

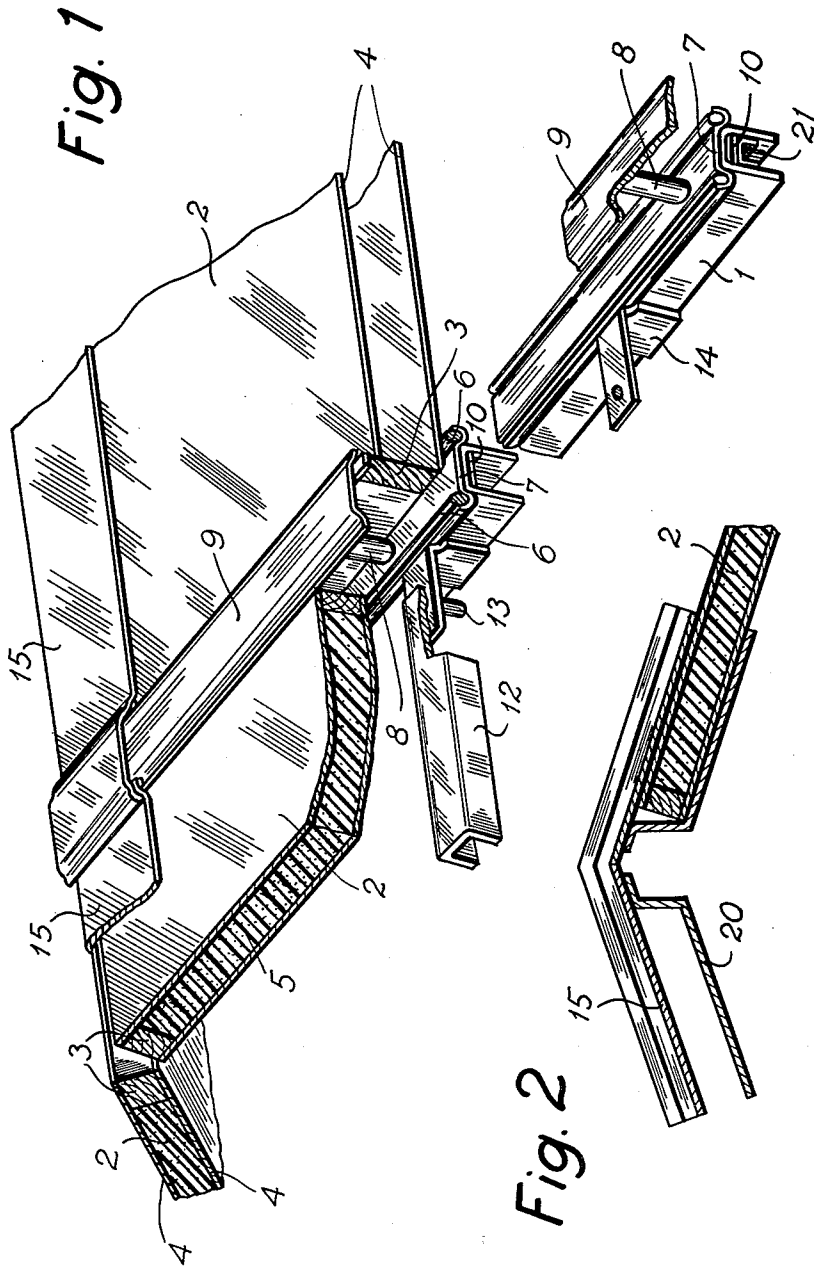
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ROOF STRUCTURE

3,173,224

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

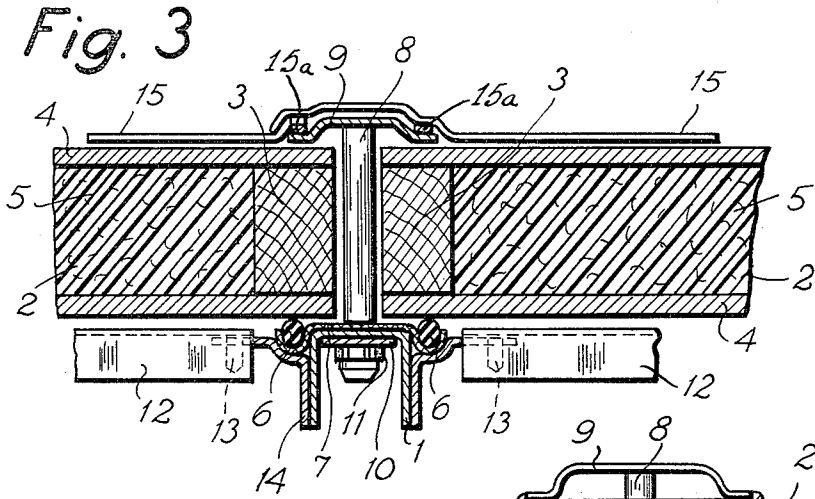


Fig. 6

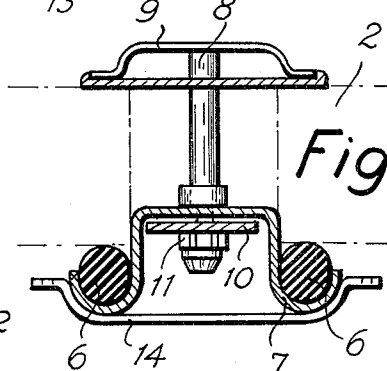
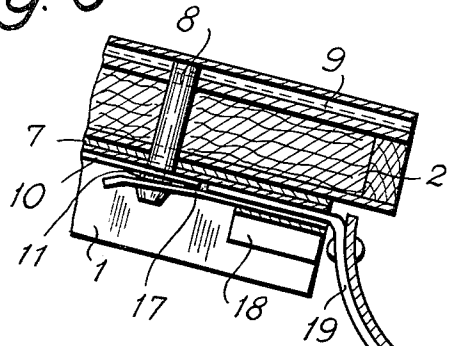


Fig. 4

Fig. 7

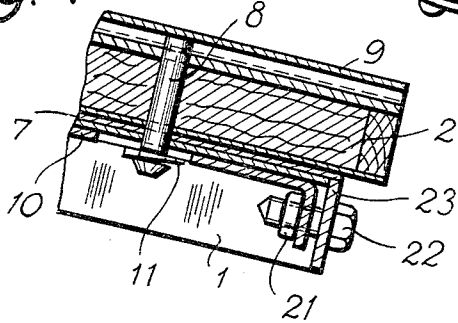
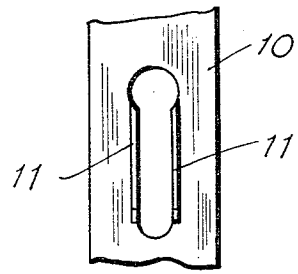


Fig. 5



1

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ROOF STRUCTURE

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6 Claims. (Cl. 50—4)

The invention relates to a roof structure for supporting and attaching readily exchangeable, prefabricated plate-shaped roof elements which at such of their edges as face each other are supported by purlins and rafters and over the rafters rest on elastic tightening fillets, the said roof elements being on their upper side at such of their edges as face each other fastened parallelly with the rafters beneath a rigid clamping strip which is attached to the rafters by means of clamping bolts.

The object of the invention is to provide a roof in which the individual plate-shaped roof elements may be mounted and replaced rapidly without the use of special tools so that, with the roof elements mounted in their position, there is provided a fully finished well insulated and tight roof which may easily be made larger or diminished to suit requirements, the roof being in particular intended for a house with a steel framework incorporating outer columns placed in such manner along a through-going foot border that wall plates may easily be mounted and, if necessary, replaced, and in which floor carriers provided between the outer beams carry floor plates and support removable partitions. Such a house may be readily expanded or diminished by addition or by removal of the wall and floor elements and by means of the invention it is possible to vary the size of the roof in a corresponding simple manner.

An essential feature of a roof structure according to the invention consists in ridge plates mounted in extension of an overlapping each other at edges bent upwards in such manner that they may pass up over the ends of the tightening fillets lying over the rafters when the said fillets are resting on the roof elements. At their underside the said ridge plates carry a longitudinal holder plate with a central section of inverted U-shape or two separated holder plates which from the top part of the ridge plates extend beneath these at a distance corresponding to the thickness of the roof elements. Furthermore, to securely retain the upper roof element in the groove thus formed there is provided at least one clamping bolt in each rafter opposite the tightening elements located in the uppermost row. The result obtained is that it is no difficult problem to provide tightness at the ridge of the roof since the roof will be perfectly tight if only the upper roof elements are pushed into the groove between the ridge plate and its holder plate, and no special holder members are required at the upper edge of the plates since they are safely retained in their position by the tightening element which is pressed down by the upper bolt.

To avoid any unnecessary work in tightening the clamping bolts for the tightening fillets it is convenient according to the invention that beneath each rafter there is provided a joint clamping strip for tightening the clamping bolts for the tightening fillet, the said clamping strip having key-shaped holes formed in such manner that they may be passed up over heads of downward projecting bolts of the tightening fillet, there being on either side of the narrowest part of the holes formed longitudi-

2

nal sloping cams which may rest in contact with a shoulder provided on the upper side of the bolt head for attachment of the tightening fillet by displacement of the clamping strip in its longitudinal direction. When a row of roof elements are arranged in the space between two rafters, the whole row may rapidly be fastened by displacing the clamping strip in its longitudinal direction.

The clamping strip may be retained by friction alone, but may of course also be retained by a special attachment member. An essential feature of one embodiment of a roof structure according to the invention is, for example, that at the outer end of each rafter there is formed a guide for a holder member for a roof gutter section; the said holder members include a leaf spring the free end of which is formed with a hole disposed in such manner that it may engage the outermost clamping bolt on the rafter. In consequence, the holder member may be used to retain a clamping strip which, while being tightened, is displaced upwards in the direction of the ridge, such part of the leaf spring or the attached holder member is located at the end of the clamping strip preventing downward displacement of the clamping strip.

In accordance with the invention the rafters may at regular intervals be connected with each other by connecting bars which at either end have a pin to be introduced into a hole provided in a corresponding bow attached to the rafters. The connecting bars act as purlins for supporting the longitudinal edges of the roof plates in addition to ensuring that the rafters are rigidly retained in exact distance without rendering the structure more difficult to disassemble.

The invention will be further described in the following with reference to the drawing, in which

FIGURE 1 shows a part of the roof structure, viewed in perspective,

FIGURE 2 is a section through a ridge plate with holder plate,

FIGURE 3 is a section through the roof plates parallelly with the ridge,

FIGURE 4 is a corresponding section through a joint between two roof plates resting on a rafter of a form different from that shown in FIGURE 3.

FIGURE 5 is a clamping strip for the clamping bolts of the tightening fillet, viewed from below,

FIGURE 6 is a longitudinal section through the lower part of a rafter and a gutter attached thereto, and

FIGURE 7 is a corresponding longitudinal section with a clamping strip of another shape.

Each rafter 1 constitutes support for a number of roof elements in the shape of roof plates 2 which consist of a frame 3 with outer surfaces 4, between which is inserted insulating foam plastic 5. The roof plates rest at such of their edges as face each other on elastic tightening fillets packing or strips 6 which in the embodiment shown in FIGURE 3 are carried by a holder 7 of profiled plate riding on the upper side of the rafter 1 which has the cross-section of inverted U. Through spaced holes provided in the rafter are passed regularly spaced clamping bolts 8 attached on a rigid tightening fillet 9 of profiled plate extending above the rafter throughout its longitudinal direction. A clamping strip 10 is formed with key-shaped holes which may be passed over the heads of the clamping bolts 8 after which the strip may be displaced

3

so that oblique cams 11 along the narrow part of the holes are brought to rest against the upper side of the bolt heads, so that all bolts 8 may be tightened simultaneously by displacement of the clamping strip 10 in its longitudinal direction and thereby press the tightening fillets 9 against the roof plates 2. In FIGURE 7 one end of the strip 10 is angularly bent and has a nut 21 welded to it and into which is screwed a threaded bolt 22 passed through a hole in a plate 23 at the end of the rafter 1 and which displaces the strip 10 when the bolts are tightened.

Connecting bars 12 serve to ensure exactly identical distance everywhere between rafters 1 lying beside each other, and the said bars have downwardly projecting pins 13 which pass into holes provided in clamps 14 welded to the rafters 1.

The uppermost roof plates close to the ridge are at their upper edges defined by ridge plates 15 which extend from rafter to rafter and have upwardly bent edges at their ends engaging each other. Between the upwardly bent end edges of the ridge plates 15 and the rigid tightening fillets 9 lying thereunder is provided sealing material 15a.

The gutter of the house is composed of sections 16 having a flange of U-shaped cross-section at one end to seize a bead-like flange of the adjoining gutter section. Opposite the rafters there is attached to the gutter sections a leaf spring 17 which is passed into a guide 18 formed of a channel section of inverted U-shape welded inside the U-section of the rafter 1. At the end of the leaf spring 17 is provided a hole which, when the gutter is in its position, received the downward-projecting end of the outer clamping bolt 8 of the rafter. The leaf spring 17 is located on a holder 19 which constitutes a stop preventing displacement of the clamping strip 10 after it has been moved into its tightening position.

To facilitate mounting of the upper roof plates 2 holder plates 20 are, as shown in FIGURE 2, attached by welding in the longitudinal direction beneath each ridge plate, the said holder plates extending beneath the ridge plate at such distance from the latter that a roof plate 2 may be pushed over the holder plate and rest on it. Of course, also a single, continuous holder plate may be used, attached along the ridge and having two webs, each extending beneath its separate roof surface.

What I claim and desire to secure by Letters Patent is:

1. A roof structure comprising rafters each having an upper surface provided with longitudinally extending elastic packing strips and a downwardly facing longitudinal channel, prefabricated plate-shaped roof elements supported by said rafters and disposed in edge-opposed relationship with edge portions of said roof elements disposed over said rafters and resting on said packing strips, rigid tightening strips disposed parallel to said rafters and overlying said edge portions of said roof elements, spaced clamping bolts extending downwardly from said tightening strips and through holes in said rafters openings into said channels, said bolts having shank portions passing between the edge portions of said roof elements and having heads disposed in said channel and providing shoulders, and a clamping strip received in said channel of each rafter and extending substantially throughout the length of the rafter, each clamping strip having elongated key-hole shaped holes with an enlarged portion at one end of each hole to receive the head of the respective bolt and an elongated narrower portion receiving the shank portion of said bolt and cam portions of gradually increasing height bordering said elongated narrower portion of the hole and engageable with said shoulder provided by the bolt head, each said clamping strip being movable longitudinally in said channel from a position in which said enlarged portions of the holes in said strip register with said holes in the respective rafter to receive the heads of said bolts to a clamping position in which cam portions of said clamping strip engage said shoulders of said bolt heads and progressively draw said bolts and

4

tightening strip downwardly to clamp said roof elements between said tightening strip and rafter.

2. A roof structure according to claim 1, wherein each clamping strip is provided adjacent one end with a downwardly projecting portion and the respective rafter is provided at the corresponding end with an abutment portion spaced from said downwardly projecting portion of said clamping strip and wherein bolt means extends between said downwardly projecting portion of the clamping strip and abutment portion of the rafter and acts to move said clamping strip longitudinally relative to said rafter.

3. A roof structure according to claim 1, further comprising a gutter extending along the eve of the roof, spaced gutter holders having portions slidably received in end portions of said channels of the rafters and leaf spring means carried by said gutter holders and each having free ends provided with a hole fitting over and engaging the clamping bolt closest to said end of the rafter to secure said rafter holder in the channel of said rafter.

4. A roof structure according to claim 3, wherein an end of each said gutter holder when in position in said channel of the respective rafter is engageable with an end of the respective clamping strip to secure said clamping strip against displacement to release said bolts.

5. A roof structure according to claim 1, wherein each said rafter is provided at longitudinally spaced intervals with laterally projecting extensions having holes and wherein connecting bars extend between successive rafters and have at opposite ends downwardly projecting pins received in said holes in said lateral extensions to connect said rafters with one another, said connecting bars being engageable by said roof elements to prevent upward movement of said connecting bars to disengage said pins from said holes.

6. A roof ridged structure comprising rafters each having an upper surface provided with longitudinally extending elastic packing strips, prefabricated plate-shaped roof elements supported by said rafters and disposed in edge-opposed relationship to one another with lateral edge portions of said roof elements disposed over said rafters and resting on said packing strips, rigid tightening strips disposed parallel to said rafters and overlying said edge portions of said roof elements, V-shaped ridge plates overlying upper edge portions of roof elements on opposite sides of the ridge of the roof and having upward bent end portions of adjacent ridge plates overlapping one another and overlying upper end portions of said tightening strips, opposed holder plates secured beneath each of said ridge plates and engaging the under faces of adjacent roof elements on each side of the roof ridge, spaced clamping bolts extending downwardly from each said tightening strip and through holes in said rafters, said bolts having shank portions passing between the edge portions of said roof elements and heads disposed beneath said rafter and providing shoulders, a clamping strip slidably received beneath each said rafter and extending substantially throughout the length of the rafter, each clamping strip having elongated keyhole shaped holes each with an enlarged end portion to receive the head of the respective bolt and an elongated narrower portion receiving the shank portion of said bolt and cam portions of gradually increasing height bordering said elongated narrower portion of the hole and engageable with said shoulder provided by the bolt head, each said clamping strip being movable longitudinally from a position in which said enlarged portions of the holes in said clamping strip register with said holes in the respective rafter to receive the heads of said bolts and to a clamping position in which said cam portions of said clamping strip engage said shoulders of said bolt heads and draw said bolts and tightening strip downwardly to clamp said roof elements between said tightening strip and rafter and thereby secure said ridge plates through engagement of said roof elements with said holder plates, and means for

5

moving each said clamping strip longitudinally relative to the respective rafter.

References Cited in the file of this patent

UNITED STATES PATENTS

735,618	Tannewitz -----	Aug. 4, 1903	5	2,040,385
937,667	Wessels -----	Oct. 19, 1909		2,084,225
1,001,646	Jeter -----	Aug. 29, 1911		2,160,225
1,133,384	Leonard -----	Mar. 30, 1915		2,488,887
1,411,882	Eberl -----	Apr. 4, 1922	10	2,801,141
				2,838,592

6

Stuckert -----	Dec. 29, 1925
Isgur -----	Mar. 25, 1930
Linck -----	July 17, 1934
Cibulas -----	July 31, 1934
Kellogg -----	May 12, 1936
Slaughter et al. -----	June 15, 1937
Newman -----	May 30, 1939
Adams -----	Nov. 22, 1949
Bergman -----	July 30, 1957
Feketics -----	June 10, 1958