmly secured to a roof.

Another means of the invention for connecting the panels to a roof or wooden sheathing thereon comprises interlocking strips which are provided with opposed flanges engageable in grooves in adjacent panels at their inclined edges and these strips are also engageable in grooves in the panels near their lower edges and extend over thin upper edges of the panels and are disposed beneath overlapping portions of the panels and may be nailed to roof sheathing or the like. The connecting strips are progressively nailed to the roof sheathing as the panels are placed on the roof such that one connecting strip is nailed along one inclined edge of each panel and along one upper edge of each panel as the panels are progressively placed on the roof and thereby secured. Each connecting strip which is placed adjacent an inclined edge of a panel is placed such that one of its flanges overlaps a thin edge of the panel and an opposing flange of the strip so placed extends outward such that it engages in a grooved area of the next panel being placed in end-to-end relation with the last mentioned panel, and whereby a thick overlapping portion of the last mentioned panel extends over the connecting strip and the relatively thin edge of the first mentioned panel.

The method of the invention also includes novel connecting and interlocking structure for installing the roofing panels of the invention on the sheathing of a building roof.

The method includes the casting of a connecting member into the normally lower side of each panel when in the mold during the forming of the polyurethane body, and also the placement of an interlocking means in generally horizontal strips on a roof sheathing

such that the normally lower edge of the connecting means of each panel may be slidably disposed beneath a generally upwardly directed edge of the interlocking means on the sheathing for readily and securely placing each large roofing panel in secure interlocked relation with the sheathing of a building roof. The interlocking strips that are placed on the sheathing are preferably nailed down at their lower edges and their upper edges are slightly spaced above the sheathing to allow the downwardly extending lip of the connecting means of each panel to be placed under the upwardly directed interlocking portion of the interlocking means on the sheathing.

The foregoing method, as well as the means used for connecting the panels to a building roof provide for the securement of large panels onto a roof in a very simple manner which involves a minimum of time and labor, and consequently provides for very desirable economy in the overall production and installation of roofing in accordance with the present invention.

According to the invention, various panels having aesthetic configuration may be produced in accordance with the invention, as for example internal wall panels and/or doors having aesthetic configuration.

Accordingly, it is an object of the present invention to provide a very attractive and economical roofing for various buildings.

Another object of the invention is to provide a roofing for buildings which has excellent insulating characteristics.

Another object of the invention is to provide light weight roofing panels which are very easy to handle and which are very large, and consequently may be used very rapidly to cover a large area of a building roof.

Another object of the invention is to provide a novel connecting and interlocking means for panels on roof sheathing which is very secure, very simple, and easy to utilize during the installation of roofing panels on roof structures.

Another object of the invention is to provide novel interlocking strips which may be nailed onto the roof of the building, and particularly on structures such as wooden sheathing or the like, said strips having opposed horizontally extending flanges adapted to be engaged in the grooves of the panels of the invention and also adapted to extend over relatively thin overlapped portions of adjacent panels of the invention.

Another object of the invention is to provide a novel method for producing a hard foam panel with a weather resistant sheet on the upper surface thereof.

Another object of the invention is to provide a novel method for producing hard foam panels having weather resistant sheet structure on the upper surface thereof; said sheet structure aesthetically simulating roofing configuration such as the attractive configuration of thick hand split cedar shakes or Spanish tile, or any other aesthetically desirable configuration.

Another object of the invention is to provide a rigid foam roofing panel of large dimensions having a weather resistant sheet bonded to the upper surface thereof and which is particularly adapted to high volume economic production and installation on roof structures.

Another object of the invention is to provide large roofing panels having novel overlapping edge structure adapted to shed water and also having adjacent in-

clined edges of irregular intermeshing configuration which obscures the joinder of the panels at their adjacent edges, thereby providing for aesthetic simulation of the various irregular roofing configurations such as cedar shakes or the like.

Another object of the invention is to provide a method for producing various aesthetic panels such as doors or the like having aesthetic configuration.

Further objects and advantages of the invention may be apparent from the following specification, appended claims and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a roofing panel in accordance with the invention, and produced to simulate the aesthetic features of hand split thick cedar shakes;

FIG. 2 is an exploded plan view showing a plurality of the roofing panels of the invention illustrating the manner in which they may be assembled in edge-to-edge relationship to each other;

FIG. 3 is a reduced fragmentary bottom plan view taken from the line 3—3 of FIG. 1;

FIG. 4 is an enlarged fragmentary sectional view taken from the line 4—4 of FIG. 2, but showing a pair of panels in installed overlapped relation to each other;

FIG. 5 is an enlarged fragmentary sectional view taken from the line 5—5 of the panel shown in FIG. 3, but showing the panel on sheathing of a roof and showing the interconnecting and interlocking strips of the panel and on the sheathing, respectively, for holding the panel on the roof sheathing;

FIG. 6 is an enlarged fragmentary sectional view taken from the line 6—6 of FIG. 2 but showing the adjacent panels in overlapping relation to each other;

FIG. 7 is a fragmentary bottom plan view of the panels shown in FIG. 6 at the normally lower edges thereof;

FIG. 8 is a fragmentary sectional view taken from the line 8—8 of FIG. 7;

FIG. 9 is a fragmentary view taken from the line 9—9 of FIG. 7, showing the normally lower overlapping edges of a pair of adjacent panels;

FIG. 10 is a fragmentary sectional view of a building roof gable structure showing roofing panels of the invention on the roof structure adjacent the gable, and showing a novel gable cap structure of the invention together with gable cap connecting and interlocking means adapted to secure the gable cap on the gable ridge timber of a roof and provide for the overlapping of the cap structure with upper edges of the roofing panels of the invention;

FIG. 11 is a cross sectional view of the gable roof and cap structure of the invention as shown in FIG. 10;

FIG. 12 is an exploded perspective fragmentary view of a mold utilized in accordance with the present method for producing roofing panels in accordance with the present invention;

FIG. 13 is a transverse sectional view of the mold shown in FIG. 12 when in closed position with a roofing panel being formed therein;

FIG. 14 is an enlarged fragmentary sectional view taken on the same plane as FIG. 13 and showing the details of an interlocking strip being cast in the panel;

FIG. 15 is a fragmentary perspective view of a modified locking strip of the invention adapted for use in locking the roofing panels of the invention on building roof structure, such as sheathing or the like;

FIG. 16 is a fragmentary top or plan view of a roof showing several of the roofing panels of the invention secured thereon by locking strips such as shown in FIG. 15;

FIG. 17 is an enlarged fragmentary sectional view taken from the line 17—17 of FIG. 16;

FIG. 18 is an enlarged fragmentary sectional view taken from the line 18—18 of FIG. 16;

FIG. 19 is a fragmentary end perspective view of a modified roofing panel of the invention adapted for use in connection with the locking strip shown in FIG. 15;

FIG. 20 is a fragmentary end view of the modified panel taken from the same end as FIG. 19 but showing the structure on enlarged scale to illustrate details thereof;

FIG. 21 is a view similar to FIG. 20 but showing the opposite end of the panel from that as shown in FIG. 20;

FIG. 22 is an enlarged fragmentary view showing a cross section of an edge of one of the panels shown in FIG. 16 but showing the structure on enlarged scale;

FIG. 23 is a sectional view of a mold in which the structure shown in FIG. 22 is produced;

FIG. 24 is an enlarged fragmentary sectional view taken from the line 24—24 of FIG. 16;

FIG. 25 is a view similar to FIG. 18 but showing a modification of the invention;

FIG. 26 is a sectional view of a seal shown in the modification of FIG. 25;

FIG. 27 is a view similar to FIG. 18 showing a mastic seal between overlapping portions of the roofing panels of the invention; and

FIG. 28 is a sectional view of the edges of panels of the invention installed on the gabled end of a roof and showing clip means for securing cut ends of the panels at the end of the roof sheathing on which the panels are secured.

PREFERRED EMBODIMENTS OF THE INVENTION

As shown in FIG. 1 of the drawings, a roofing panel of the invention may be a large panel ranging in length from 6 to 8 feet and in width from 4 to 6 feet, it being noted that these panels may be made in modules appropriate to the architecture upon which the panels may be used as roofing covers.

While the invention relates to roofing panels, it will be understood that various aesthetic panels, including doors or the like, may be produced in accordance with the teachings of the invention.

Each panel is provided with a normally upper edge 20 and a normally lower edge 22. Additionally, each panel is provided with a first generally or normally inclined edge 24 and a second normally inclined edge 26. Each edge 26 is adapted to overlap a respective edge 24 of a like panel and each lower edge 22 is adapted to overlap an upper edge 20 of a like panel.

As shown in FIG. 2 of the drawings, the overlapping relation is illustrated by means of an exploded view and it will be seen that the normally inclined edge 26 is provided with irregularities such as may be provided by conventional shake shingles or the like, these irregularities being designated 28, and they are adapted to mesh with irregularities 30 adjacent the edge 24 of a like panel, the irregularities 28 and 30 simulating the edges of cedar shakes and intermeshing with each other when the panels are disposed in adjacent relation to each

other, as shown in FIG. 2 of the drawings, so as to obscure the joinder of each of the panels at their adjacent inclined edges.

As a prime example, the panels shown in the drawings simulate the aesthetic configuration of thick hand split cedar shakes and thus the irregularities 28 and 30 at the inclined edges 26 and 24, respectively, of each panel are such as to provide for continuity of the aesthetic features of a shake roof when the panels are assembled in edge-to-edge overlapping relation, as shown in an exploded view in FIG. 2 of the drawings.

The disclosure of FIG. 6 illustrates the overlapping of an edge 24 by an edge 26 of an adjacent one of the panels of the invention.

As shown in FIG. 6 of the drawings, the generally inclined edge 26 is provided with a stepped ledge portion designated 32 which overlies a relatively thin portion 34 adjacent the edge 24, and this portion 34 is provided with a groove 36 which is generally parallel to the inclined edge 24. This groove 36 is disposed beneath the overlapping ledge 32 for draining water downwardly and this groove 36 has greater capacity than that amount of water which may flow between the ledge 32 and the upper surface of the overlapped portion 34. In FIG. 6, the aforementioned irregularities 28 and 30 are slightly spaced apart and these irregularities are meshed such as generally indicated in FIG. 2 by broken lines, so as to obscure the edge-to-edge overlapping joinder of the panels of the invention when assembled on a roof.

Each lower edge 22 of each panel as shown in FIG. 4 overlaps an upper edge 20 of an adjacent panel and a ledge portion 38 at the lower edge 22 of each panel is disposed slightly below the groove 36, as illustrated best in FIG. 8 of the drawings. The ledge 38 adjacent the edge 24 terminates at 40, as shown in FIG. 8 of the drawings, and the overlapping ledge 32, as shown in FIG. 6 of the drawings, extends beyond the terminal portion 40 of the overlapped portion 34 of the edge portion 24. As shown at 42, the overlapping ledge 32 extends downwardly toward an overlapped upper edge 20 of an adjacent panel and thus an aesthetic simulating end 44 of one of the irregularities 28 extends beyond the edge 40 of the overlapped portions 34 so as to allow water from the groove 36 to flow between the edge 40 and the downwardly extending portion 42, shown in FIG. 8, this downwardly extending portion 42 being one of the overlapping and intermeshing irregularities and particularly the irregularity terminating at 44, as shown in FIGS. 1 and 8 of the drawings, this edge simulating the lower edge of a shake shingle. The bottom portion of this lower edge 44 is designated 46 in FIG. 8 of the drawings, and it is slightly spaced above the upper surface of the panel which is overlapped thereby in order to allow for the passage of water which passes downwardly through the groove 36 and between the edge 40 and downwardly extending portion 42 of the irregularity portion 44, all as shown best in FIG. 8 of the drawings.

It will be noted that FIGS. 7 and 9 do not illustrate the overlapped upper edge 20 of the next lower panel, as shown in FIG. 8 of the drawings.

As shown in FIGS. 8 and 9, the lower surface 46 of the respective irregular portion 28 is substantially above the lower surface 38 of the overlapping ledge adjacent the lower edge 40 and accordingly a corresponding upper surface 48 near the upper edge of the panel

shown in FIG. 8 is spaced from the lower surface 46 to allow for the passage of water which passes downwardly through the groove 36 and between the spaced portions 40 and 42. The lower edge 44 of the irregularity 28 thus extends below the groove 36 and does not expose it, and therefore maintains aesthetic continuity of the entire assembly of the roofing panels of the invention at their overlapping edges. Accordingly the edge portions 44 hide the end of the grooves 36 which might otherwise be viewed by persons standing on the ground and looking upward toward the lower edges of the shake simulating configurations of the roofing panels of the invention.

As shown in FIGS. 3 and 5 of the drawings, each roofing panel is provided with a normally lower surface 50 which is flat, and a normally upper surface 52 which is formed into an aesthetic roofing simulating configuration such as shakes, Spanish tile, or the like. The panel as shown in FIGS. 3 and 5 of the drawings is provided with a hard foam body portion 54 which is covered at its normally upper surface by a thin skin of water resistant material such as an acrylic sheet 56, which is formed into an aesthetic configuration simulating conventional hand split thick cedar shakes.

The foam body 54 is cast, as will be hereinafter described, and imbedded therein is a first portion 58 of a connecting means 60. This connecting means 60 is an elongated structure having a general cross section as shown in FIG. 5 wherein barbed ridges 62 are cast and bonded into the polyurethane foam body 54 for securely holding the first portion 58 therein. A second connecting portion 64 is provided with a generally downward extending edge 66, and it is slightly spaced from the bottom or lower side 50 of the body 54, and is adapted to be fitted beneath an interlocking portion 68 of an interlocking means 70. This interlocking means 70 is provided with an offset portion 72 at a transition with a relatively thick nailer portion 74 through which nails 76 extend into roof sheathing 78 for holding the connection means 70 in position on the sheathing 78 of a roof structure. When the panels of the invention are installed, the lower edge portion 66 of the connecting means 60 is slidably moved under the upwardly directed edge 68 of the interlocking means 70 and thus the panels are secured to the roof structure on which the sheathing 78 is disposed.

It will be seen from the disclosure of FIG. 3 that there are two of the connecting strips 60 imbedded in each panel body 54 and that one of them is near the lower edge 22 of each respective panel so as to prevent disconnection of the panel in any manner, as for example by wind or other forces.

It will be seen that the interlocking means 60, as shown in FIGS. 5 and 10, are nailed to the roof sheathing 78 by means of the nails 76, as hereinbefore described.

When the interlocking means 60 are nailed onto the sheathing by the nails 76, the panels of the invention are placed on the sheathing and slidably moved downwardly into position such that the connecting portion 67 of the connecting means 60 slides under the interlocking portion 68 of the interlocking means 70, all as shown best in FIG. 5 of the drawings.

Considering the fact that the panels are large, this manner of securing the panels on the roof provides a very secure means for positively and accurately locating the panels in edge-to-edge overlapped relationship

with each other, but provides for a very rapid manner in which an entire large roof area may be quickly covered and efficiently roofed.

In accordance with the method of the invention, the foam body 54 of the panel is provided with an integral conforming weather resistant sheet 52 and the upper surfaces of these integral parts aesthetically simulate any desired roofing configuration.

The sheet 52 is at first a flat sheet and is placed in a mold having the aesthetic features of roofing configuration and is preferably vacuum formed in the mold to such configuration, then the sheet is placed in a mold, as shown in FIGS. 12, 13 and 14, adjacent to a conforming backup layer 80 having recessed cavities simulating the shape of shake shingles or other roofing configuration, as desired. The formed sheet 52 is thus conformingly supported by the thick resilient backup sheet 80 and polyurethane foam generating resin is placed in a cavity 82 and a mold plate 84 encloses one side of the cavity to provide for the formation of the normally lower surface 50 of each panel cast in the cavity 82. The plate 84 is backed by a solid steel plate 86 while the sheet backup layer 80 is carried by a relatively rigid conforming plate 88, which may be made of fiberglass or other suitable material, and adjacent this backup plate 88 is a steel plate 90 held in opposition to the plate 86. Movable holding members 92 support the plate 90, and movable holding members 94 support the plate 86 and the cavity 82, as well as the sheet 52, backup 80, and backup plate 88 are retained in a generally box-shaped frame 96 forming an enclosed mold in which the foam generating resin may produce sufficient pressure to create a very dense hard foam. As this cavity 82 is closed, the backup plate 84, which serves to form the lower surface of the roofing panel, carries the connecting means 58 hereinbefore described, relative to FIG. 5 of the drawings.

The connecting means 61, at its connecting portion 64, is held in a recess 98 in the face of the backup plate 84 and double-sided adhesive tape strips 100 and 102 hold the connecting means 58 of its connecting portion 64 in the recess 98. A cover strip 104 is secured on the normally inner side of the connecting portion 64 in order to space it properly from the normally lower surface 50 of the foam body 54 when it is cast against the backup plate 84, all as shown best in FIGS. 13 and 14 of the drawings.

It will be seen that when the hard foam body 54 has been partially cured that it may be removed from the mold cavity 82 and retained in connection with the backup plate 84 to allow additional curing before the panel is stripped from the backup plate 84.

It will be appreciated that the removal of the partially cured hard foam panels in connection with the backup plate 84 allows the molds 96, together with their plates 86 and 90 to be cycled at the highest possible rate compatible with partial curing of the panels and that a few extra backup plates 84 may serve to hold the roofing panels while they complete curing and during the time when the basic mold structures are being cycled to produce additional panels.

In accordance with the method it will be appreciated that when the polyurethane foam generating chemicals are placed in the cavity 82, that generation of foam under pressure in the cavity 82 causes intimate bonding of the hard foam as it cures to the inner surface of the acrylic sheet 52 and thereby provides an integral rela-

tionship between the weather resistant acrylic sheet 52 and the hard foam body 54, such as shown in FIGS. 4 and 5 of the drawings.

It will be appreciated that the weather resistant sheet 52 may be either vacuum formed or otherwise formed, such as in a press, and that this acrylic sheet 52 is preferable; however, sheets of other material having substantial weather resistance may be used. The thickness of the acrylic sheet 52 may range between 0.050 inch and 0.022 inch. The density of the foam body may range between that provided by forming to a free unpressurized condition and that which may be formed in accordance with the overfilling of the mold cavity 82 such as to densify the foam 2 or 3 times the density as compared to the foam which would be formed in a free ambient pressure condition. Accordingly, the method provides for the varying of the density of the foam as well as the corresponding strength of the panels, in accordance with requirements. The thickness of the weather resistant sheet 52 may vary according to the materials used and in accordance with the architectural requirements.

As related to the method, the backup plate 84 is provided with a facia layer of material such as a polyethylene sheet which is designated 106 in FIG. 14, and this material 106 is compatible with the release of the polyurethane foam body, the bottom side 50 of which is cast thereagainst. Additionally, it will be understood that some release agent may be placed on the facia 106, if desired.

In the exploded view, FIG. 12, it will be seen that there are two recesses 98 for holding two of the connecting means 60 in correspondence with the disclosure of FIG. 3 as hereinbefore described.

The backup plates 84 are provided with manually usable handles 108 for carrying these backup plates 84, together with a partially cured roofing panel, as hereinbefore described. The handles 108 are disposed on each end of the backup plates 84 and are within the confines of the frame 96 and outwardly of the cavity 82, and preferably within the area of the resilient backup structure 80, as hereinbefore described.

Referring to FIGS. 10 and 11 of the drawings, it will be seen that the interlocking means 68 are placed on the sheathing and that the panels are secured thereon in a manner as shown in FIG. 5. The sheathing is supported on rafters 110 coupled to a ridge timber 112, and rotated between the rafters 110 on the ridge timber 112 are substantially H-shaped in cross section interlocking structures 114. These structures 114, as shown in FIGS. 10 and 11 of the drawings, may be secured to the timber by means of nails 116 in the sides of the timber, and also nails 118 extending through a horizontally disposed web 120 of the generally H-shaped in cross section structure of these interlocking means 114. The H-shaped in cross section interlocking means 114 is provided with a pair of upwardly disposed spaced apart legs 122 between which the web 120 is disposed and with which it is integral. A pair of downwardly extending legs 124 are spaced apart sufficiently to straddle the gable timber 112 so as to allow the web 120 to rest on top of the gable timber 112. Accordingly, the interlocking means 114 is H-shaped in cross section and fixed onto the gable timber 112 in various locations between the rafters 110, all as shown best in FIGS. 10 and 11 of the drawings.

The legs 122 and 124 on their outer sides are provided with a plurality of vertically spaced apart downwardly declining buttress teeth 126 and the legs 124 are continuity of the legs 122 so that all of the buttress teeth on the outer sides of these legs are in a substantially aligned vertical row and their buttress ledge portions are directed downwardly.

A substantially U-shaped inverted connecting means 128 is provided with a pair of downwardly directed legs 130 adapted to straddle the legs 122 of the interlocking means 114. These legs 130, on their inner sides, are provided with vertically spaced apart buttress teeth 130 which are upwardly inclined and have their locking faces directed upwardly so that they interlock with the buttress teeth 126 having downwardly directed faces as hereinbefore described.

The legs 122 of the interlocking means 114, as well as the legs 130 of the connecting means 128 are resilient and therefore laterally springable to allow the buttress teeth 130 to progressively spring over and engage with the buttress teeth 126.

The H-shaped connecting means 128 is provided with lateral bars 132 cast in a generally inverted V-shaped in cross section gable cap 134. This gable cap 134 is formed in accordance with the hereinbefore described method and comprises a hard foam body 136 and a weather resistant sheet 138. The upper surfaces of the body 136 and the weather resistant sheet 138 are of a shape which simulates the aesthetic features and configuration of natural hand split heavy cedar shakes in the form of a gable cap. These gable cap sections are made in substantially lengthy parts and the connecting means 128 may bridge several of the interlocking means 114.

After the roofing panels have been installed in a position as shown in FIG. 11, their upper edge portions 20 are well beneath the lower surface of the body 136 and the lower outer edges 142 and 144 of the roofing cap body 136 extend downward well beyond the upper edges 20 of the roofing panels of the invention, all as shown best in FIG. 11 of the drawings. Installation of the cap structure, as shown in FIGS. 10 and 11, merely includes the downward pressure on the cap until the hereinbefore described buttress teeth 130 slide over and interlock with the respective buttress teeth 126, and when the cap has been pressed down to a level substantially in engagement with the roofing panels near their upper edges 20, the installation of the gable cap is complete.

In the modified roofing panel connecting structure shown in FIGS. 15 to 23, an interlocking strip 150 is used in lieu of the interlocking strips 60 and 70, as shown in FIG. 5 of the drawings.

In accordance with various installation requirements, the interlocking strip 150 and the panels shown in FIGS. 16 to 23, may be preferred as may hereinafter be apparent from the following description.

The interlocking strip 150 shown in FIG. 15 is provided with a base surface 152 adapted to be contiguous with an upper surface 154 of roof sheathing 156, as shown in FIGS. 17 and 18 of the drawings.

The connecting strip 150 is provided with a flat upper surface 158 substantially parallel with the flat base surface 152 and this connecting strip 150 is provided with an upstanding web 160 through which nail receiving holes 162 extend so that nails 164 may be driven through these holes 162 and so that the nails may be

driven into the sheathing 156 to a position at which the heads of the nails 164 engage the upper surface 158 of the connecting strip 150 for holding the lower surface 152 of the strip in tight contiguous engagement with the upper surface 154 of the sheathing 156.

The web 160 is provided with integral oppositely directed flanges 166 and 168 which are adapted to be engaged over thin overlapped edges of the panels and in recessed grooves respectively in adjacent edges of the panels, as will be hereinafter described in detail.

The panels are designated 170 and are substantially identical in configuration. A plurality of these panels, as shown in FIG. 16 are shown on the sheathing 154 and are in place to illustrate the progression of securing these panels on the sheathing 154 by means of the interconnecting or interlocking strips 150.

Each panel 170 is provided with a lower edge 172, an upper edge 174, and opposite inclined edges 176 and 178. Each inclined edge 176 is relatively thin and overlapped by a flange 166 of one of the interconnecting strips 150, as shown best in FIG. 18, and this edge 176 is provided with a water drain groove 180 covered by an overlapping portion of the inclined edge 178 of the adjacent panel.

The inclined edge 178 of each panel is relatively thick and overlaps the edge 176 of the adjacent panel, as shown in FIG. 18, and each edge 178, beneath its overlapping portion is provided with a ledge 182 defined by a groove 184 in which the respective flange 168 of the interconnecting strip 150 is disposed.

Similarly, the upper edge portions 174 of each of the panels 170 are thin, comparable in thickness to the edges 176 of the panels at their inclined edges, and these upper edges 174 are clamped under respective flange portions 166 of the interconnecting strips 150. Further, each panel 172 at its lower edge is relatively thicker and overlaps the upper edge 174 of the next lower panel. Each lower edge 172, beneath its overlapping portion, is provided with a ledge 186 defined by a groove 188 in which a respective flange 168 of the connecting strip 150 is disposed.

It will be understood that during the installation of each panel, the panel is slidably moved downwardly such that its ledge portion 186 fits beneath the respective flange 168 while the edge 178 of the same panel is moved into position wherein its respective ledge 182 is slid under the respective flange 168 of the respective connecting strip 150. Subsequently, a respective connecting strip 150 is secured to the sheathing by the nails 164 at a respective upper edge 174 of the panel and at a respective inclined edge 176 of the newly installed panel.

It will be noted that the interconnecting strips 150 which engage the inclined edges of the panels are relatively short and upper ends 190 of these strips 168 terminate a considerable distance from the upper edges 174 of the respective panels. It will be seen, as shown in FIGS. 20 and 21 that the overlapping structure disclosed in FIG. 18 is tapered in thickness relative to a bottom side 192 and the thickness tapers toward the upper edge 174, all as shown best in FIGS. 19, 20 and 21.

The upper edge 174 is provided with an overlapping ledge 194 which overlaps the thin edge 176 of a respective panel, and these tapered portions 194 and 196 at the upper edges 174 have a combined thickness equal

to the distance between the lower surface 152 and the flange 166 of the connecting member 150.

As indicated by a broken line in FIG. 17, the ledge 194 overlaps the upper surface 175 of the tapered portion 176 near the upper edge 174 of each panel and provides a combined overlapped thickness of the respective panels substantially equal to the overall thickness of the upper edge 174. The groove 184 in each panel, near its inclined edge 178, terminated at 196, a substantial distance below the tapered ledge 194 and the respective tapered portion 176 so that the combined thickness of the overlap portions of the ledge 194 and the reduced thickness of the thin edge 176 equals a distance 199 which corresponds to the distance between the flange 166 and the base 152 of the respective connecting strip 150.

It will be seen that the respective ends 176 and 178 are provided with irregular edge configurations 198 and 200, which are intermeshing, and which provide a random edge-to-edge relationship which tends to obscure the joinder of the adjacent panels such as the configuration of cedar shakes would appear. Accordingly, the irregularities on the inclined edges of the panels are similar to those hereinbefore described in connection with FIGS. 1 and 2 of the drawings.

The overlapping ledge 194 of each panel near its inclined edge 178 covers the respective interconnecting strip 150 and a similar overlapping edge 202 extends over the upper edge 174 of a respective adjacent panel and also this overlapping ledge 202 covers the horizontally disposed interconnecting strip 150 which has its flange 166 overlying the respective upper edge 174, of each panel.

As shown in FIG. 22, an overlapping lower edge 172 at its ledge 202 extends considerably beyond the respective ledge 186 and corresponding groove 188. This structure is formed in a mold assembly 204 having compression holding plates 206 and 208 which hold a rubber mold member 210 having internal configuration 212 similar to cedar shakes or the like, and disposed in the mold adjacent the plate 206 is a mold member 214 having a lip 216 adapted to form the groove 188 in spaced relation from the end 218 of the mold cavity which forms the normally lower edge 172 of the panel, as hereinbefore described.

The edge 178 of each panel is formed in similar detail structure in the mold assembly 204 at substantially right angles to the structure disclosed in FIG. 23, it being understood that the groove 184 is formed by another mold member similar to the mold member 214 and which is provided with a lip similar to the lip 216 which forms the groove 184.

It will be understood that the modified interconnecting strip 150 and the modified panels 170 provide a preferred method of securing the panels to roof sheathing, since the connecting strips 150 may be nailed down to the sheathing in an open position at the upper edge 174 and respective edge 176 of each panel whereupon successive panels are slidably moved into place by sliding them downward and laterally such that the respective ledges 186 and 182 are engaged under the respective flanges 168, of the connecting strips 150, all as hereinbefore described.

As shown in FIG. 25, a slot 226 is disposed in the upper overlapped portion 175 of each of the panels 170 and disposed in this slot 226 is a seal 224 having a cross section such as shown in FIG. 26. The seal strip is pro-

vided with a substantially rectangular body portion 227 with an integral tapered lip 229 which, as shown in FIG. 25, is deflected laterally to engage the lower side 194 of the overlapping panel portion near the edge 200 thereof. This lip seal 229, when so deflected by movement of the panel thereover in the direction of an arrow J, seals between the panels and prevents an amount of water which would overflow the trough 180 to pass thereinto. This lip seal 229 also prevents the collection of debris in the trough 180 and limits the possibility of the trough being clogged and overflowed during a rain-storm.

In the modification as shown in FIG. 27, mastic 230 is disposed between the surface 194 and the surface 175 of the respective panels 170 and the mastic 230 may be used in lieu of the seal 224 as hereinbefore described. The mastic 230 thus prevents undue flow of water into the trough 180 so that overflow of the trough 180 may be prevented.

As shown in FIG. 28, one of the panels 170 at an edge 157 of the sheathing 156 may be cut off at 232 adjacent to the edge 157 of the sheathing 156 which may be at the gable end of the building roof. In order to hold down the cutoff edge 232, a fixture 234 is utilized, and this fixture 234 may be made of sheet metal and is provided with a flange 236 which may be driven into the foam body of the panel 170 at its cutoff edge 232. Integral with the flange 236 is an offset portion 238 having an integral vertical flange 240 through which nails 242 are driven into the edge of the sheathing 156 at its end 157 for holding the fixture 234 in juxtaposition with the sheathing 156 and for retaining the cutoff edge of the roofing panel securely on the sheathing 156.

It will be noted that the cutoff edge 232 and the outer portion of the fixture 234 are covered with an acrylic mastic coating 244, it being understood that any suitable coating may be applied.

The fixtures 234 are elongated fixtures and may be made of sheet metal or any other suitable material and the edge of the flange 236 may readily be pounded into the foam body of the panel at the cutoff edge 232 thereof until the vertical flange portion 240 engages the edge 157 of the sheathing 156.

It will be obvious to those skilled in the art that various modifications may be resorted to without departing from the spirit of the invention.

I claim:

1. A roofing panel and associated connecting means comprising in combination: a substantially rigid plastic foam body having normally upper and lower surfaces; said upper surface having a thin, weather resistant sheet bonded thereon having a roof surface simulating configuration; said lower surface being substantially flat and adapted to conform generally to roof sheathing or the like;

said panel having upper and lower longitudinal edges and first and second normally inclined edges dis-

posed at opposite ends of said panel; said panel having said first inclined edge provided with a first ledge portion adapted to extend above and overlap the second inclined edge of an adjacent panel; the lower edge of said panel provided with a second ledge portion adapted to overlap and cover a respective upper edge of an adjacent panel; said panel at said first inclined edge and at said lower edge having a flange receiving groove, said groove being spaced from said lower surface of said panel so as to coincide with the bottoms of said first and second ledges, the thickness of said second inclined edge of an adjacent panel, and with the thickness of the upper edge of an adjacent panel;

and means for joining a plurality of said panels comprising a plurality of identically shaped elongated connecting means, each having a base portion adapted to be fixed contiguous to roof sheathing or the like upon which said lower surface of said panels are disposed, and a web portion extending upwardly from said base portion, and opposed flanges extending outwardly from the said upper part of said web portion; first ones of said connecting means having one of said opposed flanges engaged in said flange receiving grooves in the first inclined edge of each panel, the other of said opposed flanges overlying said second inclined edge of an adjacent panel; second ones of said connecting means having one of said opposed flanges overlying an upper edge of each panel, the other one of said flanges being engaged in said flange receiving groove at said second ledge of an adjacent panel.

2. The invention as defined in claim 1, wherein: said foam body is of polyurethane material and said sheet is of acrylic material.

3. The invention as defined in claim 1, wherein: the thickness of each panel at said inclined edges being convergently tapered toward said upper edge.

4. The invention as defined in claim 1, wherein: said web portion and base portion having nail receiving openings therethrough for receiving sheathing penetrating nails therethrough.

5. The invention as defined in claim 1, wherein: said second inclined edge of each panel having an upper surface provided with a recessed water drain groove extending generally parallel to the respective inclined edge; said flange of said connecting means which overlaps and overlies said second inclined edge, terminating at said recessed water drain groove.

6. The invention as defined in claim 1, wherein: said first one of said connecting means is covered by said first ledge portion.

7. The invention as defined in claim 1, wherein: said second one of said connecting means is covered by said second ledge portion.

* * * * *