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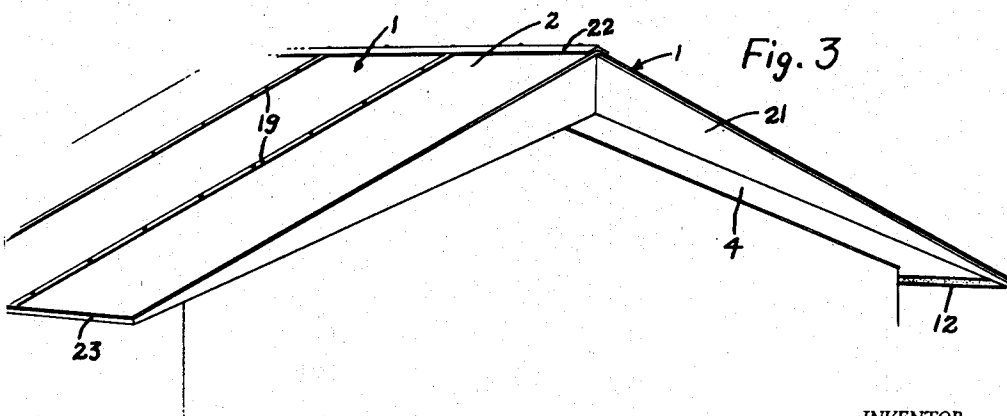
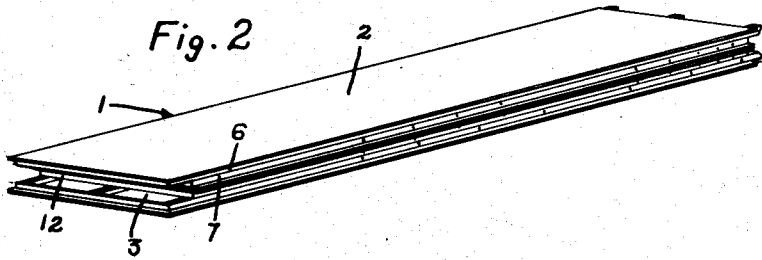
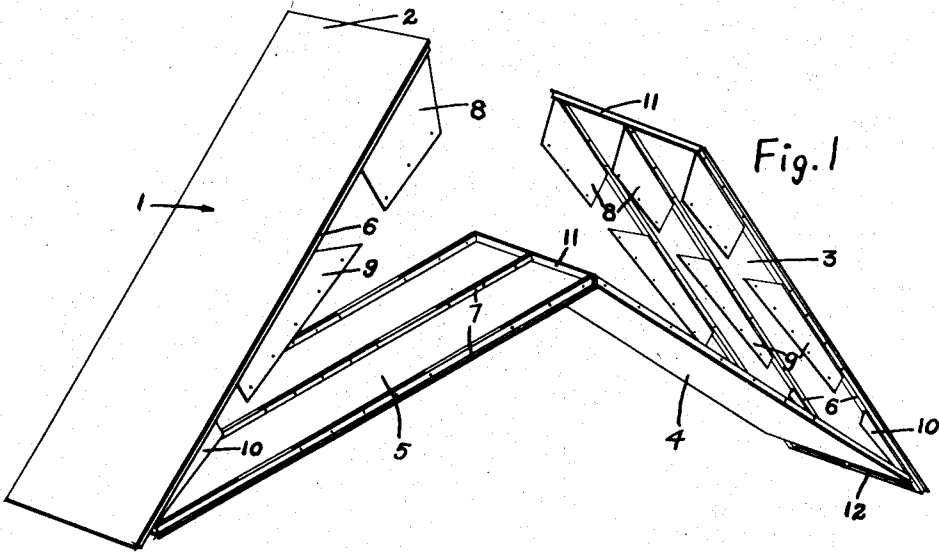
G. A. DAILEY

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DEMOUNTABLE ROOF

Filed Oct. 3, 1941

2 Sheets-Sheet 1



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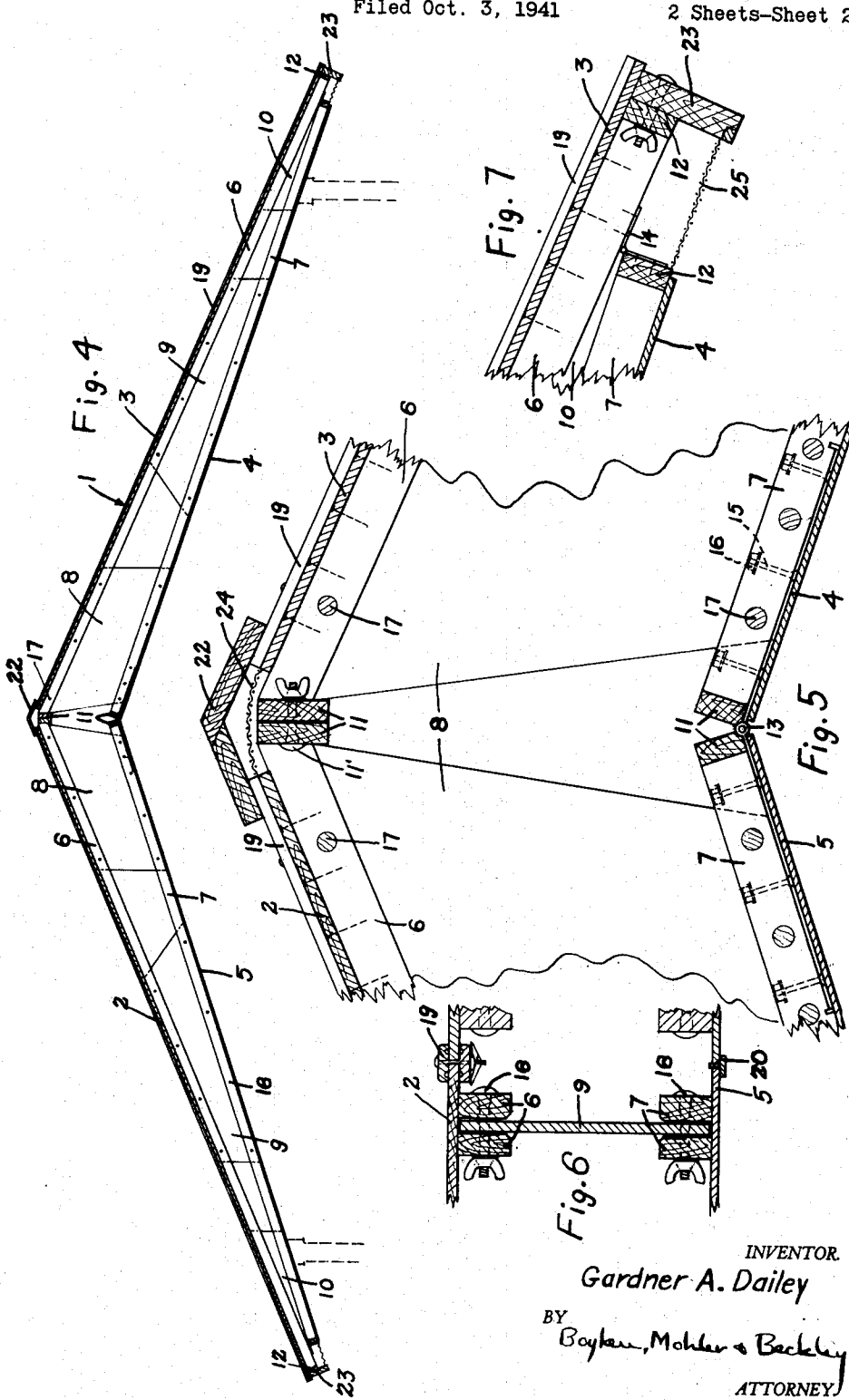
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# UNITED STATES PATENT OFFICE

2,325,747

## DEMOUNTABLE ROOF

Gardner A. Dalley, San Francisco, Calif.

Application October 3, 1941, Serial No. 413,422

10 Claims. (Cl. 108—1)

This invention relates to a demountable roof.

One of the objects of my invention is a demountable roof section which may be easily positioned.

Another object of my invention is a demountable roof section which may be completely folded for shipment.

Still another object of my invention is a demountable roof section which possesses a stressed covering, giving it great strength and eliminating the use of cross beams and tie bars.

A further object of my invention is a demountable roof section adapted to provide a weather proof covering for a building; and which may be easily and quickly positioned or demounted for periodic use without the use of nails or other attaching means which might injure or destroy some of its elements in mounting or demounting it.

A still further object of my invention is a collapsible roof section provided with hinges so that when folded, it occupies a relatively small space; and which may be easily and quickly unfolded and lifted into place to provide a strong weather proof covering for a building.

And an even further object of my invention is a demountable roof section without heavy beams or rafters and which utilizes its skin as a stressed covering for supporting its own, as well as dead weight.

In the drawings:

Fig. 1 is a perspective view of a demountable section partially unfolded.

Fig. 2 is a perspective view of the same section folded into position for shipping or storage.

Fig. 3 is a perspective view of a portion of a building with several sections joined together in place to form a continuous roof for a building.

Fig. 4 is a sectional view through a completed roof, showing one of the sections with the cross ribs, joiner and ridge strips, skin, and eave runners in section, and with the ceiling wedge omitted, the walls of the building being shown in dotted lines.

Fig. 5 is a partial detailed view of the central portion of Fig. 4 showing the hinges and bolts in place.

Fig. 6 is a partial sectional view along the line 6—6 in Fig. 4, showing in addition, the ceiling wedge.

Fig. 7 is a partial detailed view of the eave portion of Fig. 4 showing the hinges and bolts in place.

Heretofore, several methods of demountable or collapsible roof structures have been devised;

but generally, they have been of complicated structure and necessitated the service of skilled workmen for properly mounting them. Then too, they have generally been adapted for small buildings, the single unit occupying a considerable amount of space, even when folded. In addition, they generally relied upon heavy beams or tie bars for their strength, and it should also be noted that many of them constituted simply a frame work upon which a weather proof covering had to be added, subsequently.

My invention overcomes these various difficulties by providing demountable sections, each small enough to be handled easily by two men and which do not require skilled labor for mounting them. Sections are provided with means for folding them in compact form for shipping as shown in Fig. 2 and in which folded position they may be used to form the walls of a crate for carrying other portions of a demountable building. Each section is adapted to be easily and rigidly mounted by means of a small number of removable bolts or dowels, lifted into place, and may be rigidly connected to adjacent sections as shown in Fig. 3. Each section is designed to form a complete roof for a given area and requires no further covering other than joiner strips between adjacent sections to make it weather proof. The sections are provided with flat surfaces on both their upper and lower planes, which surfaces, as has been stated, form both the weather proof outer covering and the inside ceiling of the building.

Further, it is particularly important to note that these same sections act as stressed covering to carry the weight of the section and its dead load, thereby eliminating any unsightly cross beams and tie bars underneath the section within the building; thus, most of the tension and compression forces are set up in the stressed covering, itself. The sections provide continuous smooth upper and lower surfaces which require no further covering.

Generally, each demountable section, generally designated 1, is formed with four flat covering members 2, 3, 4 and 5; members 2 and 3 serving as the outer and upper covering and members 4 and 5 constituting the inner covering which also serves as the ceiling inside the building. Members 2 and 3 may be treated with suitable waterproofing to prevent any leakage. These members may be made from any strong, rigid material, such as weatherproof plywood, metal, or plastic, although I have found that sections of plywood make a very successful struc-

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ture. This is because the sections may be formed of plywood strips, often of the same size as they may be purchased. Further, the plywood is advantageous because it is light in weight, inexpensive, and is designed to carry large tension and compression forces. Naturally, the size of members 2, 3, 4 and 5 is dependent upon the size of the building to be roofed. Their length is determined directly by the size of the building to be spanned, but their width may be varied; but I have found that very satisfactory sections are about 3 feet in width which is, incidentally, one of the stock widths of ordinary plywood sheets.

Each of the flat covering members 2, 3, 4 and 5 is provided on one of its sides with parallel pairs of ribs 6 and 7; ribs 6, being positioned on upper covering members 2 and 3 and ribs 7 being attached to lower covering members 4 and 5. These ribs may be attached to the flat members by any convenient means such as gluing, nailing, bolting, or riveting, depending upon the material used. Since this connection is rigid and permanent, and is not broken in demounting the section, the use of any of these means is quite satisfactory. The ribs 6 and 7 are positioned to run in the direction of the longest dimension of the covering members, and one pair of ribs is located near, but not directly next to, the edge of the covering members; thus the covering members are allowed to overhang the covering ribs slightly, so as to allow them to be positioned abutting the corresponding member on an adjacent section as shown in Fig. 7. The single ribs of each pair of ribs are slightly spaced from one another to allow webs 8, 9 and 10, as will be described later, to be inserted between them. Other pairs of ribs may be spaced parallel to these ribs, but I have found that in a 3 foot strip of plywood, that only one additional pair of ribs is necessary, positioned centrally. At each end of the members 2, 3, 4 and 5 and at right angles to the ribs 6 and 7 are cross ribs 11 and 12 to further strengthen the members. It should be noted here that ribs 6, 7, 11 and 12 may be made of very light material as they are designed not so much to carry the load of the roof, but simply as means for attaching the webs and preventing the warping of the covering members. The strength of the units is primarily to be found in the covering members themselves: for instance; where plywood strips 3' x 12' are used, the individual ribs may be formed of wooden strips 1" x 2".

Members 2, 3, 4 and 5, with their attached pairs of ribs 6 and 7, are attached to one another at their ends by hinges 13 and 14. Members 4 and 5, forming the underside of the roof section, are attached to one another by means of hinges 13, as shown in Fig. 5, so that these members may be folded into adjacent planes with the covering members 4 and 5 lying flat against one another. Hinges 13 are strip hinges of high compression steel with relatively long leaves; one being placed between the covering member and each pair of ribs 7. The ribs are slotted so as to receive the leaves of the hinges which are bolted to the ribs by means of bolts 15 as shown in Fig. 5. The nuts 16 on bolts 15 are counter-sunk into ribs 7 so that the whole unit may be compactly folded. It may also be desirable to have the hinges made with loose pins; the removal of the pins allowing the several members to be taken apart if desired. From the illustrative sections shown in the drawings, it will be seen that 3 pairs of hinges 13 are used on each section illustrated. At the opposite and outer ends of each

of members 4 and 5, similar hinges 14 are mounted on cross ribs 12 to connect these lower members with the ends of upper members 3 and 2 respectively, as shown in Fig. 7. It is to be noted that hinges 14 are attached to the ribs of members 2 and 3 a short distance from their ends to form an extended eave over the edge of the building. As has been described with reference to hinges 13, there is one hinge 14 positioned at each pair of the ribs 6 and 7, and it is seen that hinges 14 will allow the ribs of members 2 and 3 to lie flat against ribs of members 5 and 4 respectively. For example, then, if plywood sheets are used with 1" x 2" ribs, the thickness of the units when folded is only about 8 inches.

The hinges 13 and 14 allow the unit to be folded into a position as shown in Fig. 4, the free ends of members 2 and 3 being brought together along cross ribs 11, which may be bolted together with bolts 11', or other convenient means.

However, before the members are folded to form the roof section, the series of thin webs 8, 9 and 10 formed from the same material as members 2, 3, 4 and 5 are positioned between the upper and lower covering members. These webs are positioned in the slots along the parallel pairs of ribs 6 and 7 and are attached thereto by means of removable dowels 17 and bolts 18. Properly positioned holes are drilled into the ribs and webs so that when properly aligned, the dowels 17 and bolts 18 may be slipped or driven therethrough as shown in Fig. 5. Of course, dowels, wing-nut-bolts or wedged-key-bolts may be used for this purpose, but I have found that more strength is obtained by using dowels at the outermost holes in the webs and bolts at the centrally located ones. This combination of bolts and dowels is particularly useful to prevent both movements of the webs both by clamping them between the parallel pairs of ribs, and to prevent the shearing forces exerted by the bolts.

The webs may either be continuous or spaced as desired and depending upon the loads to be carried; but I have found that the spacing shown in the drawings is of high utility in carrying the various tension and compression strains set up in the section. The greatest forces are concentrated in the ends and the center of the sections and the webs are positioned at these points to further strengthen the roof section.

When the section is rigidly connected by means of the hinges, the cross ribs 11, located at the free ends of members 2 and 3, act as compression strips to distribute the forces exerted by the ribs 6 and thereby forming a strong, rigid, substantially hollow beam, the cover members acting as a stressed covering adapted to carry much of the load when placed in position.

The whole unit is placed on the walls of the building as indicated in Figs. 3 and 4 and an identical section may be placed adjacent to it. On the upper or roof side of adjacent sections, a weather proof joiner strip 19 is bolted to join members 2 and 3 by means of toggle bolts. It may be of any convenient material or shape, a satisfactory one being shown in Fig. 6 and acts to weather proof the roof and hold adjoining sections together. On the underside and between adjacent sections 4 and 5, ceiling wedges 20 may be placed as shown in Fig. 6 to prevent possible leakage of air in or out of the building.

The section forming the end of the building may be provided with a continuous web 21 positioned on the outer sides of ribs 6 and 7 to

form a finished end surface as shown in Fig. 3. In addition, a ridge strip 22 may be added at the apex of the roof extending for its entire length and an eave runner 23 may be used at the outer edge of the eave adjacent cross ribs 12 extending likewise for the length of the building. The ridge strip 22 and the eave runner 23 serve both to weatherproof the building and hold the sections together.

Screens 24 and 25 may also be added adjacent the apex of the roof and at the eaves as shown in Figs. 5 and 7 to allow natural ventilation and to prevent insects from getting between the upper and lower portions of the roof sections.

In operation, the collapsible sections come crated in their compact form shown in Fig. 2.

The section is then partially unfolded as shown in Fig. 1 and the webs may be placed by means of the bolts and dowels. The free ends of members 2 and 3 are then connected adjacent cross ribs 11 after which the section becomes a rigid structure of the form shown in Fig. 4. The section is then hoisted into place on the walls of the building. Succeeding sections are then placed to form a continuous roofing surface. When all of the sections are in place, ridge strip 22, eave runners 23, and screens 24 and 25 are added to complete the finished structure and the continuous end webs 21 may be added to the end sections. Joiner strips 19 may be placed as the sections are positioned or after all of them are in place, depending upon the means used to fasten said joiner strips.

Thus, there is formed a hollow, rigid, weatherproof roof which because of its double layered structure, allows for ventilation and cooling, not found in the ordinary single layer structure. The stressed covering, together with the webs, serve to make an exceedingly strong structure capable of carrying very heavy loads; for instance, when covering members are formed from 3' x 12' plywood sections, spanning approximately an 18' building, I found that the structure would support in addition to its own weight, a load of approximately 60 pounds per square foot before collapsing, and then failure came in the hinges rather than the plywood sheets.

Of course, if it is desired, the joiner strips may be dispensed with for the purpose of providing the roof with an additional weather proofed covering which will extend over the entire surface of the roof. This may be asphalt, shingles, tar paper, or metal.

I claim:

1. Roof structure for a building comprising; a pair of gable-like roof coverings of relatively rigid sheet material having their ridges parallel and disposed one over the other in spaced relationship, the eaves of said coverings being secured together and the pitch of the uppermost of said coverings being greater than the pitch of the one therebelow whereby each of said roof coverings will be held together as a unit under compressive stress thereof when they are supported at points adjacent their eaves with their ridges generally horizontal.

2. Roof structure for a building comprising; a pair of gable-like roof coverings of relatively rigid sheet material having their ridges parallel and disposed one over the other in spaced relationship, the eaves of said coverings being secured together and the pitch of the uppermost of said coverings being greater than the pitch of the one therebelow whereby each of said roof cover-

ings will be held together as a unit under compressive stress thereof when they are supported at points adjacent their eaves with their ridges generally horizontal, vertically disposed webs extending between said coverings at right angles thereto and parallel with their inclined edges respectively secured to the upper and lower of the roof coverings of said pair.

3. Roof structure for a building comprising: a pair of gable-like roof coverings of relatively rigid sheet material having their ridges parallel and disposed one over the other in spaced relationship, the eaves of said coverings being secured together and the pitch of the uppermost of said coverings being greater than the pitch of the one therebelow whereby each of said roof coverings will be held together as a unit under compressive stress thereof when they are supported at points adjacent their eaves with their ridges generally horizontal, vertically disposed webs of relatively rigid sheet material between said coverings at right angles thereto and parallel with their inclined edges respectively secured to the upper and lower of the roof coverings of said pair.

4. Roof structure for a building comprising; a pair of gable-like roof coverings of relatively rigid sheet material having their ridges parallel and disposed one over the other in spaced relationship, the eaves of said coverings being secured together and the pitch of the uppermost of said coverings being greater than the pitch of the one therebelow whereby each of said roof coverings will be held together as a unit under compressive stress thereof when they are supported at points adjacent their eaves with their ridges generally horizontal, a pair of spaced ribs carried by each of said roof coverings disposed between said coverings and extending from the ridge of each covering to its eaves, means detachably securing the ribs carried by the uppermost roof member of the pair thereof to ribs respectively that are carried by the lowermost roof member.

5. Roof structure for a building comprising; a pair of gable-like roof coverings of relatively rigid sheet material having their ridges parallel and disposed one over the other in spaced relationship, the eaves of said coverings being secured together and the pitch of the uppermost of said coverings being greater than the pitch of the one therebelow whereby each of said roof coverings will be held together as a unit under compressive stress thereof when they are supported at points adjacent their eaves with their ridges generally horizontal, a pair of spaced ribs carried by each of said coverings on their adjacent sides respectively extending from the ridge of each covering to its eaves, and webs of sheet material perpendicular to said coverings secured to one of the ribs of each pair thereof along two opposite edges of each web.

6. Collapsible roof structure for a building comprising; a pair of gable-like roof coverings of relatively rigid sheet material disposed one over the other, each of said coverings being a pair of rectangular sheets of said material in substantially adjoining relation along one of their edges with said adjoining edges of one of said pair of sheets being spaced above and parallel with the said adjoining edges of the other pair of said sheets for forming the ridges of said coverings, the opposite edges of the sheets of the pairs thereof being at the eaves of

the coverings, hinges securing the sheets of the lowermost of said covering together along their said adjoining edges and other hinges securing the eave portions of the sheets of the said coverings together for swinging said eave portions toward each other to overlying relation of the sheets of both coverings when the sheets of the uppermost covering of said pair are disconnected at their adjoining edges, and means for detachably securing said last mentioned sheets together along their said adjoining edges.

7. Collapsible roof structure for a building comprising; a pair of gable-like roof coverings of relatively rigid sheet material disposed one over the other, each of said coverings being a pair of rectangular sheets of said material in substantially adjoining relation along one of their edges with said adjoining edges of one of said pair of sheets being spaced above and parallel with the said adjoining edges of the other pair of said sheets for forming the ridges of said coverings, the opposite edges of the sheets of the pairs thereof being at the eaves of the coverings, hinges securing the sheets of the lowermost of said coverings together along their said adjoining edges and other hinges securing the eave portions of the sheets of the said coverings together for swinging said eave portions toward each other to overlying relation of the sheets of both coverings when the sheets of the uppermost covering of said pair are disconnected at their adjoining edges; and means for detachably securing said last mentioned sheets together along their said adjoining edges, the uppermost of said coverings being of greater pitch than the one therebelow whereby the sheets of said coverings will be under compressive stress when the said adjoining edges of the sheets of the uppermost coverings are secured together and when the eaves of said coverings are supported from below the same.

8. A collapsible section for forming part of the roof of a building comprising; a pair of gable-like roof coverings positioned one above the other and having parallel adjacent eaves and vertically spaced parallel ridges, each of said coverings being a pair of rectangular sheets of relatively rigid material secured together along one of their edges along the said ridges with the sheets of the uppermost of said coverings extending convergently relative to the respective sheets of the covering therebelow in direction away from said ridges and projecting a distance outwardly of the last mentioned sheets along the portions of the latter that are at the eaves of said coverings, hinges connecting the sheets of the lowermost covering along their adjacent edges at the ridge of the latter covering for swinging of the eave portions of the coverings toward each other when the adjacent edges of the sheets of the uppermost covering at the ridge thereof are disconnected,

and means detachably securing said last mentioned edges together.

9. A collapsible section for forming part of the roof of a building comprising; a pair of gable-like roof coverings positioned one above the other and having parallel adjacent eaves and vertically spaced parallel ridges, each of said coverings being a pair of rectangular sheets of relatively rigid material secured together along one of their edges along the said ridges with the sheets of the uppermost of said coverings extending convergently relative to the respective sheets of the covering therebelow in direction away from said ridges and projecting a distance outwardly of the last mentioned sheets along the portions of the latter that are at the eaves of said coverings, hinges connecting the sheets of the lowermost covering along their adjacent edges at the ridge of the latter covering for swinging of the eave portions of the coverings toward each other when the adjacent edges of the sheets of the uppermost coverings at the ridge thereof are disconnected, and means detachably securing said last mentioned edges together, ribs carried by the sheets of both of said coverings extending from the ridges of the latter to the eave portions thereof, and struts securing the ribs on the sheets of the lowermost covering of said pair to the ribs on the sheets of the uppermost covering, said ribs being in pairs respectively extending along two of the opposite edges of each sheet and a third rib parallel with each of the pairs thereof spaced between the ribs at said opposite edges.

10. A collapsible section for forming part of the roof of a building comprising; a pair of gable-like roof coverings positioned one above the other and having parallel adjacent eaves and vertically spaced parallel ridges, each of said coverings being a pair of rectangular sheets of relatively rigid material secured together along one of their edges along the said ridges with the sheets of the uppermost of said coverings extending convergently relative to the respective sheets of the covering therebelow in direction away from said ridges and projecting a distance outwardly of the last mentioned sheets along the portions of the latter that are at the eaves of said coverings, hinges connecting the sheets of the lowermost covering along their adjacent edges at the ridge of the latter covering for swinging of the eave portions of the covering toward each other when the adjacent edges of the sheets of the uppermost covering at the ridge thereof are disconnected, and means detachably securing said last mentioned edges together, elongated webs of sheet material having two convergently extending opposite edges longitudinally thereof respectively parallel with the sheets of the pairs thereof extending from the ridges of said coverings, and means securing said webs to the sheets of both coverings.

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