Oct. 23, 1962 B. H. TRIPP 3,059,734

PREFABRICATED BUILDING STRUCTURE

Filed Nov. 30, 1955 5 Sheets-Sheet 1

Fig. 1.

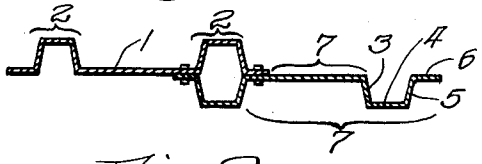


Fig. 2.

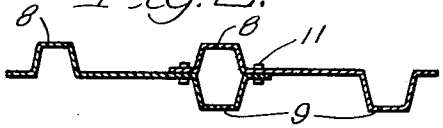


Fig. 3.

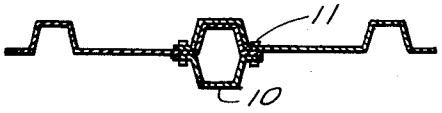
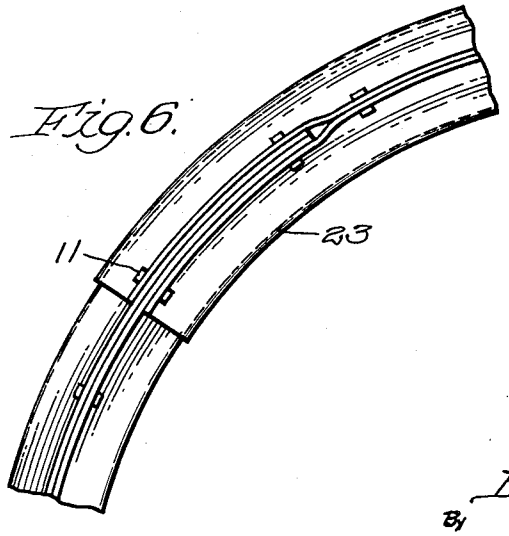


Fig. 4.

Fig. 5.

Fig. 6.



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PREFABRICATED BUILDING STRUCTURE

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Fig. 7.

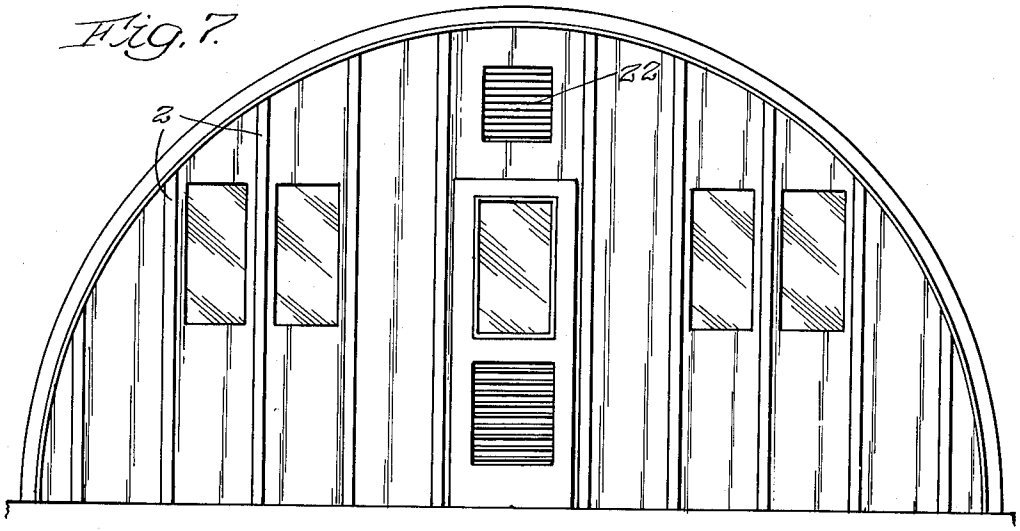
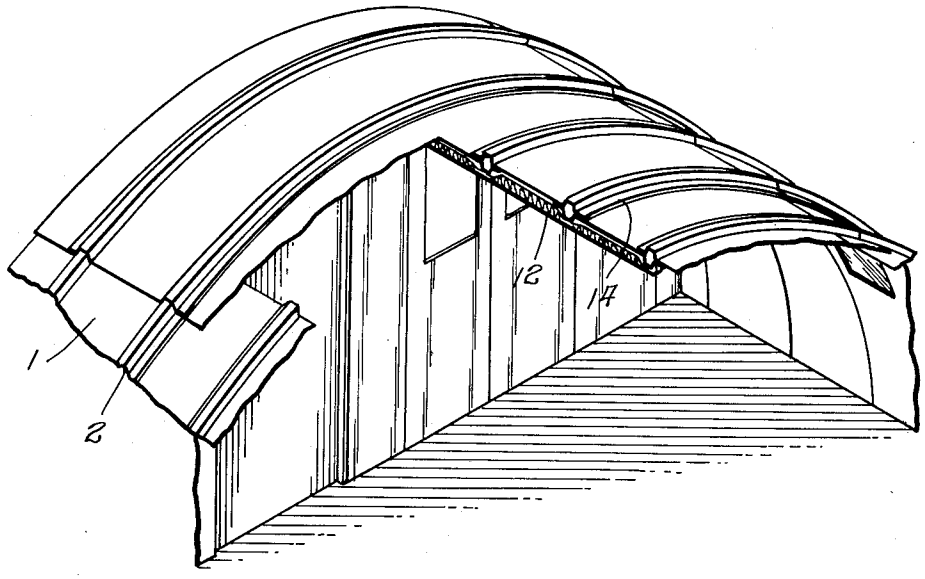


Fig. 8.



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PREFABRICATED BUILDING STRUCTURE

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Fig. 9.

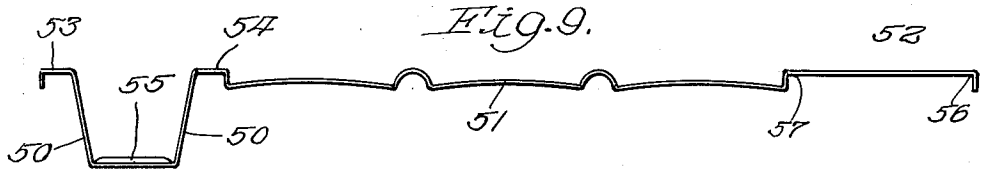


Fig. 10.

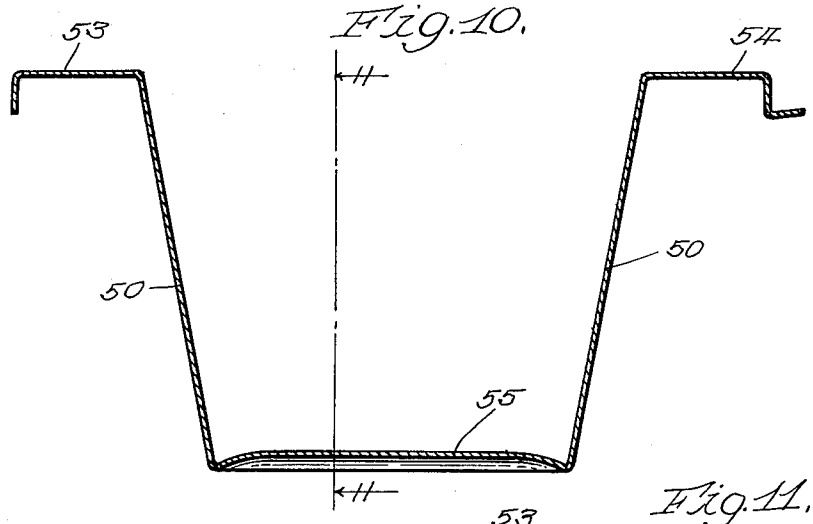


Fig. 11.

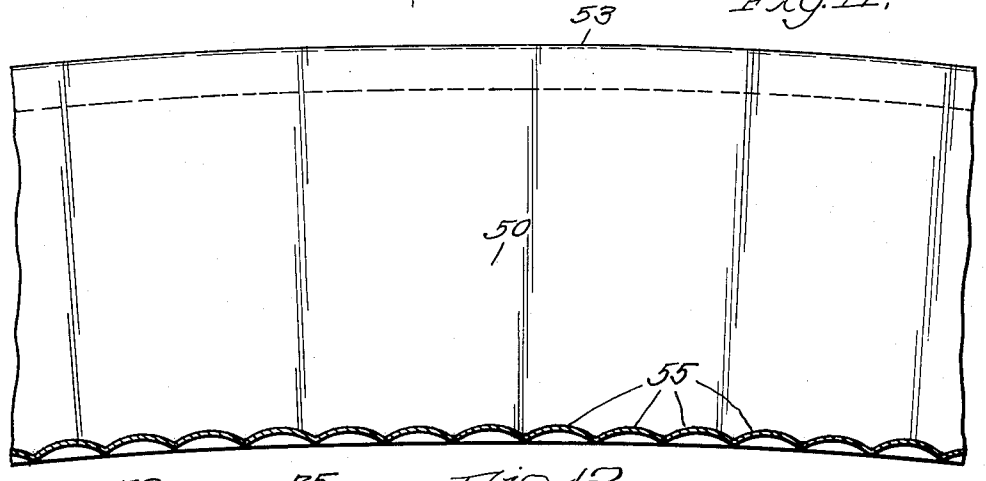
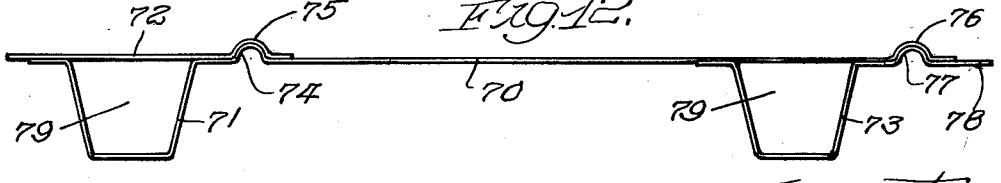


Fig. 12.



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PREFABRICATED BUILDING STRUCTURE

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Fig. 13.

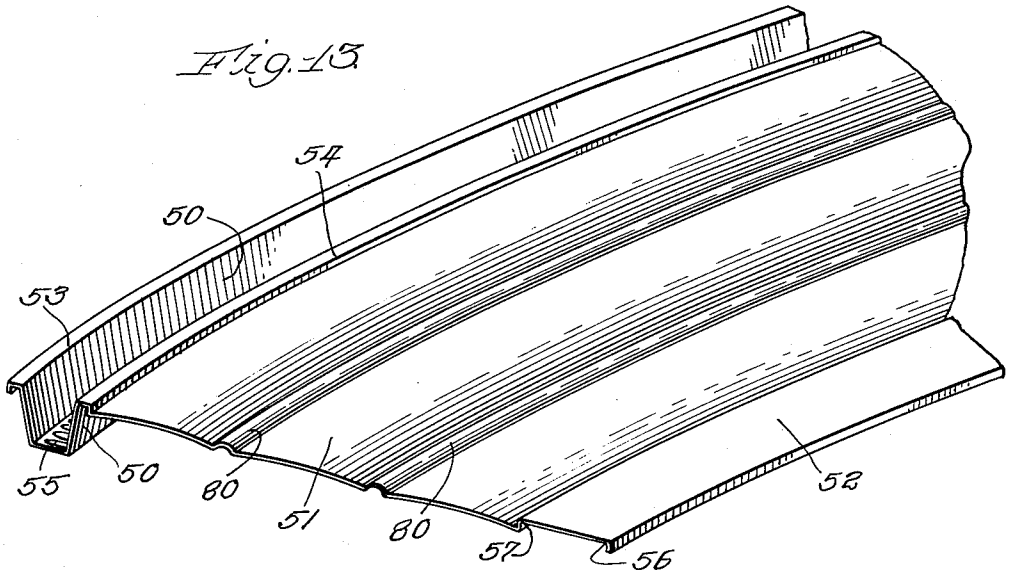
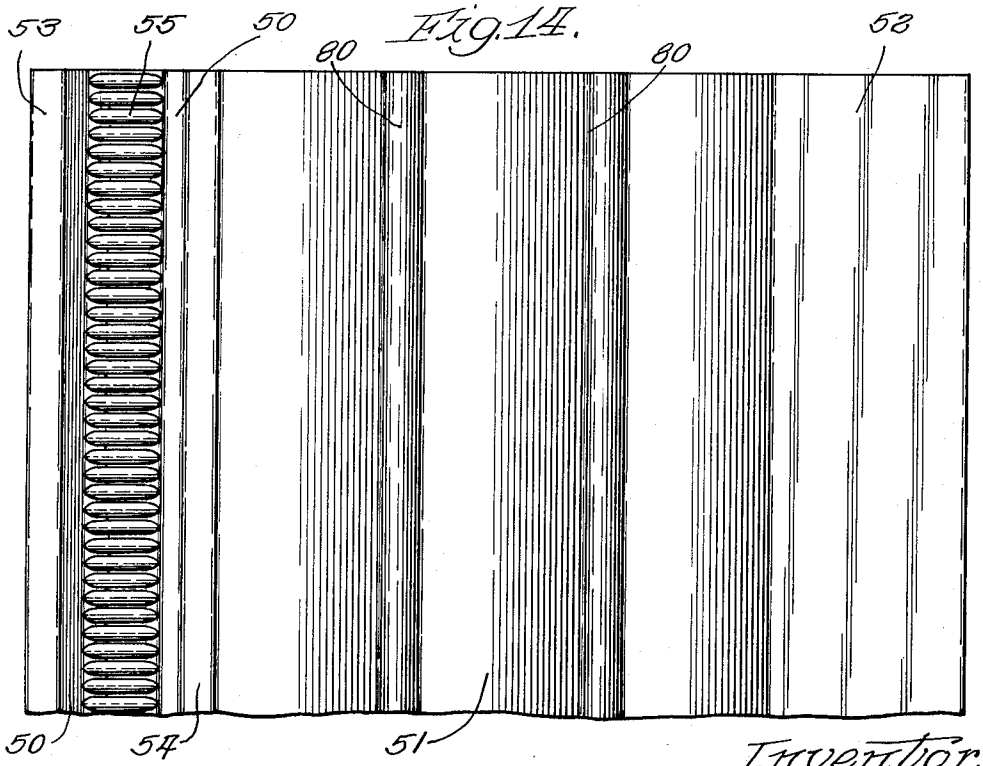


Fig. 14.



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PREFABRICATED BUILDING STRUCTURE

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Fig. 15.

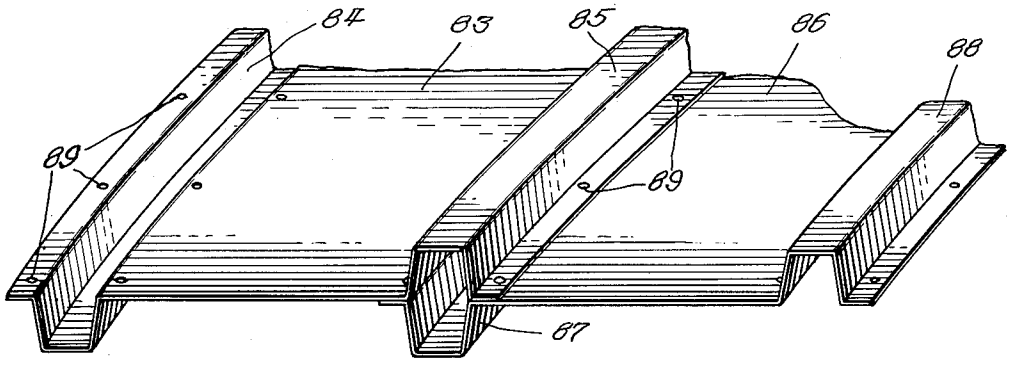


Fig. 16.

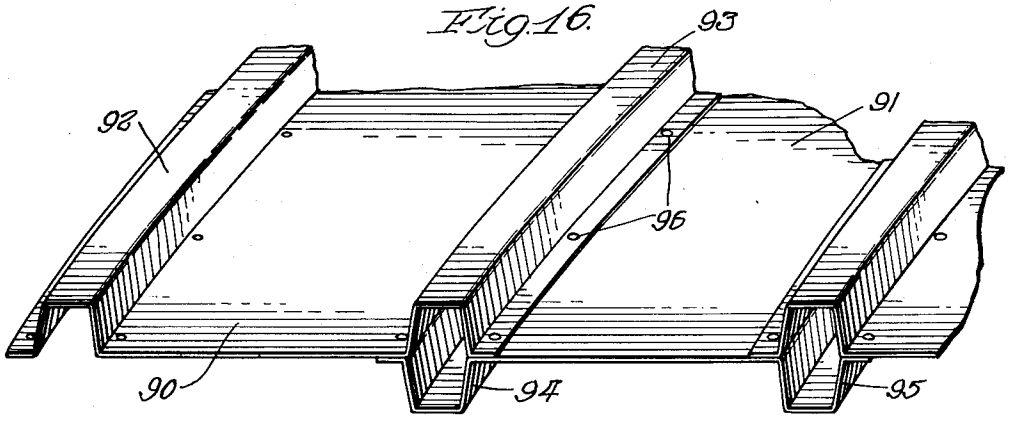
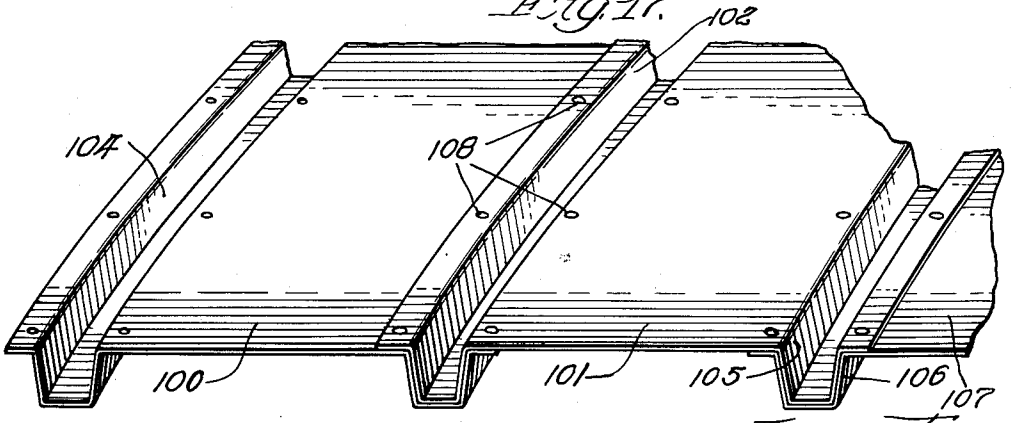


Fig. 17.



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United States Patent Office

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PREFABRICATED BUILDING STRUCTURE

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Filed Nov. 30, 1955, Ser. No. 549,923
7 Claims. (Cl. 189—34)

This invention relates to a prefabricated arched building structure and, more particularly, to one having overlapping panels so constructed that the panels form a unitary skin and structural frame member. One object of the invention is to provide a structure which has the advantages of both a panel building system and a structural member building system. A panel building system is one where the supporting structural members and the skin of the building are combined and the panels are of sufficient structural strength to carry the required load. A structural frame building system is one where there is a skeleton framework of a building erected which is thereafter covered with a protective skin. In this case the framework takes the entire load. This is in contrast to the panel system where there is no framework over and above the actual panels themselves. In order to get the necessary strength it has heretofore been true that the panel building system requires the use of bulky panels. This is both expensive and awkward when making up packages for shipment, especially for export. A structural framework building system takes considerably longer to erect and is more complex.

This application is a continuation-in-part of my copending application, Serial No. 208,298, filed January 29, 1951, now abandoned.

It is characteristic of structures made according to my invention that the basic element is a rectangular panel longitudinally arched having a channel along at least one of its longitudinal edges, which channel is so constructed that when similar panels are arranged adjacent to each other and overlapped, a hollow columnar framework member is formed which stiffens and strengthens the panels. In one form of the invention the structure at the overlap is completed by two opposed channels opening into each other. In another form an independent channel member is fastened to nested channels of adjacent panels.

In the drawings:

FIG. 1 is a schematic view of a horizontal section through two panel units of a building structure made in accordance with my invention, in which the two channels of each panel unit are on the same side of the wall of the building; but in which adjacent panels have the channels opening alternately up and down, the metal of one unit being shown heavier than that of the other, although both may be of the same thickness;

FIG. 2 is a view similar to FIG. 1 of a pair of overlapped panel units in which the two channels of each panel unit are on opposite sides of the wall;

FIG. 3 is a view similar to FIG. 1 in which all the panel channels are on the same side of the wall of the building and the channels of adjacent panels overlap in a nesting arrangement and the hollow columnar truss member is completed by an independent channel section shown here of heavier metal, although it may be the same;

FIG. 4 is a view in horizontal section through a corner of a curved panel or arch rib hut building made in accordance with my invention, the panels shown being slightly modified from the forms shown in FIGS. 1 and 2;

FIG. 5 is a view in vertical section through parts of the end wall of the building of FIG. 4;

FIG. 6 is a view of longitudinal section through the intersection of two curved roof panels having cross-sections such as shown in FIGS. 4 and 5;

FIG. 7 is a view in end elevation of a curved or arch rib hut type of building made according to my invention, such as shown in FIGS. 4, 5 and 6;

FIG. 8 is an isometric view in perspective of part of the roof and end wall of the arch rib hut of FIGS. 4, 5, 6 and 7;

FIG. 9 is a cross-section of another arched panel which I provide;

FIG. 10 is an enlarged view of the rib of the panel shown in FIG. 9;

FIG. 11 is a section through the arched rib of FIG. 10 at the line 11—11;

FIG. 12 is a cross section of a structural unit formed of two adjacent overlapping panels;

FIG. 13 is an isometric view of the panel shown in FIGS. 9–11;

FIG. 14 is a plan view of the panel of FIG. 9;

FIG. 15 is an isometric view of arched panels shown in cross-section in FIG. 2;

FIG. 16 is an isometric view of arched panels shown in cross-section in FIG. 1; and

FIG. 17 is an isometric view of arched panels in adjacent nested relationship.

The present invention relates to buildings of light-gauge metal as distinguished from heavy frame structural steel buildings. In this type of building there is need for a simplified, strong structure which can be prefabricated, shipped easily and erected on the scene in a minimum of time. My invention provides a system which has very little bulk when in transit, is simple in construction and easily assembled. It also provides a maximum of flexibility. In panel systems of buildings heretofore known, it was necessary to use heavier panels than would otherwise be necessary to provide merely the outer skin of the building. This resulted in the use of bulky, expensive material which was hard to ship—especially when the supplies had to be packaged for export.

According to my invention, light longitudinally arched panel units having longitudinal channels along the edges are provided of a construction such that when the panels are erected with their longitudinal edges overlapped, the tubular truss formed acts as a framework and make it possible to form an arched structure of such panels without additional framing. Other advantages of my invention will be described below.

In FIG. 1, I have shown a diagrammatic cross-section of a simple form of my arched panels arranged with their edges in overlapping relationship. These units can be made of any building side material, non-laminated or laminated. While I prefer to make them of steel, they can be made of aluminum or plastic and they can be either metallic or non-metallic. The central or main portion 1 of the panel unit is in the form of a sheet. While I have shown this central portion as flat, it can

equally well be corrugated. Along the edges of the panel are channels 2. I have shown the channels on the two longitudinal edges of the panel—namely, the side edges when the panel is installed. Basically, the arched panel can be the main and only part of the outside skin of the building. The channels 2 project laterally beyond the plane of the central portion 1, even when the latter is corrugated. As shown in FIG. 1, both channels project or open to the same side. Affixed to the central portion 1 along each edge thereof is a channel 2 formed by opposed diverging side walls 3 and 5 which are interconnected by a horizontal web 4. Preferably there also is an edge or end flange 6 in extension of that portion. The ribs may be curvilinear in cross-section rather than multisided.

It will be noted that the two channels shown on one arched panel in FIG. 1 are facing upwardly and in the adjacent panel unit are facing downwardly. The two units, however, are identical in structure and will nest for shipping requirements. By turning every second panel unit so that its channels face on the opposite side from the intervening units, and by proper overlapping of the panels, it is possible to arrange the channels to produce an integral hollow; i.e., tubular truss member. The hollow truss member formed by the overlapping channels as shown in the drawings is structurally strong and desirable as a framework element. While all the units can be made of the same thickness of material, I have shown the panel 7 appearing in this figure as made of a different gauge of material from its neighbor. In this way the tubular truss member can be strengthened further without having to use the heavier metal in all panel units.

In FIG. 2 a slightly different arrangement of channels is shown. In this case the two channels on any one panel unit extend in opposite directions from the plane of the unit. Thus, the left channel 8 in each unit is shown facing upwardly and opening downwardly while the right channel 9 faces downwardly and opens upwardly. With this arrangement of the channels the panels are still all alike and will still nest perfectly for shipping. Except as to gauge, the units differ from those of FIG. 1 only in that they need not be faced oppositely to form the hollow tubular truss element.

In FIG. 3 I have shown another and more versatile form of wall where the channels on any one unit are all on one side. Two panel units which are to be adjacent are assembled with their channels all facing on the same side of the wall and the adjacent ribs of adjoining panels are nested. If desired, an independent rib section 10 may be fastened to the nested panel ribs to form a tubular structure. I have shown this independent channel as made of heavier metal than the panels, thereby giving extra strength to the tubular truss member. I have stated that this embodiment of my invention is a more versatile form because the independent rib section not only can be of a different weight of metal, but it can be of different depth. Thus, if structurally it is desired to make the channels on one side deeper than those on the other side, this independent channel section embodiment provides a convenient way of varying the channel depth and thickness of metal as needed without varying the panel units. In this way a wide range of strength in the built-up structural units made of the panels is obtainable and the live load supported by the building can be varied while keeping the basic panel of the lightest gauge of material.

When two adjacent channels are overlapped it will be seen that weather tightness is provided. Where, as in FIG. 3, the channels are nested one inside the other, the best and simplest weather tightness is provided.

It should be noted that the overlapped panel channels plus the independent channel section combine to give the necessary structural strength. Since the independent channel section can be varied in both thickness and depth, thinner gauges of metal can be used in the panels than if any one member had to take the entire weight.

Another embodiment of my invention is shown in FIG. 9, which is a cross-section of an arched panel. This panel has a channel 50 along one edge, a body portion 51 and overlapping channel portion 52 which is adapted to span and cover channel 50. When two such panels are placed in adjacent overlapping position, the lip 53 fits snugly into the area 57 of the adjacent panel and the bead or hump 54 fits into the area 56 also of the adjacent panel. In other words, the channel 52 is adapted to cap channel 50 of an adjacent panel and thereby form an arched tubular truss.

The channel of FIG. 9 is shown in FIG. 10 in an enlarged view to illustrate the folded metal 55 at the bottom of the channel 50. Such folding may be effected in arching the channel. The walls of the channel are sometimes disrupted to a small extent at the bottom of the channel due to the arching. However, the channels still can be nested together snugly to form my arched buildings. The view of FIG. 11 is a section at 11—11 of FIG. 10 and shows the longitudinal arch 62 in the channel, which arch, of course, is present throughout the body 51 and cap portions 52 of the panel.

Another variation of my arched building is shown by the section in FIG. 12 in which panel 70 has a channel 71 along one edge overlapped by an adjacent panel 72 and the other edge of panel 70 overlaps channel 73 of an adjacent panel of similar section. Raised beaded portion or hump 74 is adjacent channel 71. The adjacent panel 72 has bead 75 along its longitudinal edge adapted to nest with bead 74 when panels 72 and 70 are placed in overlapping relationship. Bead 76 of panel 70 nests with bead 77 of the adjacent similar panel 78. The nesting beaded portions, obviously, may be depressed rather than raised to keep moisture and air from entering the area 79 formed by the tubular framework when panels are overlapped.

The panel shown in isometric view, FIG. 13, is the same as that of FIGS. 9–11, but shows more clearly the arch in the panel. Raised portions 80 may be placed in the body of the panel to stiffen this area if desired, or the body may be corrugated. FIG. 14 is a plan view of the panel of FIG. 9.

To further illustrate the arched building structures formed of my panels, FIGS. 15, 16 and 17 are presented. The partial building structure shown in FIG. 15 is similar to FIG. 2 in that each panel is the same and has two channels each of which open on opposite sides. Thus, in panel 83 the channel 84 opens upwardly and channel 85 opens downwardly while in the similar panel 86 channel 87 opens upwardly and channel 88 opens downwardly. Channels 85 and 87 of the adjacent panels overlap to form a hollow tubular truss member. Holes 89 may be provided to bolt the panels together to form an arcuate building structure.

FIG. 16 is a building structure made up of panels 90 and 91 in adjacent overlapping position similar to FIG. 1. Panel 90 has two channels 92 and 93 opening downwardly while panel 91 has channels 94 and 95 opening upwardly. Channels 93 and 94 of the adjacent panels open toward each other in overlapping position. Fastening means such as holes 96 are provided.

FIG. 17 is related to FIG. 3 except that the channels open up instead of down. Adjacent arched panels 100 and 101 are positioned so that rib 102 of panel 101 nests in rib 103 of panel 100. Each panel has another rib along the other longitudinal edge; thus, panel 100 has channel 104 along the edge and panel 101 has channel 105 along its other edge which nests in channel 106 of the next adjacent panel 107. Holes 108 are provided to bolt or rivet the panels together.

Besides being adapted to overlap in adjacent position, the panels also are formed to overlap at least partially in end-to-end relationship to create arches of a plurality of similar panels.

My novel wall also provides convenient means for at-

taching inside insulation and finish. The fact that the ribs project beyond the central portion of the panel makes it possible to attach composition board or hardboard **12** to the channels and to place insulating material **13** in the space thus enclosed. This is shown in FIG. 4 and other figures where lengths of hardboard are attached to the webs **4** of the channels of the panel units by any desired means and blanket insulating material **13** is placed between the central portion **1** of the panel unit and the hardboard **12**. The panel units shown in this figure and in FIG. 5 are a modification of the embodiments of FIG. 2 in that while the two channels of any panel unit are on opposite sides of the wall, there is a bead or hump on one side of each channel. In the case of the unit having the channel designed to be on the outside of the wall, the bead or hump **14** is shown on the end flange **6** of the channel, while in the case of the other unit the bead or hump **15** is between the central portion **1** of the unit and the channel. The two beads or humps **14** and **15** register and nest with each other. This adds to the weatherproofness and ensures proper registry of the parts. In the construction shown in FIG. 4 the corner is made by an ordinary lap of the two panel units. A small channel iron **16** can be used to close the end of the space in back of the hardboard on the overlapping panel unit **17**. The panel unit **18** will butt against the unit **17** and be held against the channel iron **16** by an angle iron **19** and filler strip **20** on the unit **17**.

FIG. 5 is a vertical section of part of the end wall of the same building as shown in FIG. 4. At the bottom of the figure can be seen the special form of angle irons which form the top or head **21** of a door frame in the end of the building (see FIG. 7). Near the top of this view can be seen a louver **22** embodied in my construction by the use of another channel iron **60**.

When the channels are properly juxtaposed they are fastened together on both sides by any suitable means. Thus, bolts and nuts **11** can be used, as shown in FIGS. 1, 2 and 3. If quicker assembly is required, slotted bolts with wedges **43**, as shown in FIGS. 4 and 5, can be used. In this case each bolt is passed through the outermost or end flange **6** of one panel and the central portion of the other panel adjacent the channel. There is a bolt on each side of the channel so that the parts are pulled together on both sides of the columnar or tubular truss member thus formed. In these latter figures I have shown some of the wedges located in the middle of the humps **14** and **15**. These wedges can be driven into the bolts on the inner side of the overlapped channels when the building is being erected and before the blanket insulation **13** and hardboards **12** are put in place. The hardboards can be held in place by any desired form of screw. In FIGS. 4 and 5 I have shown a self-retaining form of fastener **28** which, passing through a slotted opening in the horizontal web **4** of the channel, will lock itself in place when turned. I prefer to use a fastener whose length is such that when in place there is room for insulation between the horizontal flange and the hardboards, as shown in the drawings. With the structure arranged in this manner it can easily be taken down by turning and removing the fasteners, then taking off the hardboard and insulation and knocking out the wedges.

Because the building being described is a circular rib type such as an arch rib type hut, a section of the curved side wall will appear as in FIG. 6. This figure is taken at a point intermediate the ground and top where the ends of two curved panel sections overlap. The overlapped section or splice **23** of the two units can be seen at the center of the figure and it will be observed that the panels are telescoped. This tubular form of telescoping provides the necessary strength. It does not interfere with a lining and insulation between the central portion of the panel unit and the lining. Plain bolts and nuts can be used here.

It will be seen that my panel channel system provides a prefabricated form of structure having a minimum number of different kinds of units; that the units all nest for shipment; that assembly is simple and quick, not requiring skilled technicians; and that the invention is adaptable to any type or size of gauge metal structure desired. By the use of my system I obtain a maximum efficiency and strength with a minimum weight of structure.

I claim:

1. A prefabricated arched panel type building structure comprising a plurality of elongated, joined, longitudinally arched light gauge sheet metal building panels, each of said panels being arched in substantially the segment of a circle and comprising a central rectangular longitudinally arched portion having a first open-face channel element and a second open-face channel element mounted respectively along the longitudinal edges of said central portion, said channel elements having congruent cross sections, each of said second channel elements completely overlying the first open-face channel of a laterally adjacent panel in at least partial non-gripping engagement therewith and registering with said first channel to form a hollow, tubular truss member, the building structure being assembled of a plurality of said panels with each panel being aligned with and engaging at least one laterally and one longitudinally adjacent panel in partial overlapping relationship, said plurality of panels being positioned by virtue of the particular congruity of the channel elements thereof so that all of said rectangular portions of said panels lie on substantially the same arcuate contour and the engaging channels of separate panels register one with the other, vis-a-vis to form hollow, tubular truss members along their longitudinal length to form a metal building heaving an arcuate profile.

2. A prefabricated arched building structure in accordance with claim 1 wherein insulation is installed between adjacent longitudinally extending tubular truss members, and held in place by sheeting means affixed to the tubular truss members.

3. A panel type building structure of the type described comprising a plurality of first and second joined, light gauge sheet metal panels, each of said panels being substantially rectangular in plan and being arched in substantially the segment of a circle along a first line defining one of the dimensions of said rectangular plan and comprising a central rectangular portion being arched along said first line and being substantially rectilinear along any line drawn on a face of said portion laterally perpendicular to said first line, said central portion having a first open-faced arched channel element and a second open-faced arched channel element mounted, respectively, along the opposite edges of said central portion which parallel said first line, each of said channel elements comprising two substantially identical opposing side walls and a connecting web, said web having opposite edges joined to first like edges of said side walls, said channel elements being mounted on said central portion by having an edge of one side wall opposite said first edge thereof integrally joined to one of said edges of said central portion in such manner that the webs of said first and second channel elements extend outwardly from said opposite edges of said central portion, some of said second channel elements on some of said first panels being aligned with and at least partially overlapping and registering with some of said first channel elements on some of said second panels, in such manner that said first and second channel elements when they are aligned, overlapped and registered cooperate to form hollow tubular truss members extending parallel to said first line in such manner that corresponding portions of each pair of central portions which are joined to and extend laterally outwardly from opposite sides of said truss member-forming channel elements are substantially laterally aligned, said alignment of the individual central portions which comprise said pairs of central portions differing at most by an amount equal to the thickness of the sheet metal of which said individual central portions are formed.

4. A building structure as defined in claim 3 in which said first and second panels are substantially identical.

5. A building structure as defined in claim 3 in which said first and second channel elements on each panel open in the same direction.

6. A building structure as defined in claim 3 in which said first and second channel elements on each panel open in opposite directions.

7. A building structure as defined in claim 3 including means for securing each panel to at least one other panel.

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