

[54] **ALUMINUM FACING AND ROOFING SHEET SYSTEM**

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[51] Int. Cl. **E04c 1/10, E04c 1/30**

[58] Field of Search.....**52/478, 522, 528, 529, 542, 52/588; 287/189.35**

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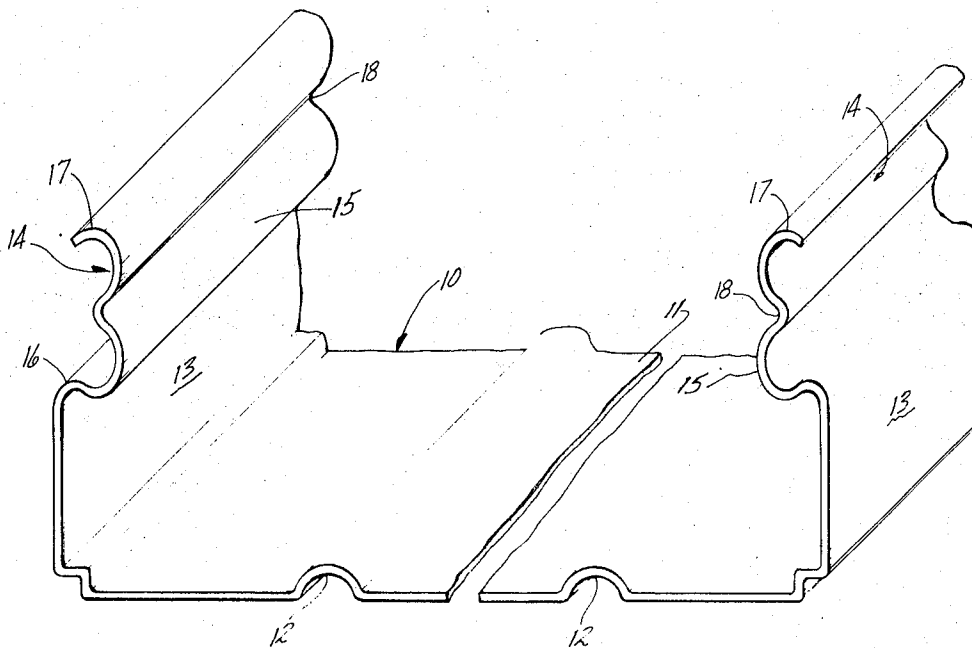
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[57] **ABSTRACT**

Aluminum facing and roofing sheet, joint configuration or building structures are provided which employ metal panels of channel configuration joined together by means of a separate closure cap. The closure cap is formed around channel-like grooves extending along the free edges of the panel sidewalls. These grooves have S-shaped shoulders and convex free ends which coact with similar shoulders of the closure cap and the anchoring clips to resist heavy loads such as those to be expected from hurricane winds. The panels are normally made of aluminum or aluminum alloys and may be backed by a cellular polymeric material such as polyurethane foam. The anchoring clips are designed to snap into the grooves of adjacent panels so as to hold firm the panels even before the closure cap is formed around the grooves. The anchoring clips may also be designed to include inserts to affect the thermal conductivity or electrical conductivity between the panels and the building frame.

30 Claims, 17 Drawing Figures



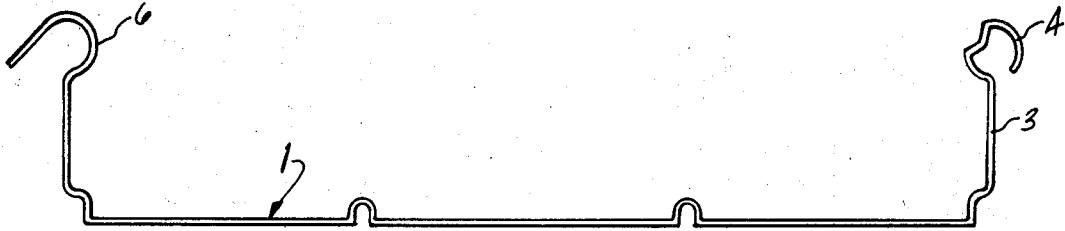


FIG-1

PRIOR ART

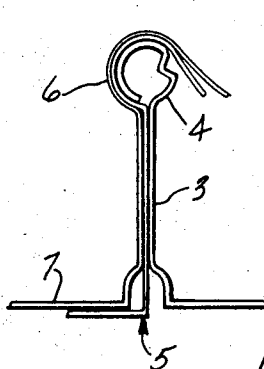


FIG-3A

PRIOR ART

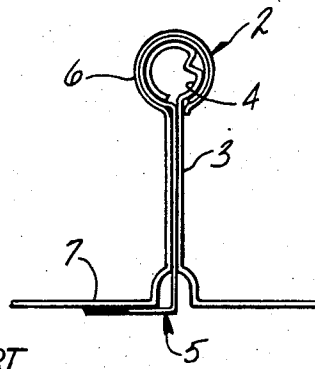


FIG-3B

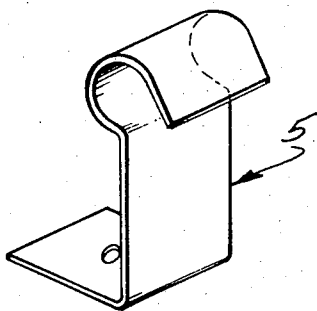


FIG-2

PRIOR ART

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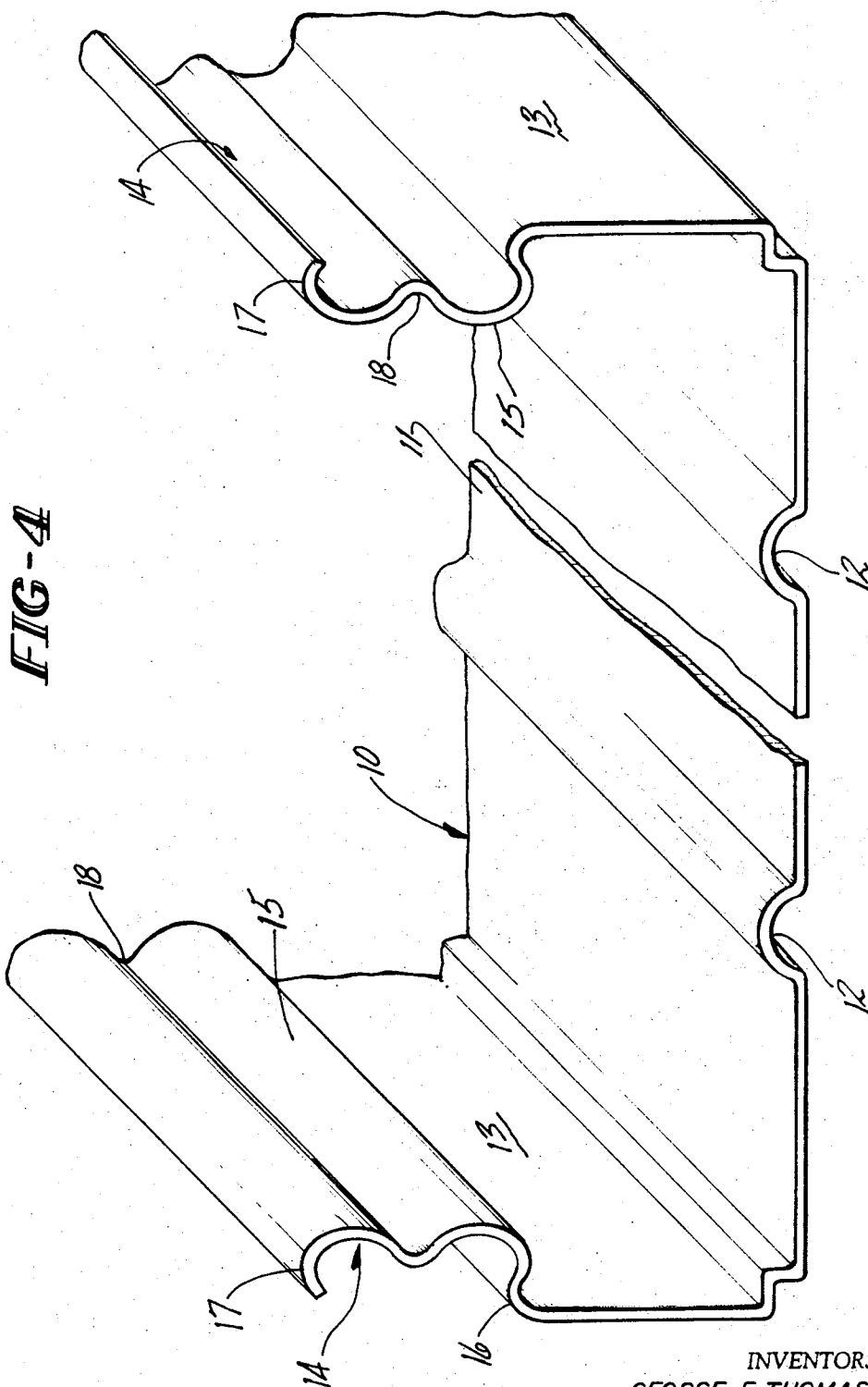
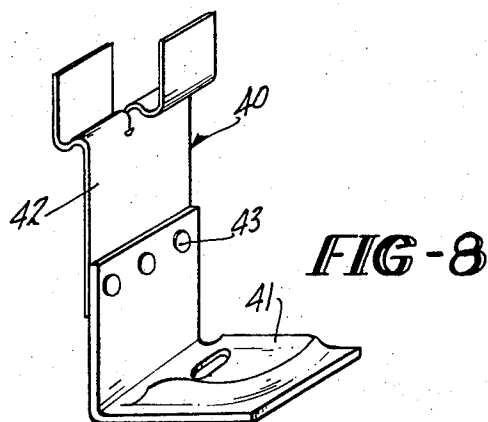
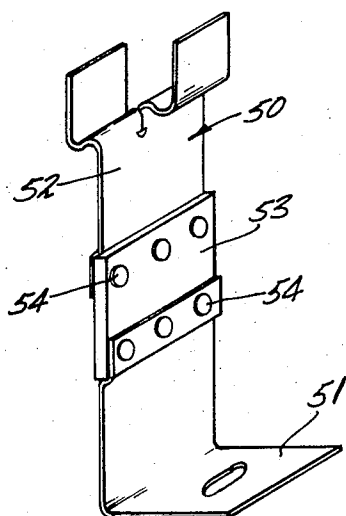
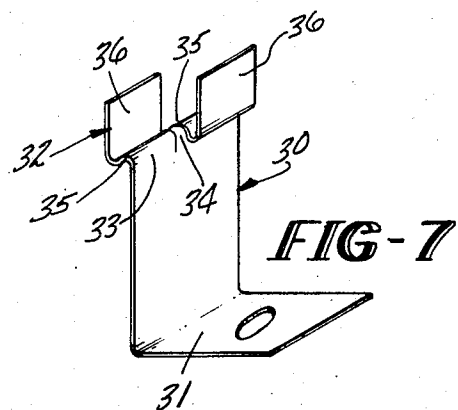
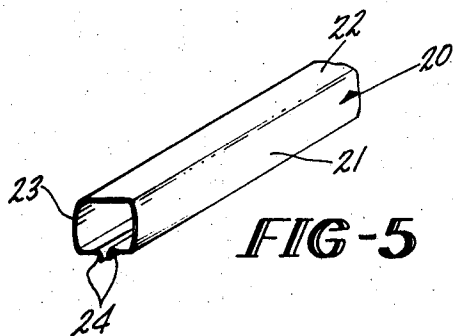


FIG-4

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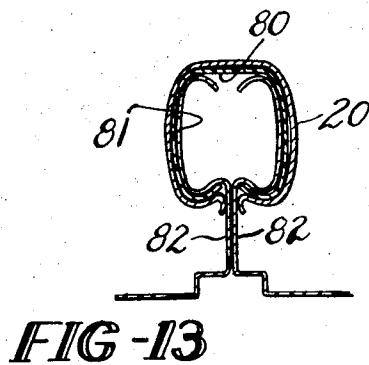
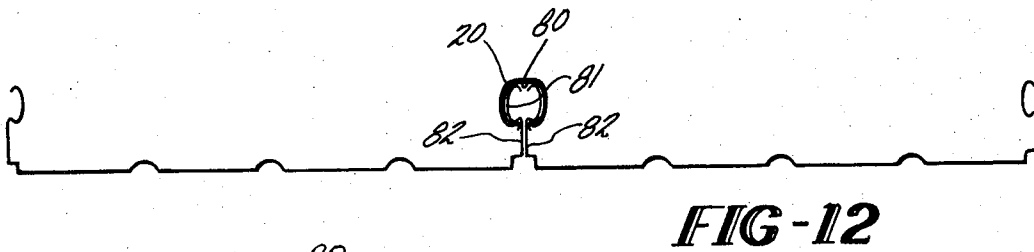
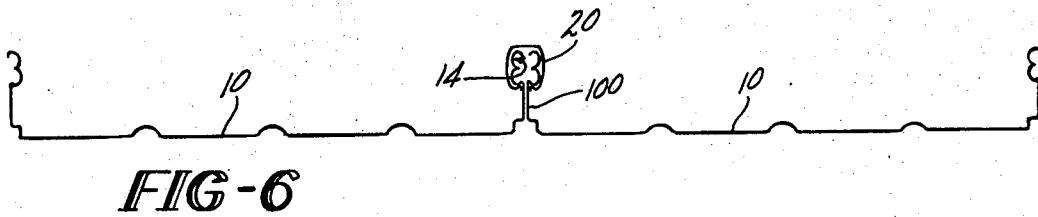
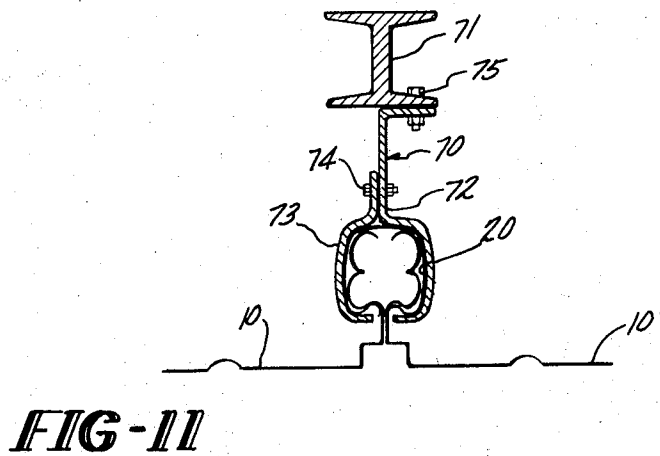
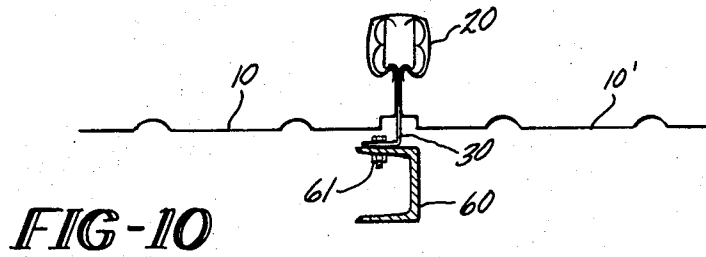
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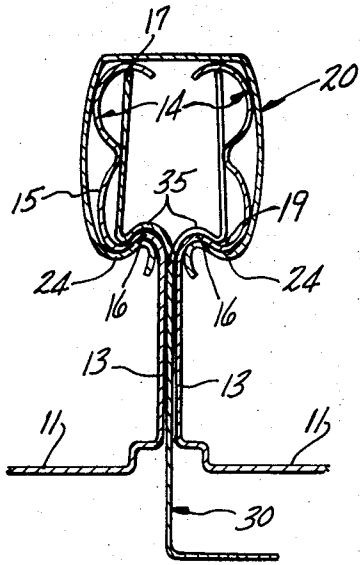


FIG-15A

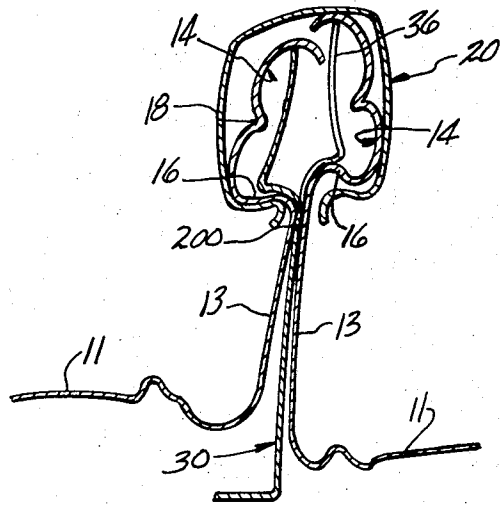


FIG-15B

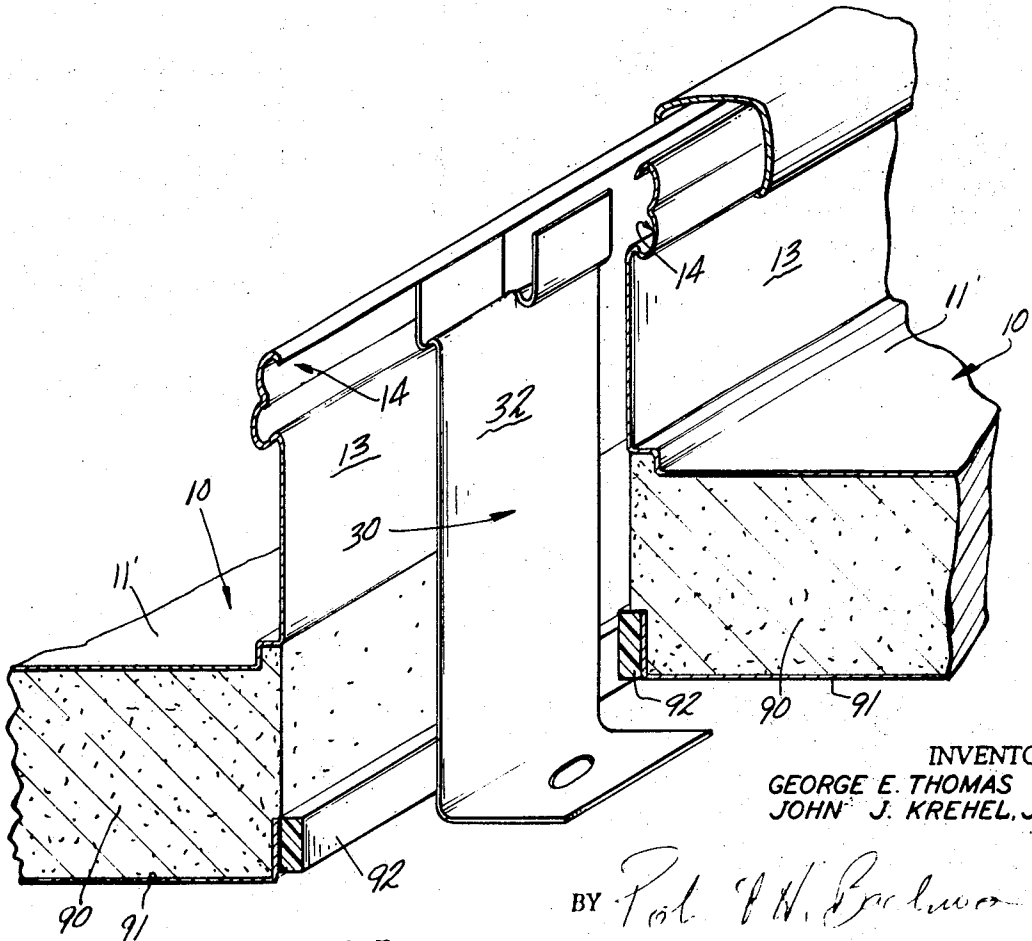


FIG-14

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ALUMINUM FACING AND ROOFING SHEET SYSTEM

The instant invention relates to an aluminum facing or roofing sheet, joint configuration and building structure.

In all building construction, design considerations must take into account pressures inside a building generated by high velocity winds which tend to blow walls outward and roofs upward. Conventional building materials resist such pressures by their own weight. For example, a 4 inch thick brick wall weighs about 40 lbs. per square foot, and a tar and gravel roof weighs about 7 lbs. per square foot (not including the roof boards and other structure). A building wall or roof of aluminum weighs only about ½ lb. per square foot and a composite panel of aluminum and urethane foam may weigh only 2 lbs. per square foot. Thus, in construction employing aluminum panels, a serious problem is how to keep the panels from blowing away. This problem is compounded by the fact that thin building sheet tends to tear around a screw or other fastener. Further, each fastener that penetrates the exterior sheet detracts from the general appearance of the building, and each hole in the exterior sheet is potentially a point at which water can penetrate.

One solution to this problem is exemplified by the prior art system of roofing and siding, which is covered by U.S. Pat. No. 3,312,028, granted Apr. 4, 1967. The prior art system is installed without perforating the sheets with fasteners, and consists of panels of any required length which are joined by marginal joints. Coupling of margins is effected by means of nestable beads or sleeves of respective flanges, the bead of one flange being nested within a somewhat larger sleeve of an adjacent flange. The nested margins are roll formed into a tightly coupled bead assembly. This system while it avoids some of the aforementioned problems with respect to fastener perforations has been known to fail under high stress such as would result from hurricane force winds.

In accordance with this invention, metal panels of channel configuration are joined together by means of a separate closure cap. The closure cap is formed around channel-like grooves extending along the free edges of the panel sidewalls. These grooves have specially shaped shoulders and free ends which coact with the closure cap and the anchor clips to resist heavy loads such as those to be expected from hurricane winds.

Accordingly, it is an object of this invention to provide metal panels of channel configuration for use in roofing and siding of buildings, which are adapted to be joined to other similar panels by a separate closure cap.

It is another object of this invention to provide an anchor clip which is adapted to mate with adjacent panels and secure them to a building frame.

It is another object of this invention to provide a building structure comprising a plurality of panels in accordance with this invention secured together by closure caps and anchored to the structural components of a building by means of clips in accordance with this invention.

It is a further object of this invention to provide a building structure as aforementioned wherein the web sections of the panels have a suitable backing material such as urethane foam.

Other objects and advantages will become apparent to those skilled in the art as a detailed discussion of particular embodiments proceeds with reference to the drawings which form a part hereof, in which:

FIG. 1 is an edge view of a facing or roofing panel in accordance with the prior art.

FIG. 2 is a perspective view of an anchor clip in accordance with the prior art.

FIG. 3 shows edge views which illustrate a roll formed joint in accordance with the prior art.

FIG. 4 shows a perspective view of a facing or roofing panel in accordance with one embodiment of the instant invention.

FIG. 5 shows a perspective view of a closure cap in accordance with the instant invention.

FIG. 6 is an edge view showing two panels in accordance with one embodiment of the instant invention, secured together by a closure cap.

FIG. 7 shows a perspective view of a split anchoring clip in accordance with the instant invention.

FIG. 8 shows a perspective view of a different embodiment of an anchoring clip in accordance with this invention.

FIG. 9 shows a perspective view of a still different embodiment of an anchoring clip in accordance with this invention.

FIG. 10 is an edge view of the joint configuration in accordance with the instant invention.

FIG. 11 is an edge view showing means for suspending interlocked panels from an overhead beam, in accordance with this invention.

FIG. 12 is an edge view showing two panels in accordance with a different embodiment of the instant invention, secured together by a closure cap and including a sealing means.

FIG. 13 is an enlargement of the joint configuration shown in FIG. 12.

FIG. 14 is a perspective view showing a panel assembly in accordance with the instant invention having a foam backing.

FIG. 15 shows edge views of a joint configuration in accordance with the instant invention before and after the application of a severe uplifting load.

Referring now to the drawings, and especially to FIGS. 1 to 3, there is illustrated a facing or roofing panel 1 and joint configuration 2 in accordance with the prior art. The structure which is illustrated is that found in U.S. Pat. No. 3,312,028, granted Apr. 4, 1967. FIG. 1 shows the free edge of one margin 3 of the panel 1 which is formed into a relatively small inner ring 4. The anchor 5, as shown in FIG. 2, is placed over the inner ring 4 and secured to the building frame. As shown in FIG. 3A, the larger outer sleeve 6 of the adjacent panel 7 is placed over the anchor 5 and the inner ring 4, and then rolled closed as shown in FIG. 3B. The prior art system was found to fail under an upward acting load of 365 lbs. To overcome this problem, panels, anchoring clips and a joint configuration were developed in accordance with the instant invention as will now be set forth.

FIG. 4 shows a panel 10 in accordance with the instant invention. The panel 10 may be of any desired length and width. Generally, the width of the panel may be from about 12 to 24 inches wide, although a 16 inch width is preferred as being the most efficient and safest to handle.

The panel 10 as shown comprises a web section 11 having longitudinally extending ribs 12 formed in the web section. Sidewalls 13 project outwardly from the opposing edges of the web section 11. A groove 14 is formed along the free edge of each sidewall 13 projecting inwardly toward the opposing sidewall 13. The shape of this groove 14 is an essential and critical aspect of this invention. It has a general channel-like shape with web section 15 and legs 16 and 17. One leg 16 of the groove 14 forms a reversed curved shoulder between the web 15 of the groove 14 and the sidewall 13 of the panel 10. The other leg 17 of the groove 14 has a free end and has a generally convexly curved shape adapted to confine the anchor clip 30. The reversed curved shoulder 16 has a substantially S-shaped cross section extending initially convexly from the panel sidewall 13. The "S" shaped shoulder is not limited to a smoothly curved one as shown but may be composed of flat portions suitably arranged or a combination of curved and flat portions. This applies also to the mating shoulders 24 and 35, respectively, of the closure cap 20 and anchor clip 30. The smoothly curved shoulder 16 is preferred since it is readily roll formed.

A slot 18 is preferably provided in each of the groove webs 15 projecting in a direction opposite to that in which the grooves 14 themselves project. The purpose of this slot 18 is to provide a water tight joint by preventing capillary action from carrying water in between the metal sheets at the joint. As will be discussed later, other means for obtaining a water tight joint could be employed.

The panels are secured together by means of closure cap 20 as shown in FIG. 5. The closure cap 20 has three surfaces 21, 22 and 23 which are softly rounded to present a pleasing appearance and to develop large surface contact with the grooved portions 14 of the panel sidewalls 13, as shown in FIG. 6. Close contact between the closure cap 20 and the grooved portions 14 along the largest possible area increases the structural efficiency of the joint 100. The cap 20 has shoulders 24 which are adapted to mate with the S-shaped shoulders 16 of the sidewall grooves 14. This is best shown in FIG. 15A.

In use the cap 20 may be preformed as shown in FIG. 5 and slid over the groove sections 14 of the adjacent sidewalls 13 of adjacent panels 10, or it may be roll formed in place in a manner similar to that employed in U.S. Pat. No. 3,312,028. The roll forming could be performed in a variety of ways, such as by providing a channel shaped cap 20 which is placed over the grooved portions 14 of adjacent panels 10 and then roll forming the S-shaped shoulders 24 so they mate with the shoulders 16 of the grooves as shown in FIG. 15A. In accordance with another embodiment, the cap 20 is formed from a coiled strip which is first roll formed into a channel, and then the S-shaped shoulders 24 are roll formed. Substantial advantages are obtained by roll forming the closure cap 20 on the assembled panels, rather than sliding it on, since the latter operation is difficult and cumbersome. The roll forming is performed utilizing a tool similar to that described in the aforementioned patent. In most cases, the closure cap 20 will be formed from 0.032 inch coiled strip, however, since it is separate from the panels 10, its gage and size can be varied to meet desired strength requirements.

In order to secure the panels 10 to the underlying building frame, it is necessary to employ an anchoring clip 30 as shown in FIG. 7. The bottom portion 31 of the anchoring clip 30 is suitably designed for securing the clip to a building frame. The upper portion 32 of the clip is highly novel and comprises one aspect of the instant invention. The upper portion 32 of the clip 30 comprises at least two tab portions 33 and 34 which are bent in opposite directions to form S-shaped shoulders 35 adapted to mate with the S-shaped shoulders 16 of adjacent sidewall grooves 14. The tab portions 33 and 34 also include blade portions 36 which project in the same direction and have a height approximately equal to the width of the grooves 14 in the panel sidewalls 13. The width in question as seen from FIG. 15A is measured between the concave portion 19 of the S-shaped shoulder of the sidewall groove 14 and the convexly curved leg 17 of the groove. The split anchor of FIG. 7 is adapted to secure two panels 10 to the building frame. The S shaped shoulders 35 of each tab portion 33 and 34 are essential and critical to the coaction which occurs between the anchor 30 and the panel sidewall grooves 14, which coaction provides resistance to uplift loads. Total height of the anchor 30 may be varied to accommodate any desired panel and backing thickness as shown in FIG. 14. If desired, more than two tab portions can be used.

The anchor 30 in accordance with this invention is easy to install. The tab portion 33 of the split anchor 30 is snapped into a sidewall groove 14 of a panel 10 down in place. Then the lower portion 31 of the anchor 30 is fastened to the building frame. The sidewall groove 14 of an adjacent panel 10 is then snapped over the other tab portion 34 of the split anchor 30, and both panels 10 are safely secured to the frame even if installation of the closure cap 20 is delayed for hours or days.

When greater strength is required, a heavy formed base 41 may be used, as shown in FIG. 8, which is secured to an upper portion 42 of a split anchor 40 in any suitable manner, as by rivets 43. In some applications, as shown in FIG. 9, where it is desired to reduce thermal conductivity or otherwise change the conductivity between the panels 10 and the building frame, an insulating type insert 53 may be secured in any suitable manner, as by rivets 54, between the lower 51 and upper 52 portions of the anchor 50. Plastic or ceramic materials are most useful as the inserts 53.

FIG. 10 shows a joint configuration in accordance with this invention. Panels 10 and 10' are secured together by the closure cap 20 and joined to a channel member 60 of a building frame, by means of a split anchor 30 and bolt 61. This method of joining the panels 10 to the frame is most useful for outside facing and roofing.

The panels in accordance with the instant invention may also be employed in suspended ceilings by means of a suitable mounting clamp 70 as shown in FIG. 11. In FIG. 11, panels 10 and 10' are joined together by closure cap 20, and the so joined panels 10 and 10' are suspended from an I-beam 71 by means of a clamp 70 which fits around the closure cap 20. The clamp comprises a first member 72 which is secured to the I-beam 71 and fits around a substantial portion of the closure cap 20. A second member 73 which is clamped to the first member by bolt 74 fits around substantially the remainder of the closure cap 20. The split clamp 70 is

secured to the I-beam 71 by means of bolt 75. The use of the split clamp 70 provides for easy construction of suspended roofs and ceilings using the facing and roofing panels 10 of this invention.

The panels 10 which have been shown in the drawings up to this point all have anti-capillary slots 18 in the web sections 15 of the panel sidewall grooves 14. The purpose of the anticapillary slots 18 as aforementioned is to provide a water tight joint between the panels. FIG. 12 shows another means by which the water tight joint may be obtained. In accordance with this embodiment, the anti-capillary slot 18 is omitted, and a resilient sealing strip 80 is roll formed simultaneously with the closure cap 20 about the groove portions 81 of the adjacent panel sidewalls 82. This embodiment is best depicted in FIG. 13 which shows the groove portions 81 of adjacent sidewalls 82, the resilient sealing strip 80 and the closure cap 20.

FIG. 14 shows the most preferred embodiment of the instant invention. As shown therein, the web section 11' of the panels 10 is backed 90 by a suitable material. The material which is used may be determined by particular needs. For example, it could be selected from the group consisting of wood, plastic, metal or cork. Preferably, however, it is a cellular polymeric material, such as polyurethane foam, styrofoam, or other similar foam material. The cellular polymeric material may be either rigid or flexible, depending on whether it is desired to provide increased strength and rigidity. The use of a rigid foam provides added strength and rigidity as well as insulation.

The back surface of the backing material should usually have a metal cover sheet 91 or foil secured to it. However, wood, paper, cardboard, plasterboard, or other suitable sheet materials could be employed.

To provide added protection against moisture or air leaks, resilient sealing strips 92 can be secured to the cover sheet 91 of the backing material 90 as shown. Therefore, sections 11' of the embodiment of FIG. 14 comprise a composite composed of the panel web section 11', a backing material 90 and a cover sheet 91. The purpose of using this composite web section 11' is to provide added strength and insulation.

When the panels 10 have a backing material 90, as shown in FIG. 14, the height of the sidewalls 13 of the panels 10 may be substantially decreased from that in accordance with the previously described prior art, thus securing a substantial savings in metal.

FIG. 14 also illustrates how the upper portion 32 of the split anchor 30 is snapped into the sidewall groove 14.

FIG. 15A shows a joint configuration in accordance with one embodiment of the invention. It can be seen that the S-shaped shoulders of the sidewall grooves 14, split anchor 30 and closure cap 20 all snugly interfit.

Tests were run to determine the resistances to uplifting loads of this joint configuration as compared to that of the prior art as shown in FIG. 3B. A 6 inch long test piece in accordance with the prior art configuration of FIG. 3B failed completely under a load of 365 lbs. with the anchor being straightened and pulled through the gap in the joint. In a similar test, a 6 inch test piece having a joint configuration in accordance with the instant invention as shown in FIG. 15, did not fail under an uplifting load of 1,320 lbs. at which load the test fixture broke.

FIG. 15B shows an edge view of the test sample in accordance with this invention, after the test has been run.

Referring to FIG. 15, moderate loads are easily resisted by the S-shaped shoulder 35 of the split anchor 30 in contact with the S-shaped shoulder 16 of the panel sidewall groove 14. Heavier loads tend to deform this shoulder 35. The shoulder 35, however, is not formed to a simple 90° angle, but has the reverse curved S-shape so that it must be moved through a certain distance to reach the horizontal plane at which point it is still an effective anchor. Note that the moment arm is very short in this assembly.

As the anchor 30 resists the loads, forces are directed by the reversed curved shoulder 35, in a horizontal direction causing the groove portions 14 of the panel sidewalls 13 to move toward each other, i.e., the forces which tend to pull the anchor 30 through the gap 200 between the sidewalls 13 also tend to close the gap 200. In contrast, the prior art joint configuration of FIG. 3B began to spread under very similar loads.

As greater loads tend to force reversed curved shoulder 35 of the split anchor clip 30 up the shoulder 16 of the sidewall groove, the upper blade portion 36 of the anchor 30 pushes against the upper curved portion 17 of the sidewall groove 14. At this time, the groove 14 begins to offer resistance in the vertical direction.

Still greater loads will cause deformation of the shoulder 35 causing the upper blade 36 to move inwardly at which time the upper curved portion 17 of the sidewall groove 14 confines the blade 36, and resists horizontal movement.

Even greater loads cause the upper curved portion 17 of the sidewall groove 14 to move in a horizontal direction where it meets the similar portion 17 of the adjacent sidewall groove 14, i.e., as one blade 36 of the anchor 30 moves the upper curved portion 17 of one sidewall groove 14, it is met by the equal and opposite horizontal force of the opposing anchor blade 36 and opposing sidewall groove 14.

Under even greater loads, the sidewall grooves 14 of our 6 inch long specimen began to fail in column action. In actual practice, a much longer length of sidewall groove 14 would be available to resist this columnar load. The test specimen, in accordance with the prior art, did not resist loads which would have been sufficient to cause this type of columnar distortion.

Under certain conditions, it is possible that the shoulders 35 of the anchor 30 might be flattened and start to pull through the gap 200 between the two sidewall grooves 14. This movement would be resisted in a horizontal direction by the separate closure cap 20.

The joint configuration described above is also applicable to window and door frames which might be used with the facing panels 10 of the instant invention. The door and window frames could be made from modular extrusions that mate with the sidewall grooves 14 of the panels 10 of this invention. The joint between the frame and the panel 10 would then be covered by a typical closure cap 20 and closed by a suitable roll forming closing tool.

Because the joint configuration in accordance with this invention is closed by a separate cap 20, there is no need for one panel 10 to overlap the other 10, and no need for some version of a tongued and grooved clo-

sure. The panels 10 are engaged by the split anchor clip 30 but they do not engage each other. As a result, both sides of the panel 10 have the same configuration: there are no rights and lefts to complicate fabrication or erection.

Since the panels 10 do not engage each other, an individual panel may be readily removed without disturbing the next panel. The closure caps 20 can be pried loose and peeled back with relative ease to permit economical replacement of damaged panels.

Since the panels 10 are secured to the building entirely by the split anchor 30, the closure caps 20 may be installed at the convenience of the erector. In contrast, the aforementioned prior art panels are not safely anchored until the joints are rolled closed.

While the joint in accordance with this invention is open to view, the panel erector standing on the roof can inspect it, adjust it and if desired, fill it with a polyurethane foam or other suitable sealing material. In contrast, joints in accordance with the aforementioned prior art system cannot be filled from the rooftop. When joints must be filled, the work is done from scaffolding inside the building.

The panels, in accordance with this invention as depicted in FIG. 14, are easier to fabricate than those of the prior art because the sidewall grooves do not project beyond the outside faces of the sidewalls, thereby permitting simple form boards to be used to control the rise of the polymeric foam. With the prior art system, the inner ring and outer flange project beyond the faces of the sidewalls and interfere with the forms.

The panels and closure caps may be made from any suitable metal and preferably from aluminum and aluminum alloys. The thickness of the sheet from which the panels are fabricated may or may not be the same as that from which the closure caps are made. The surfaces of the panels may be naked or they may be painted or coated, colored or textured in any suitable manner.

It is to be understood that the invention is not limited to the illustrations described and shown herein, which are deemed to be merely illustrative of the best modes of carrying out the invention, and which are suitable of modification of form, size, arrangement of parts and details of operation. The invention rather is intended to encompass all such modifications which are within its spirit and scope as defined by the claims.

What is claimed is:

1. In a facing or roofing member comprising a panel of channel configuration having a central web and first and second sidewalls projecting outwardly from the opposing edges of said web, the improvement wherein: each of said sidewalls has a groove of channel configuration extending along its free edge, with the groove in said first sidewall extending inwardly toward said second sidewall and with the groove in said second sidewall extending inwardly toward said first sidewall, each of said grooves comprising a groove web with a first leg being integral with said groove web and having a free edge and a second leg forming an integral shoulder between said groove web and one of said first and second panel sidewalls, said first leg having a substantially convex shape and said second leg having a substantially S-shaped cross section extending initially convexly from said one of said first and second panel sidewalls.

2. In a facing or roofing member as in claim 1, the improvement wherein said groove webs and said first and second legs are smoothly curved.

3. In a facing or roofing member as in claim 1, the further improvement wherein the web of each of said grooves contains at least one anti-capillary slot extending coextensively with said groove.

4. In a facing or roofing member as in claim 3, the further improvement wherein said member is made of aluminum or aluminum alloys.

5. In a facing or roofing member as in claim 4, the further improvement wherein each of said first and said second legs is smoothly curved.

6. In a facing or roofing member as in claim 4, the further improvement wherein said central web of said panel further includes a backing of a cellular polymeric material.

7. In a facing or roofing member as in claim 6, the further improvement wherein a facing sheet is secured to said backing material.

8. In a facing or roofing member as in claim 7, the further improvement wherein said facing sheet includes a sealing strip which is secured to said facing sheet, said sealing strip being adapted to engage a similar sealing strip of an adjacent panel and providing a water and air tight seal.

9. In a facing or roofing member as in claim 6, the further improvement wherein said cellular polymeric material is a polyurethane foam.

10. In a facing or roofing member as in claim 9, the further improvement wherein said polyurethane foam is a rigid polyurethane foam.

11. In a building structure comprising:

a plurality of panels of channel configuration having a central web and first and second sidewalls projecting outwardly from the opposing edges of said web, said panels being secured to a frame of the building to form a roof or facing, the improvement wherein:

each of said panel sidewalls has a groove of channel configuration extending along its free edge with the groove in said first sidewall extending inwardly toward said second sidewall and with the groove of said second sidewall extending inwardly toward said first sidewall, each of said grooves comprising a groove web with a first leg being integral with said groove web and having a free edge and a second leg forming an integral shoulder between said groove web and one of said first and second panel sidewalls, said first leg having a substantially convex shape, said second leg having a substantially S-shaped cross section extending initially convexly from said panel sidewall;

said panels being secured to said building frame by an anchoring clip comprising:

a first portion having at least one aperture therein, said first portion being secured to said building frame;

a second portion connected to said first portion comprising at least two tab portions with at least one of said tab portions having an S-shaped shoulder projecting in a first direction and with at least one other of said tab portions having an S-shaped shoulder projecting in a direction substantially opposite to that in which said first S-shaped shoulder projects;

each of said tab portions having a blade portion integral with said "S" shaped shoulder with each of said blade portions projecting in substantially the same direction;

said blade portions being nested in the groove portions of adjacent panels with said "S" shaped shoulders of said tab portions substantially mating with the "S" shaped leg of said sidewall grooves; and

a closure cap securing adjacent panels together about their sidewall grooves, said closure cap having integral S-shaped shoulders which substantially mate with the S-shaped legs of said sidewall grooves of said adjacent panels.

12. In a building structure as in claim 11, the further improvement wherein a sealing strip is interposed between said closure cap and said grooves of said panel sidewalls.

13. In a building structure as in claim 11, the further improvement wherein the webs of each of said sidewall grooves have at least one anti-capillary slot extending coextensively with said grooves.

14. In a building structure as in claim 13, the further improvement wherein said panels are made of aluminum or aluminum alloys.

15. In a building structure as in claim 14, the further improvement wherein said first and second legs are smoothly curved.

16. In a building structure as in claim 14, the further improvement wherein said first portion and said second portion of said anchoring clips are integrally connected.

17. In a building structure as in claim 14, the further improvement wherein said first portion of said anchoring clip is separated from said second portion by an insert having a thermal conductivity different from that of said first and second portion, said first portion and said second portion being secured to said insert.

18. In a building structure as in claim 14, the further improvement wherein the web sections of said panels are backed by a cellular polymeric material.

19. In a building structure as in claim 18, the further improvement wherein said cellular polymeric material is a polyurethane foam.

20. In a building structure as in claim 18, the further improvement wherein a facing sheet is secured to said backing material.

21. In a building structure as in claim 20, the further improvement wherein a sealing strip is secured to said facing sheet, said sealing strip being adapted to engage a similar sealing strip of an adjacent panel so as to provide a substantially water and air tight seal.

22. In a ceiling structure comprising:

a plurality of panels of channel configuration having a central web and first and second sidewalls pro-

jecting outwardly from the opposing edges of said web, said panels being suspended from a member of a building by clamping means, the improvement wherein:

each of said panel sidewalls has a groove of channel configuration extending along its free edge with the groove in said first sidewall extending inwardly toward said second sidewall and with the groove in said second sidewall extending inwardly toward said first sidewall, each of said grooves comprising: a groove web with a first leg being integral with said groove web and having a free edge and a second leg forming an integral shoulder between said groove web and one of said first and second panel sidewalls;

said first leg having a substantially convex shape, said second leg having a substantial S-shaped cross section extending initially convexly from said panel sidewall;

a closure cap securing adjacent panels together about their sidewall grooves, said closure cap having integral S-shaped shoulders which substantially mate with the S-shaped legs of said sidewall grooves of said adjacent panels;

said plurality of panels being suspended from said building member by means of a clamp which engages said closure cap.

23. In a ceiling structure as in claim 22, the further improvement wherein a sealing strip is interposed between said closure cap and said grooves of said panel sidewalls.

24. In a ceiling structure as in claim 22, the further improvement wherein the webs of each of said sidewall grooves have at least one anti-capillary slot extending coextensively with said grooves.

25. In a ceiling structure as in claim 24, the further improvement wherein said panels are made of aluminum or aluminum alloys.

26. In a ceiling structure as in claim 25, the further improvement wherein said first and second legs are smoothly curved.

27. In a ceiling structure as in claim 26, the further improvement wherein the web sections of said panels are backed by a cellular polymeric material.

28. In a ceiling structure as in claim 27, the further improvement wherein said cellular polymeric material is a polyurethane foam.

29. In a ceiling structure as in claim 27, the further improvement wherein a facing sheet is secured to said backing material.

30. In a ceiling structure as in claim 29, the further improvement wherein a sealing strip is secured to said facing sheet, said sealing strip being adapted to engage a similar sealing strip of an adjacent panel so as to provide a substantially water and air tight seal.

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