United States Patent [19]

Stewart

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[54] **ROOF STRUCTURE**

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[52] **U.S. Cl.** **52/80;** 52/82; 52/463; 52/529; 52/537

[51] **Int. Cl.²** **E04B 1/32;** E04B 7/00

[58] **Field of Search** 52/63, 80, 82, 75, 460–466, 52/495, 329, 245, 281, 282, 289, 630, 537, 245, 519–529, 542, 544, 547

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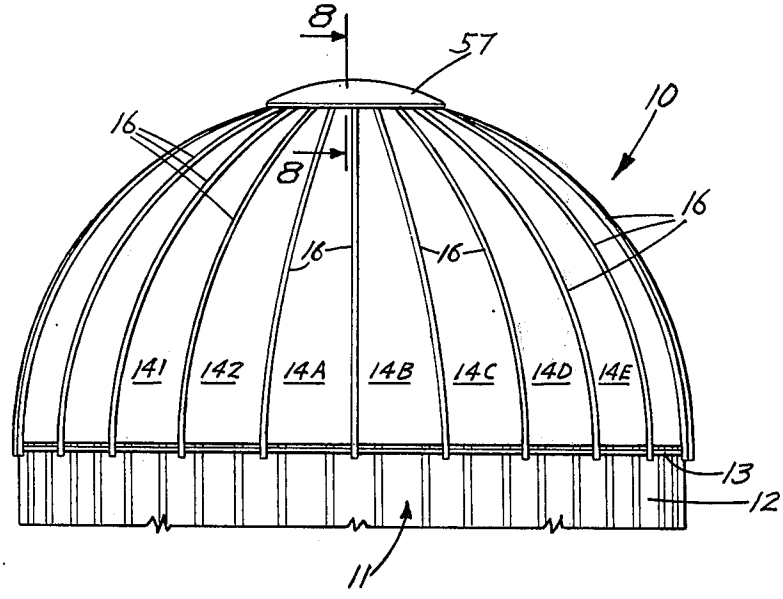
Primary Examiner—J. Karl Bell

Attorney, Agent, or Firm—Burd, Braddock & Bartz

[57] **ABSTRACT**

A domed roof covering the top of a structure, as a tower silo. The roof has a plurality of panels having adjacent edges mounted into connecting ribs.. Each connecting rib has grooves extended along the longitudinal length of the rib for accommodating flanges along the edges of the panels. Connectors attach the lower end of each rib to the structure. The upper ends of the panels are attached to a ring. A cover is located over the ring. A plurality of members attach the cover to the ring.

14 Claims, 8 Drawing Figures



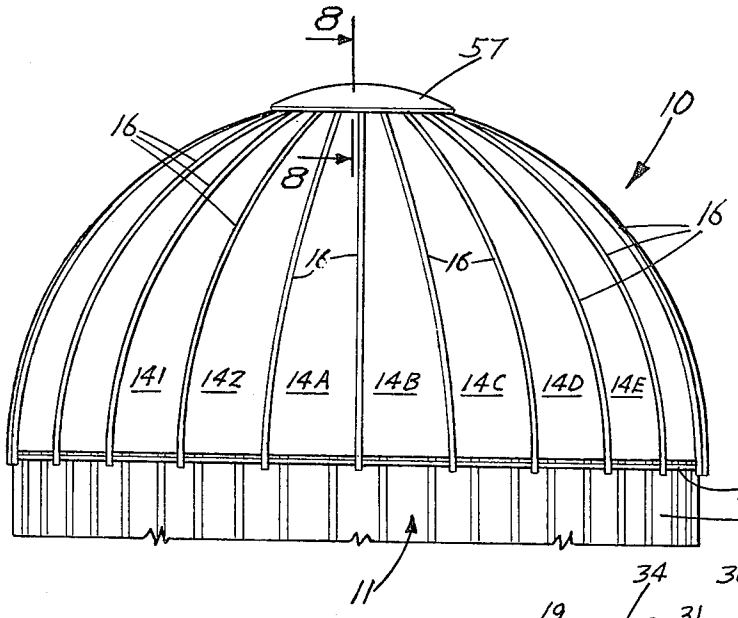


FIG_1

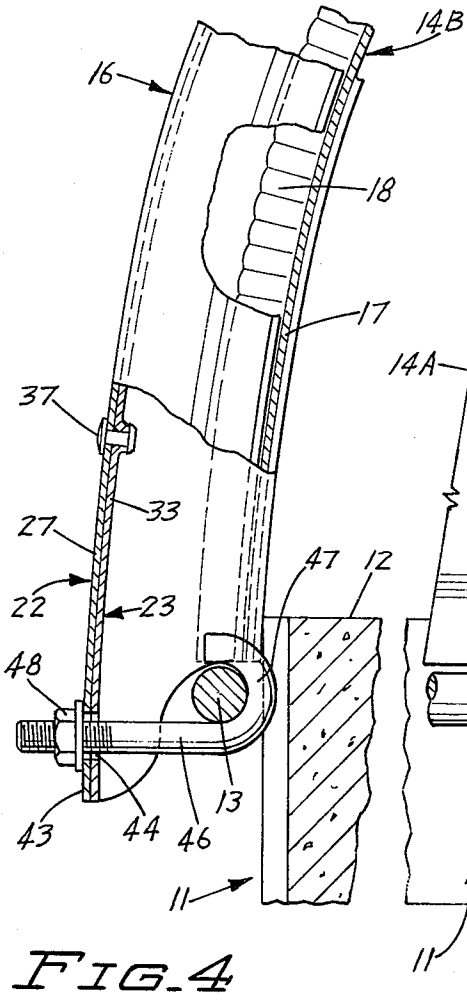


FIG_4

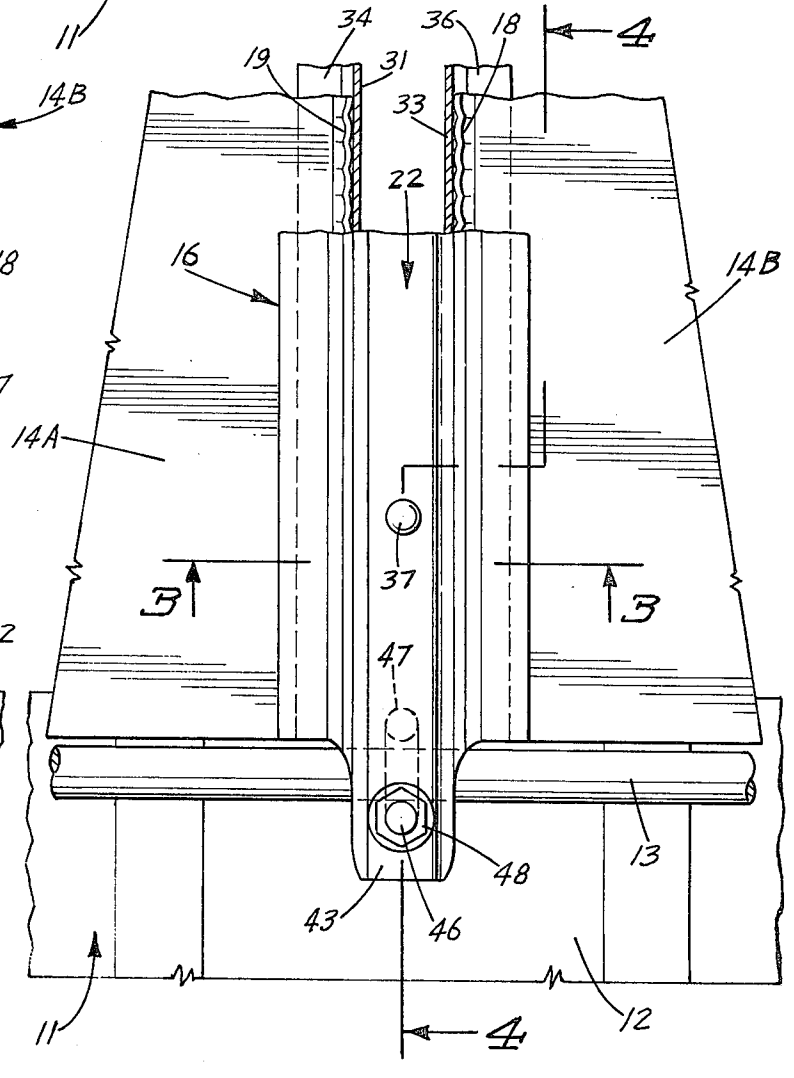


FIG_2

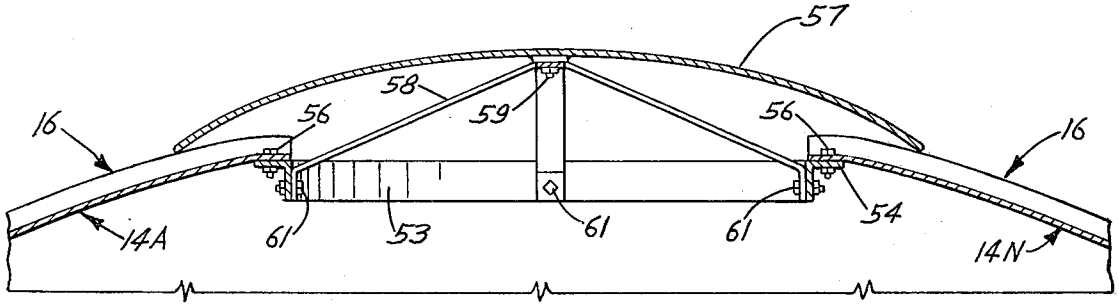


FIG. 8

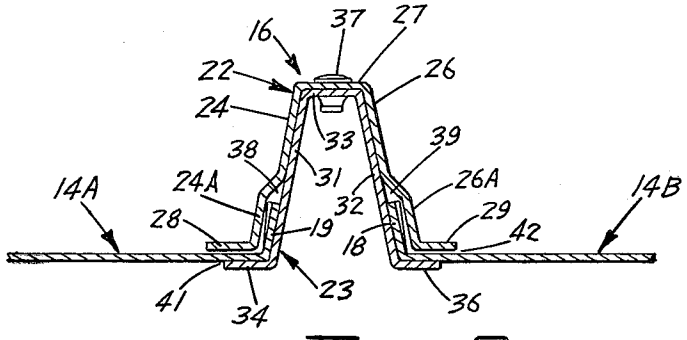


FIG. 3

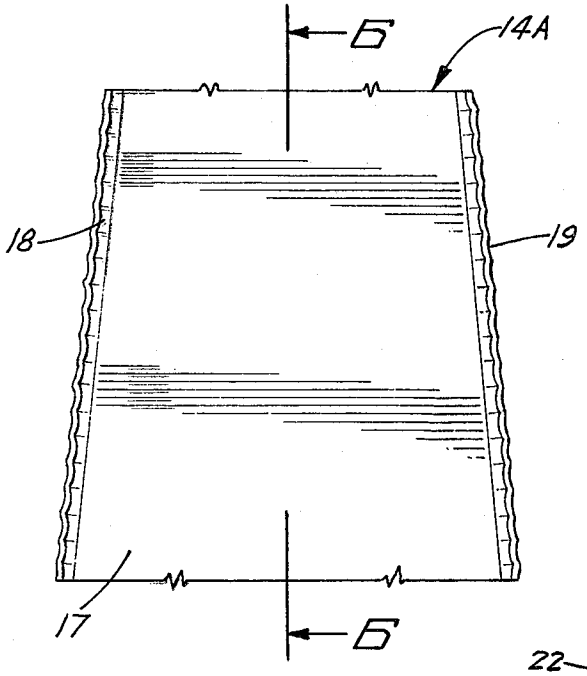


FIG. 5

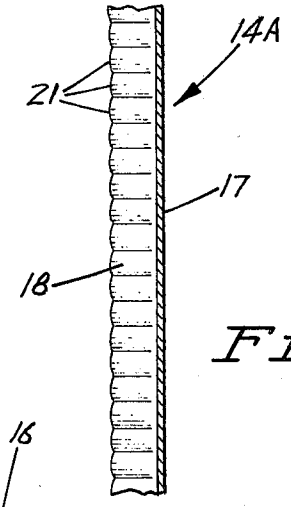


FIG. 6

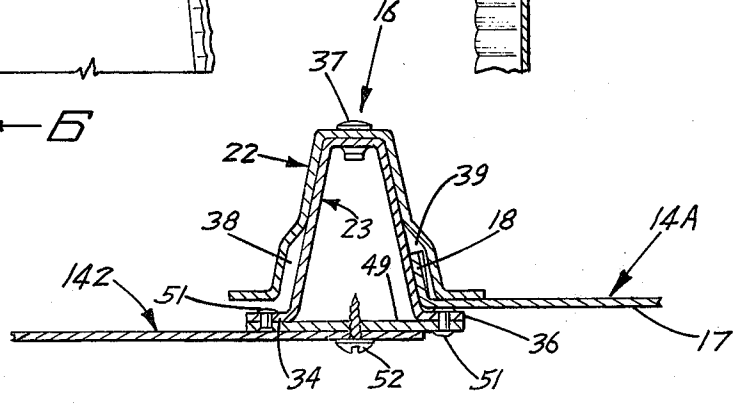


FIG. 7

ROOF STRUCTURE

BACKGROUND OF INVENTION

Roof structures for silos having a plurality of interconnected panels are used to cover the top of a silo. The adjacent edges of the panel are connected with longitudinally extended ribs. In the assembly of this type of roof, special tooling and procedures are required, making the job of erecting the roof on the silo difficult and time consuming. The panel structures do not have sufficient strength to hold the roof in its erected position. Additional ribs of thicker material and strengthening members are used to reinforce the roof.

SUMMARY OF INVENTION

The invention is related to dome structures for covering a location. More particularly, the structure is a roof for a tower silo mounted on the top of the silo. The roof has a plurality of panels having crimped side flanges. The adjacent sides of the panels are connected to an elongated rib having pockets to accommodate the flanges of the panels. Fastening means attach the lower ends of the ribs to the top of the silo. A cap means covers the center portion of the roof.

An object of the invention is to provide an elongated rib for connecting adjacent panels of a roof structure which will automatically center the panels in assembled relation with the rib with a minimum of time and labor. A further object of the invention is to provide a panel with structure which controls the folds of the edges of the panels so that the panels can be shipped in a flat condition and used in a curved condition on an assembled roof. A further object of the invention is to provide roof structures with the same raw material stock so that the roof can be fabricated from a minimum inventory. Another object of the invention is to provide a roof structure for a silo that can accommodate relatively large variations within a nominal diameter of silos without the use of special parts. A further object of the invention is to provide a roof for a silo that has substantial strength and can be readily assembled without jambing and without special tooling and procedures.

IN THE DRAWING

FIG. 1 is a side elevational view of the roof of the invention secured to the top of a tower silo;

FIG. 2 is an enlarged elevational view, partly sectioned, of a portion of the roof of FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 1;

FIG. 5 is a foreshortened plan view of a panel used in the roof of FIG. 1;

FIG. 6 is a sectional view taken along the line 6—6 of FIG. 5;

FIG. 7 is a sectional view similar to FIG. 3 showing the connection of the panel to the last rib; and

FIG. 8 is an enlarged sectional view taken along the line 8—8 of FIG. 1.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawing, there is shown in FIG. 1 the dome roof of the invention indicated generally at 10 mounted on top of a structure 11. The structure 11 is shown as a tower silo for storing particulate material, as silage, haylage and the like. Other types of structures

and silos can be covered with the dome roof of the invention. Silo 11 has a cylindrical upright side wall 12. A plurality of circular hoops or rings 13 surround the side wall and provide reinforcement of side wall 12. The top hoop 13 is located adjacent the top edge of side wall 12.

The domed roof 10 has a plurality of panels 14A–14Z connected to elongated ribs indicated generally at 16. The plurality of panels are identical to each other. The number of panels varies with the diameter of the silo. The ribs 16 are identical to each other.

Referring to FIGS. 5 and 6, there is shown a panel 14A having a generally elongated trapezoidal shape. Panel 14A has a flat flexible sheet member or base 17. An upwardly directed flange 18 is integral with one side of base 17. In a similar manner, an upwardly directed side flange 19 is integral with the opposite side of the base. The flanges 18 and 19 extend the full length of the panel. Each flange has a crimped configuration. The plan view of the flanges shows the broad reverse S-curve shape of the flanges. The panels 14A–14Z are manufactured and shipped in a flat condition. Panels 14A–14Z are curved at the erection site of the domed structure to follow the curvature of the ribs 16. The crimped flanges 18 and 19 permit the flanges to stretch out to an arcuate shape. Panels which do not have crimped or slotted flanges will fold when the panel is bent, with the result that the flanges will jamb into the rib and at times cannot be assembled on a rib.

Referring to FIGS. 3 and 4, the rib indicated generally at 16 comprises a pair of channel members indicated generally at 22 and 23. The outside channel member 22 fits over and is seated on the inside channel member 23 so that the channel members 22 and 23 are automatically centered relative to each other.

Channel member 22 has a first side 24 and a second side 26. An elongated back 27 joins the outer edges of the sides 24 and 26 to form the U-shaped member The outer end section of the sides 24 and 26 have off-sets 24A and 26A and terminate in outwardly directed flanges 28 and 29.

The inside channel member 23 has spaced sides 31 and 32 joined with an elongated back 33. Sides 31 and 32 terminate in oppositely directed outwardly flanges 34 and 36. The channel member 22 and 23 are made from the same stock material, with the outside channel member 22 having the offsets 24A and 26A. The configuration of the offsets adds strength to the rib. The taper or angular relationship between the sides of the respective channel members is the same so that the inside channel member 23 nests firmly within the outside channel member 22 shown in FIG. 3. A plurality of fasteners, as rivets, bolts or the like, extended through the backs 27 and 33, secure the channel members 22 and 23 together. Other fastening means, as screws, cement or adhesive, can be used to secure the channel member 22 to the channel member 23 to form rib 16.

As shown in FIG. 3, the offsets 24A and 26A are spaced from the adjacent sections of the inside side walls 31 and 32 and form therewith pockets 38 and 39. Pocket 38 has an outwardly open mouth 41 formed by the space between flanges 28 and 34. The pocket 39 has a mouth 42 formed by flanges 29 and 36.

Returning to FIGS. 2 and 4, the rib 16 has a downwardly directed leg or projection 43. The midportion of leg 43 has a hole 44. A J-bolt 46 has a threaded end extended through hole 44. The opposite end of J-bolt 46 has a hook 47 positioned about the silo hoop 13. A nut

48 turned on the end of bolt 46 clamps the lower end of the rib 16 to the silo wall 12. As shown in FIG. 4, the inside flanges 34 and 36 bear against the outside of the silo wall 12.

In the construction of the dome roof 10, the last rib can be placed on two panels if the silo structure is of a size which is in precise agreement with the circumferential dimensions of the silo. In the event there is variation between the circular dimension of the lower section of the dome roof 10 and the top of the silo, the structure shown in FIG. 7 is used to accomodate the size variation. The rib 16 is provided with a strip 49. Rivets 51 secure the strip to flanges 34 and 36. The sheet member of the last panel 14Z is trimmed to remove the outside flange 19. A plurality of fasteners 52, as screws, attach the last panel 14Z to the strip 49. The panel 14Z is circumferentially moved to the right, as shown in FIG. 7, to make the lower portion of the roof conform to the circular dimension of the top of the silo.

Referring to FIG. 8, there is shown a ring 53 at the apex portion of the dome roof 10. Ring 53 has an outwardly directed annular flange 54. The top portions of the sheet members of the panels 14A–14Z are attached to the flange 54 with fasteners 56, as bolts, screws, rivets and the like. The center opening defined by ring 53 is closed with an inverted dish-shaped cover 57. The cover 57 has a diameter larger than the opening so that the outer edge of the cover rests on the upper ends of ribs 16. A plurality of straps 58 are secured to the center portion of the cover with a fastener 59, as a nut, bolt or the like. Straps 58 extend downwardly and are attached to ring 53 with fasteners 61, as nuts, bolts and the like. The straps 58 are circumferentially spaced from each other and can comprise three or more members.

The erection of dome roof 10 on top of the silo 11 is as follows. The panels 14A–14Z, the ribs 16 and the cap 57, along with the fasteners to attach the ribs to the hoop 13 and the nuts and bolts to connect the panels to the ring 53, are shipped to the site of the silo. The panels 14A–14Z are identical in structure and are shipped in a flat position. The ribs 16 are of an arcuate curvature to conform to the curvature of the erected dome roof 10. The channel members 22 and 23 of the ribs 16 are preassembled at the place of manufacture and are made from the same stock material. The ribs 16 and panels 14A–14Z are assembled in sequence. The flanges 18 and 19 of the panels are moved into the pockets 38 and 39 to connect the ribs 16 to the panels. The upper ends of the panels are secured with fasteners 56 to the ring 53. The lower ends of the ribs 16 are attached to the top hoop 13 around the silo wall 12 with J-bolts 46.

The last rib is simultaneously placed on two panels if the adjacent ribs 16 have the required circumferential distance to accommodate the panels. In the event the circumference of the silo will not permit the exact fit of the last panel, the outer flange 19 is removed from the last panel 14Z. The strip 49 is attached to the inside of rib 16, as shown in FIG. 7. The last panel 14Z is circumferentially moved to tighten the lower section of the roof around the silo. A plurality of fasteners 52, as screws, are used to attach the last panel 14Z to strip 49.

The cover 57 is placed over the ring 53 and rests on the upper ends of ribs 16. Straps 58 are attached with bolts 59 and 61 to cover 57 and ring 53, respectively, to fixedly secure the cover to the ring.

While there has been shown and described a preferred embodiment of the invention and method of erecting the dome roof, it is understood that various changes, modifications and erection procedures may be used without departing from the invention. The invention is defined in the following claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A structure comprising: a plurality of panels and elongated rib means connecting adjacent panels, each of said panels having outwardly directed side flanges, said flanges having continuous reversing S-curved shapes extending the length of said panels, said rib means having pockets to accommodate said flanges whereby the panels are connected to the elongated rib means, each rib means comprising an inside channel member and an outside channel member, said inside and outside channel members having side portions in engagement with each other to center the channel members relative to each other, one of said channel members having sides with offset portions forming said pockets for receipt of said continuous reversing S-curved flanges.

2. The structure of claim 1 wherein: the outside channel member has sides with outwardly offset portions spaced from the inside channel member to form said pockets.

3. The structure of claim 1 wherein: the inside channel member and the outside channel member each have sides and outwardly directed flanges at the ends of the sides, said flanges of the inside member and outside member being spaced from each other providing mouths for said pockets.

4. The structure of claim 1 including: means to connect the inside channel member to the outside channel member.

5. The structure of claim 1 including: means adjacent the upper ends of said panels, means for fastening the panels to said means adjacent the upper end of the panels.

6. The structure of claim 5 including: cover means located over the means adjacent the upper ends of the panels and the upper ends of the panels, and means to attach the cover means to said means located adjacent the upper ends of the panels.

7. The structure of claim 5 wherein: the means adjacent the upper ends of the panels is a ring member.

8. The structure of claim 1 including: a rib means having a strip member, a panel located adjacent said strip member, and means for connecting said panel to said strip member.

9. A structure comprising: a plurality of panels and elongated rib means connecting adjacent panels, each of said panels having outwardly directed side flanges, each rib means having an inside channel member, an outside channel member, means for connecting the inside channel member with the outside channel member, said inside channel member and outside channel member having side portions in engagement with each other to center the channel members relative to each other, said inside channel member and said outside channel member each having outwardly tapering sides with the outside channel member nested over parallel portions of the inside channel member, said means attaching the channel members together to hold said sides in surface engagement with each other, the sides of said outside channel member having outwardly off-

set portions providing side pockets between said channel members, said flanges of said panels being located in said side pockets.

10. The structure of claim **9** wherein: the channel members of the rib means are curved, said panels being curved to conform to the channel members of the rib means, said side flanges of said panels located in said pockets having continuous reversing S-curved shapes.

11. The structure of claim **10** wherein: said inside channel member and said outside channel member each have outwardly directed flanges on the ends of said sides, said flanges being spaced from each other.

12. The structure of claim **9** including: means adjacent the upper ends of said panels, and means for fastening the panels to said means adjacent the upper ends of said panels.

13. The structure of claim **12** including: cover means located over the means adjacent the upper ends of the panels and the upper ends of the panels, and means to attach the cover means to said means located adjacent the upper ends of the panels.

14. The structure of claim **9** wherein: the lower ends of the channel members have a downwardly directed projection, said projection having means to accommodate a structure to fasten the rib means to a support.

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