Jan. 5, 1943. E. SCHAEFER 2,307,080

METHOD OF AND MEANS FOR ATTACHING PANELS TO FRAMEWORK

Filed Feb. 17, 1938 2 Sheets-Sheet 1

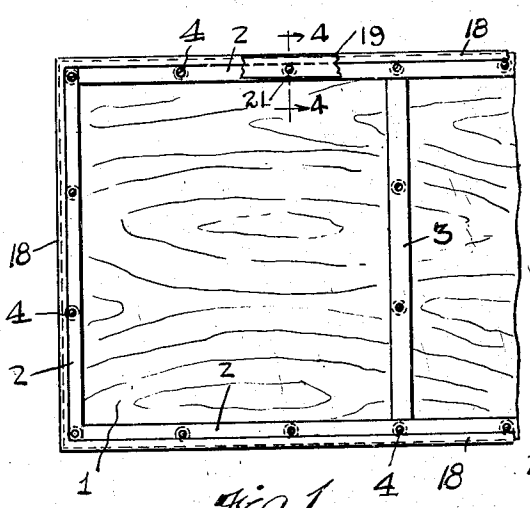


Fig. 1

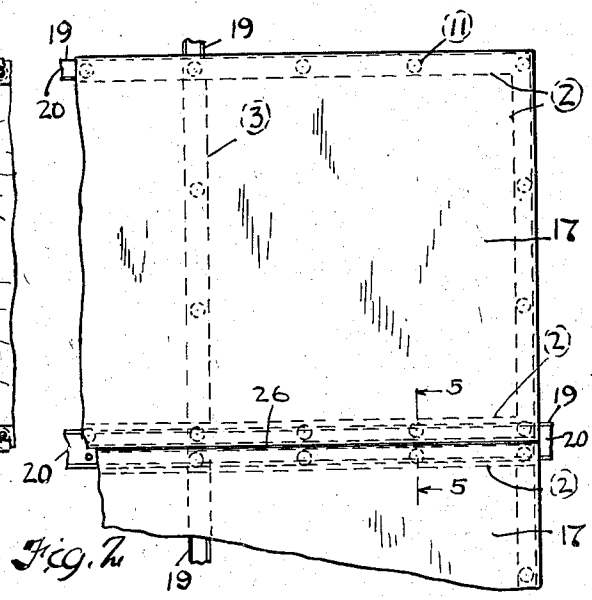


Fig. 2

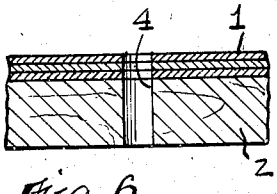


Fig. 6

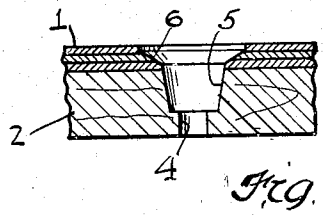


Fig. 7

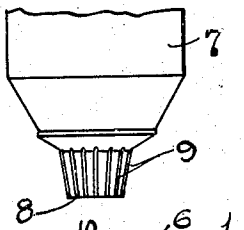


Fig. 8

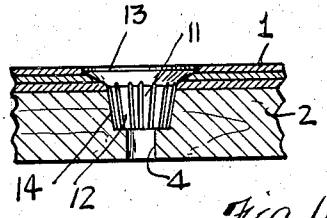
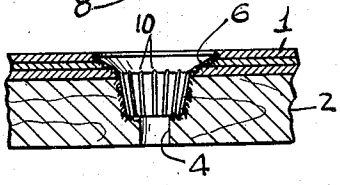


Fig. 10



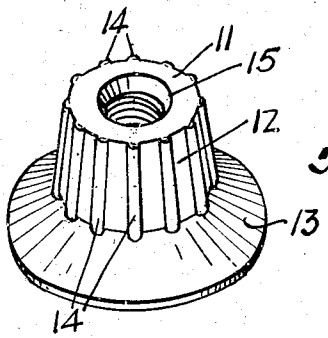


Fig. 11

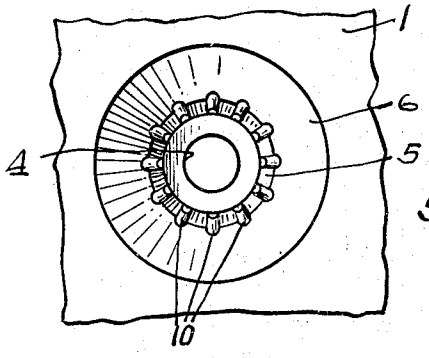


Fig. 9

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METHOD OF AND MEANS FOR ATTACHING PANELS TO FRAMEWORK

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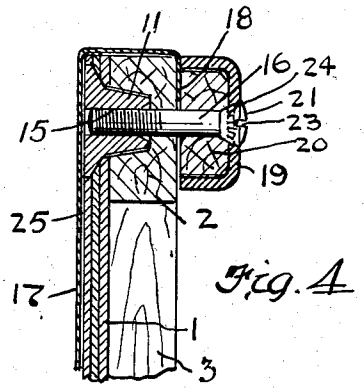


Fig. 4

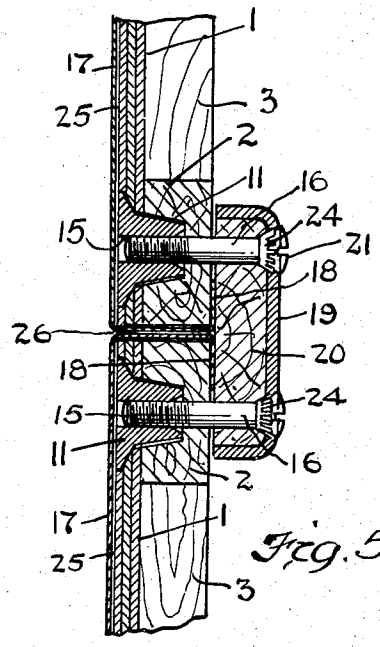


Fig. 5

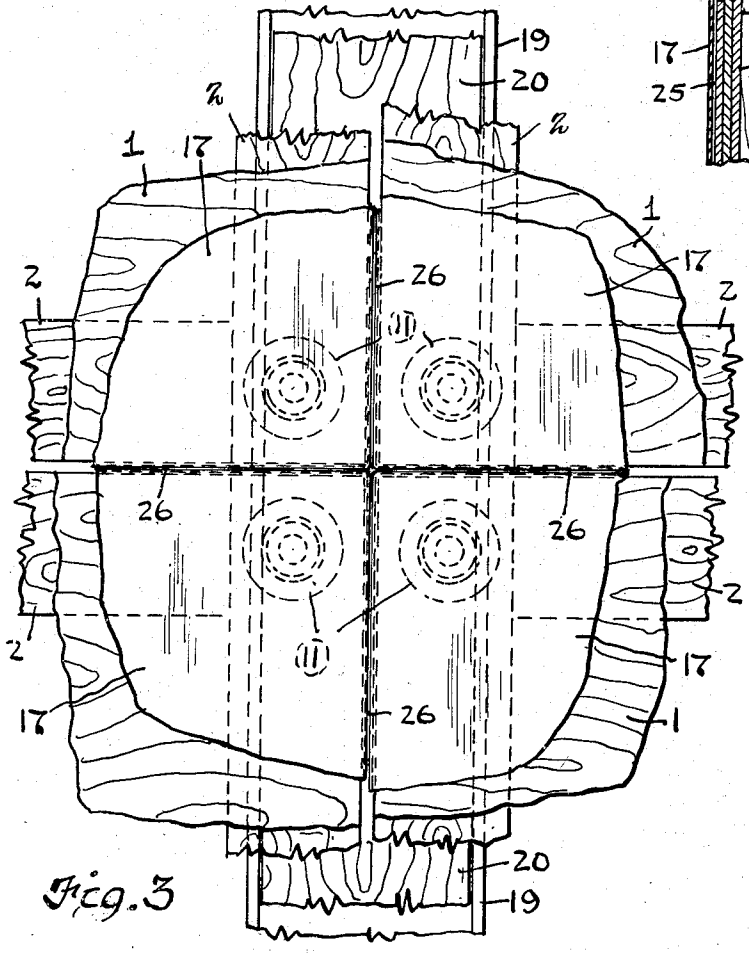


Fig. 3

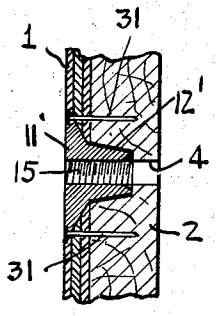


Fig. 12

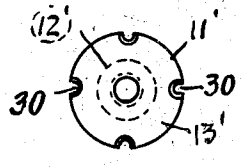


Fig. 13

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UNITED STATES PATENT OFFICE

2,307,080

METHOD OF AND MEANS FOR ATTACHING PANELS TO FRAMEWORK

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Application February 17, 1938, Serial No. 190,921

15 Claims. (Cl. 296—30)

This invention relates, as indicated, to a method of and means for attaching panels to framework.

Among other objects of the invention are the provision of a method of and means for firmly attaching panels to framework, whereby streamlining is rendered possible without the use of expensive plant and die equipment; whereby a smooth outer surface is obtained, entirely free from exposed mouldings, canvas fabric, outside bracing and fasteners; and whereby unusual structural strength is obtained.

To the accomplishment of the foregoing and related ends, said invention, then consists of means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a plan view of the inner surface of a portion of a panel embodying the invention;

Fig. 2 is a plan view of the outer surfaces of portions of two panels embodying the invention, and showing the manner in which the panels are associated for building up automobile body and other structures;

Fig. 3 is a plan view of the outer surfaces of the corner portions of four panels embodying the invention;

Fig. 4 is a fragmentary cross-sectional view, taken on the line 4—4 of Fig. 1;

Fig. 5 is a fragmentary cross-sectional view taken on the line 5—5 of Fig. 2;

Figs. 6, 7 and 8 illustrate various steps in the treatment of a panel for the reception of the fastening devices;

Fig. 9 is a plan view of the portion of a panel shown in Fig. 8;

Fig. 10 is a view similar to Fig. 8, but showing the fastener nut in place;

Fig. 11 is a perspective view of a fastener nut which forms one of the essential elements of the invention;

Fig. 12 is a view similar to Fig. 10, but illustrating a somewhat modified fastener nut and means for holding the nut in place; and

Fig. 13 is an elevation of the head end of the nut shown in Fig. 12.

Referring more particularly to the drawings, a structure embodying the invention is fabricated from a plurality of panels, which are associated and secured to a framework in the manner illustrated in Figs. 2, 3, 4 and 5.

Each panel comprises a rectangular sheet of plywood 1, shown in this instance as consisting of three plies or laminations and having secured, as by gluing and/or nailing, to one surface thereof adjacent the edges of the sheet, wood backing strips 2. Where the sheet 1 is considerably longer than it is wide, additional wood backing strips 3 may be provided.

In preparing the panel for the reception of fastening devices, holes 4 are drilled through the plywood sheet 1 and strips 2 and 3, at suitably spaced intervals, one of such holes being shown in Fig. 6. These holes are then counterbored, as shown in Fig. 7, to provide frusto-conical portions 5 and 6, for the reception of the nut shown in Fig. 11.

In order to avoid splitting of the backing strips 2 and 3 when the nuts are inserted in the counterbored holes and subsequently drawn up, the walls of the counterbored portions 5 and 6 of the holes are subjected to a charring or branding operation, as by means of a special electrically heated branding tool 7, shown in the upper portion of Fig. 8, the branded portions of the hole being indicated in the lower portion of Fig. 8. The branding tool 7 has a frusto-conical end 8 provided on its outer surface with a multiplicity of circumferentially spaced ribs 9, which, when the tool is inserted in the opening 4 (Fig. 7), forms corresponding recesses or flutes 10 in the frusto-conical portion 5 of the hole.

A nut 11 such as shown in Fig. 11, consisting of frusto-conical shank and head portions 12 and 13, which correspond with the tapered portions 5 and 6 respectively of the hole 4, is then inserted into the hole, as shown in Fig. 10. The portion 12 of the nut is provided on its outer surface with a multiplicity of circumferentially spaced ribs 14 which enter the recesses or flutes 10, so as to prevent the nut from turning, when the nut is subsequently drawn up, as will be presently described. The nuts 11 are either pressed into position in the holes 4 or are driven in by means of a hammer, and each nut has a threaded aperture 15 extending axially therethrough for the reception of a bolt 16.

After the nuts 11 have been inserted in the holes 4, the outer surface of the panel is covered with a sheet of metal 17, and all of the edges of this sheet are bent or rolled to provide rebent flanges 18, which engage the rear surfaces of the strips 2, the flanges extending inwardly to points adjacent the holes 4 in the strips.

The finished panel is now ready to secure to the frame of the automobile body or other structure, portions of such frame being shown in Figs. 2, 3, 4 and 5, and consisting in this instance of channel members 19 which are welded or otherwise rigidly secured together. Disposed within the frame channels are wooden strips 20. The frame members at the joints, as shown in Figs. 3 and 5, are approximately twice the width of those at other portions of the frame, as in Fig. 4. The frame members and strips are drilled to provide openings for the passage therethrough of the bolts 16, the holes in the frame members being also countersunk for engagement by the tapered heads 21 of the bolts. The heads 21 of the bolts have screw-driver slots 23 therein.

In securing the panels to the frame, the bolts 16 are inserted in the holes in the frame members 19 and strips 20 and into the apertures 15 in the nuts 11, being then turned as by means of a screw-driver, to tightly draw up the nuts. Since the nuts 11 have shank portions 12 which are tapered oppositely to the taper of the heads 21 of the bolts 16, a double wedge effect is secured when the nuts are drawn up, which results in the panel being firmly held to the frame. In practice, bolts $\frac{5}{16}$'' in diameter are used, and these will enable each fastener unit to withstand a pull of 3400 pounds, so that only a relatively small number of fasteners is required to hold the panels securely in position. For other types of installations, smaller or larger fastener units may be employed, as required. As an extra precaution against the effects of vibration, lock washers 24 may be employed under the heads 21 of the bolts 16. In supporting the panels on stationary or non-vibrating objects, however, these lock washers may be dispensed with.

It will be noted that in securing the panels to the frame in the manner just described, that the flanges 18 of the panels are tightly clamped between the backing strips 2 and the wooden strips 20 of the frame. This clamping of the flanges to the frame is sufficient to support the sheets 17 of the panels, so that such sheets are relieved of all carrying strains.

It will be further noted that in rolling the edges of the sheets 17, a small space 25 is left between the plywood sheets 1 and the metal sheets 17, avoiding metallic contact between the sheets 17 and the nuts 11, and thereby eliminating this source of noise and heat transmission. At this point, it may also be noted that small spaces 26 are left between the edges of the assembled panels (Figs. 3 and 5), thereby avoiding metal to metal contact between the panels and eliminating this source of noise. These spaces 26 are so small as not to appreciably detract from the smooth finished appearance of the entire structure, and in fact, the seamed appearance which they create will, in some types of structures, such as inner wall surfaces, enhance the appearance of such structures. If desired, however, these spaces or joints may be filled in which solder or similar material, where a smooth, continuous surface is required. Moreover, except at points where there is no joint between panels, as in Fig. 4, there is no metal to metal contact between the panels and the frame, so that this source of noise and heat transmission is virtually eliminated.

Due to the absence of exposed fastening devices, the invention lends itself admirably to the building of modern streamlined structures, which demand an unobstructed outer surface. Since the method of constructing and assembling the panel is very simple, it becomes possible to build even single units, or a relatively small number of units, to individual requirements, and in the modern pleasing styles, now found only in the so-called "mass production" units, but without the expensive plant equipment required in "mass production."

Due to the absence of holes in the metal sheets of the panels, required in other structures for fastening purposes, this source of wear and corrosion (at the holes) is eliminated, and ordinary sheet steel may therefore be used as an outer covering for the panels, with assurance that this hidden source of wear and corrosion will not have to be contended with. Moreover, the outer metal sheathing may be of any desired thickness and hardness, limited only by the fact that it is required to withstand sufficient bending to form the edge flanges.

Since the metal of the outer covering of the panels is not itself subject to strain, any type of ferrous or non-ferrous metal may be used for such covering. The use of non-ferrous sheet metals is especially desirable, particularly along the seaboard, where atmospheric conditions tend to rust conventional steels. Non-ferrous metals are usually softer than ordinary steel, and therefore are not suitable for carrying strains, in present construction methods which require piercing of the outer surface to accommodate exposed fasteners, these holes having a tendency to become elongated under strain and vibration. Moreover, since the sheet metal covering is not rigidly attached to the plywood backing of the panel, buckling or weaving due to the difference in the thermal coefficients of expansion between the metal and plywood, are avoided. The separate anchorage of the outer metal surface (held separately by its flanges 18) and of the plywood (held separately by the concealed fastening devices) permits the wood and the metal to expand or contract independently of each other with changes in weather conditions, without harm to either the metal or the wood.

The plywood of the panels serves both as insulation against heat and sound transmission, and as a load carrying member. Plywood, with its laminated structure, is especially desirable for its strength and resiliency, weight and bulk considered. Heretofore, however, it has been difficult to "hold" plywood, since the fibers were usually crushed and the rivets or other fastening devices would "pull through" under strain and vibration. These difficulties have been eliminated in the present construction by the use of the nuts 11, with their large tapered bearing surfaces. The plywood, as used in the present construction (1) carries the load and relieves the outer sheet-metal of carrying strains, (2) protects the outer sheet metal panel against damage from within and (3) insulates against heat and cold, and reduces rumbling noise. If desired, however, other types of manufactured board may be used instead of plywood, and in some cases, especially for curved sections, plastics may be used instead of plywood. On certain types of installations, the "backing" may be entirely omitted, and a built-up wood frame of backing strips, such as 2 and 3, used, in which the nuts 11 are directly embedded.

Due to the difficulty of working armor plate, armored units have heretofore been constructed in a clumsy fashion, and, because of exposed rivets, are usually unattractive in appearance.

Moreover, since armor plate which can be drilled or otherwise pierced for the insertion of rivets, can also be pierced with bullets, the hardness and toughness of such plate have heretofore been limited by such working and piercing factors. The present construction permits armor plate of extreme hardness and toughness to be used, since such plates can be inserted between the plywood backing and the sheet metal outer covering of the panel, without requiring additional securing or supporting means for such armor plate. Moreover, such armor plate will be concealed from view, and the entire appearance of the armored structure improved.

In structures used for transporting perishable goods, extra heat or sound sheet-insulation material is often found desirable, and can be inserted in the panel in the manner described above with reference to armor plate.

Manufacturers and assemblers of baked enamelled sheets and plates and other objects have heretofore suffered much loss from the enamel chipping off because of the method of securing such sheets in place at a plurality of isolated points or spots, and because the fasteners had to pass through the enamel surface, thereby setting up strains in the enamel at such points By the use of the present invention, sheets or objects may be enamelled and baked before the wood backing is installed. Since the flange 18 is in contact with the frame throughout its entire length, the outer surface of the enamelled sheet is relieved of harmful strains and chipping is thus avoided.

The invention is of particular advantage in the manufacture of structures for export, since it provides a simple, strong and effective method of assembling the unit at its destination.

The invention is particularly adapted for the construction of motor truck bodies, trailers, street cars, railroad cars, coaches, ships, boats, aeroplanes, etc. It is also of use in any industry that requires a strong concealed method of fastening, and is valuable in the manufacture of store fronts, partitions, counters, bar fixtures, soda fountains, factory-built houses, ready made factory buildings, etc. It is also of interest to workers in the finer sheet metals, enamelled sheets and plates, baked objects, armor-plate, insulation material, wall board and plywood, plastics, manufacture of signs, building of refrigerator units, etc.

For light duty installations, or in cases where branding has been somewhat overdone, a nut 11', such as shown in Figs. 12 and 13, may be employed instead of the nut 11. The head 13' of the nut has formed therein at circumferentially spaced points, semicircular recesses 30, through which nails 31 may be driven into the plywood 1 and backing strips 2. Such nails prevent the nut from turning, and where they are employed, the holes in the elements 1 and 2 need not be branded, and the shank portion 12' of the nut need not have ribs formed thereon, although such ribs may be provided as an additional feature, if desired.

Although the units have been described as secured to a frame consisting of channel members, it will be understood that the units may be secured to frames made of other members, such, for example, as angles, wood strips, etc.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A panel comprising backing means comprising wood strips arranged to form a closed framework, a metallic covering for said backing means, said covering having rebent flanges at all its edges embracing said backing means, and nuts extending into said strips, said nuts having broad tapered heads entirely concealed by said covering.

2. A panel comprising backing means consisting of a sheet of plywood and wood strips secured to one surface thereof, a sheet metal covering for the other surface of said plywood sheet, said sheet metal covering having edge flanges embracing said plywood sheet and strips, and nuts having tapered portions extending into said plywood and strips, said nuts being entirely concealed by said sheet metal covering.

3. A panel comprising backing means comprising wood strips arranged to form a closed framework, a metallic covering for said backing means, and nuts having a tapered portion extending into said strips, said nuts being entirely concealed by said covering, and said tapered portion of said nuts having a multiplicity of circumferentially spaced ribs thereon.

4. In a structure of the character described, a frame, a panel comprising backing means comprising wood strips, arranged to form a closed framework, a metallic covering for said backing means, said covering having flange portions interposed between said strips and said frame, and means for securing said panel to said frame, said means being concealed by said covering.

5. In a structure of the character described, a frame, a panel comprising a backing means comprising wood strips arranged to form a closed framework, a metallic covering for said backing means, said covering having flange portions interposed between said strips and said frame, and means for securing said panel to said frame, said means comprising nuts having heads concealed by said covering and tapered shanks extending into said strips, and bolts extending through said frame and into said nuts.

6. In a structure of the character described, a frame, a panel consisting of a sheet of plywood and wood strips secured to the rear surface thereof, a metallic covering for the front surface of said plywood and having flange portions interposed between said strips and said frame, and means for securing said panel to said frame, said means comprising nuts having head portions embedded in said plywood and flush with the outer surface thereof and tapered shanks extending into said strips, and bolts extending through said frame and into said nuts.

7. In a structure of the character described, a frame, a metal panel having flange portions formed integrally therewith and spaced therefrom, nuts disposed within the space between the body of said panel and said flange portions, said nuts being spaced from each other along the edge portions of said panels, and means extending through said frame and into said nuts, said means securing said panel to said frame with said flange portions in engagement with said frame.

8. In a structure of the character described, a self-sustaining frame, a panel comprising a framework of wood strips secured to each other, and a metallic covering for said framework, said covering having flange portions spaced therefrom

and interposed between said strips and said frame, and means for securing said panel to said frame, said means comprising nuts spaced along the edges of said covering and having heads concealed by said covering and tapered shanks extending into said strips, and bolts extending through said frame and into said nuts.

9. In a structure of the character described, a self-sustaining frame, a panel comprising a sheet of plywood and wood strips secured to the rear surface thereof adjacent all of the edges thereof, and a metallic covering having flange portions formed integrally therewith and spaced therefrom, said flange portions interposed between said strips and said frame, and means for securing said panel to said frame, said means comprising nuts spaced along the edges of said covering and having heads concealed by said covering and tapered shanks embedded in said strips, and bolts extending through said frame and into said nuts.

10. In a structure of the character described, a self-sustaining frame, a panel comprising a framework of wood strips secured to each other and a metallic covering for said framework, said covering having flange portions spaced therefrom and interposed between said strips and said frame, and means for securing said panel to said frame, said means comprising nuts spaced along the edges of said covering and having heads concealed by said covering and tapered shanks extending into said strips, and bolts extending through said frame and into said nuts, said bolts having heads with portions engaging said frame and tapered in a direction opposite to the taper of said nuts.

11. In vehicle construction, a frame consisting of members secured to each other and supported by said vehicle, a covering for said frame comprising metal panels having flange portions spaced from the bodies of said panels and in engagement with said frame, nuts disposed adjacent the edges of said panel and spaced from each other along said edges, and bolts extending through said frame and engaging said nuts.

12. In vehicle construction, a body frame consisting of channel members rigidly secured together, wooden strips disposed within said channel members, a covering for said frame comprising panels, each consisting of a framework of wood strips secured to each other and a metallic covering therefor, said framework coverings having flange portions interposed between said wooden strips and said frame, and means for securing said panels to said frame, said means comprising nuts spaced along the edges of said framework coverings and having tapered shanks extending into said wood strips, and bolts extending through said frame and wooden strips and into said nuts.

13. In a structure of the character described, a frame, a metal panel having flange portions formed integrally therewith and spaced therefrom, nuts disposed within the space between the body of said panel and said flange portions, said nuts being spaced from each other along the edge portions of said panels, and means extending through said frame and into said nuts, said means securing said panel to said frame with said flange portions adjacent said frame.

14. In a structure of the character described, a frame, a metal panel having flange portions at its edges, said flange portions being spaced from the body of the panel and in engagement with said frame, nuts disposed adjacent the edges of said panel and spaced from each other along said edges, said nuts having their axes normal to the body of said panel and head portions closely adjacent said panel, and bolts extending through said frame and engaging said nuts.

15. In a structure of the character described, a frame, a metal panel having flange portions at the edges, said flange portions being spaced from the body of the panel and disposed adjacent said frame, nuts disposed adjacent the edges of said panel and spaced from each other along said edges, said nuts having their axes normal to the body of said panel and head portions closely adjacent said panel, and bolts extending through said frame and engaging said nuts.

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