March 8, 1966 E. VIVIO 3,238,681

STRUCTURAL MEMBERS OF SHEET MATERIAL FOR WALLS, ROOFINGS, FLOORS AND THE LIKE

Filed March 7, 1963 2 Sheets-Sheet 1

Fig. 1

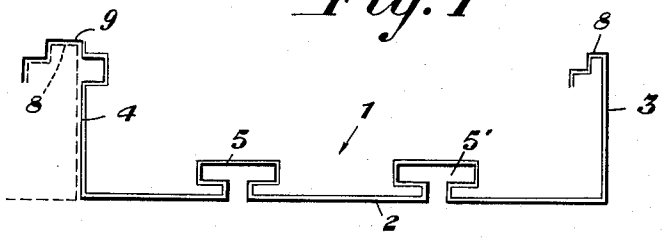



Fig. 2

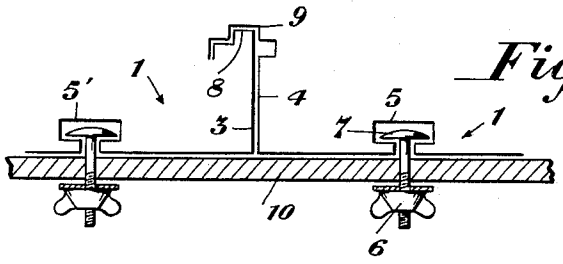



Fig. 3

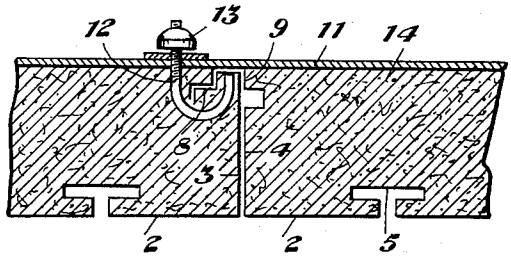
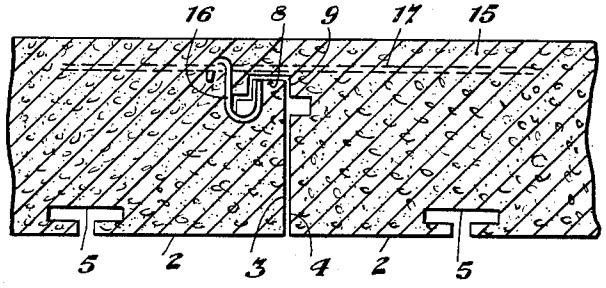



Fig. 4



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Fig. 5

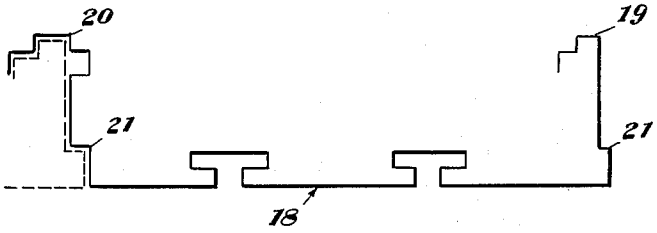



Fig. 6

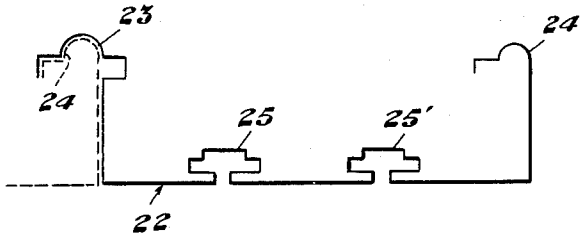
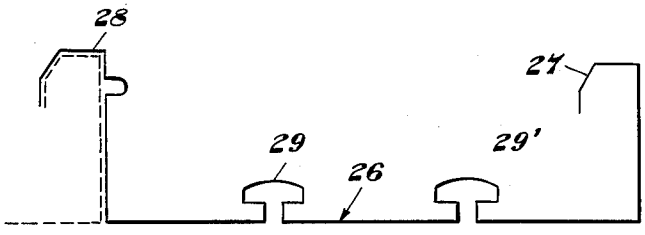



Fig. 7



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# STRUCTURAL MEMBERS OF SHEET MATERIAL FOR WALLS, ROOFINGS, FLOORS AND THE LIKE

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The present invention refers to fabrication of roofing, siding, floors and the like by means of particular structural members made from sheet material, such as metal sheet, laminated, rolled or otherwise formed plastic, glass and similar material, and it further refers to structural members adapted for said fabrication.

It is known to make roofing by means of metal sheet or other rolled material of the most diverse shapes, such members being assembled in a side by side relationship with overlapping or abutting edges and fastened to the framing of the building by means of screws, bolts or clips passed through holes drilled into the material, the joints between abutting sheets being covered by gussets, joint covers, straps, battens or other special elements in order to prevent the penetration or seepage of water into said joints.

The need for such additional roofing accessories as well as the work involved in their installation renders the construction of roofing slow and complex.

It is an object of the present invention to render roof construction more simple and speedy by eliminating said need for hole drilling and the application of said accessories by providing a novel method of roofing construction using engageable structural members, whose sides are formed into battens, each batten being slidable over or inserted into a corresponding batten of the adjacent member, said structural members being also provided with elongated recesses into which are engageable fasteners to attach said members to the framing, whereby the novel method of roofing construction is essentially reduced to the steps of assembling the members of each course by interlocking the corresponding battens of the adjacent members in the manner described, and fastening each member to the underlying framing area by tightening the fasteners engaging in the previously mentioned recesses.

Another object of this invention is to extend this method to the construction of sidings and partitions by a slightly modified use of the aforesaid structural elements, the sidings and partitions built according said method using said members being excellently adapted to receive heat and/or sound insulating material.

It is a still further object of the invention to also extend said method to the construction of floors by a further modified use of the inventive structural elements, wherein the latter serve both as reinforcement taking up tensile stresses in the resulting reinforced concrete floor, to which suspended ceilings or other structures as well as all sorts of appliances may be easily fastened without the need of holes, welds or the like.

Another object of the invention is to provide structural members which are adapted to be used in the application of the method of the invention. Such structural members consist of sheets or plates whose lateral edges are bent upwards and sideways into cross-sectional shapes, into which the correspondingly shaped lateral edges of adjoining members may be slidably engaged, with the result of interlocking and jointing together of said members and the forming of a batten preventing water from penetrating into the joint.

Between the upturned edges of said structural members, and preferably running parallel to the former, are spaced-apart elongated recesses formed in said members, the cross-sectional shape of said recesses being such as to receive clips, anchor bolts or other fasteners which are to connect said members to the roof framing or other supporting structure, or, when said structural members are applied to the other users mentioned, to anchor suspended ceilings or sundry accessories.



The invention will be better understood from the following description of some of its possible embodiments, made with reference to the accompanying drawings, in which:

FIGURE 1 is a vertical cross-sectional view through a structural member according to the invention;

FIGURE 2 is a vertical cross-sectional view showing the mode of interconnecting two such adjacent members and fastening these to a purlin;

FIGURE 3 is a cross-sectional view showing two interlocked structural members fastened to a wall plate and filled with insulating material to form a partition;

FIGURE 4 is a vertical cross-sectional view showing a floor portion made by assembling the structural members of the preceding figures; and

FIGURES 5–7 each represent cross-sectional views of modified embodiments of the structural member of the invention.

The structural members generally indicated at **1** in FIGS. 1 and 2, as well as those indicated at **18, 22, 26** in FIGS. 5 through 7 are represented as being formed integral from one sheet or plate, although it is evident that they can be built up from various shapes by riveting, welding, brazing etc. With particular reference to FIGS. 1 through 4, the structural member, which is generally indicated at **1**, comprises a horizontal plate or body portion **2** terminating in two upturned legs **3** and **4** respectively. Plate or web **2** has raised T-shaped portions spaced apart along its width and running parallel to both legs **3** and **4**. As shown in the drawing, these raised portions **5** define grooves open to the bottom face of plate **2** and ending in lateral recesses **5'**. These raised portions **5**, in addition to acting as stiffening ribs for the structural members **1**, are intended for receiving, within the recesses **5'** they define, fastening means anchoring them to the frame structure. In FIG. 2, the fasteners represented are bolts, whose umbrella-heads engage in recesses **5'** to press the members **1** against a purlin **10** once the bolts are tightened by wing nuts **6**. This provision not only eliminates the need of drilling holes into members **2**, but also permits their longitudinal adjustment prior to fixing them in place.

The end portion of leg **3** is bent inward to form a molding **8**, which, as indicated in dotted lines shows how an adjacent member fits into a complementarily molded bend **9** provided at the end of the other leg **4** of member **1**. Thus, the coupling of a bend **8** of a member with the adjoining bend **9** of an adjacent member results in a joint which not only acts as a batten to prevent seepage but insures a sturdy connection between adjacent members of a course or strake. It is obviously convenient to arrange the legs of each member in the manner shown in the figures, i.e. with one bend, say **8**, formed as the inner part of the joint, and the other, say **9**, as the outer part of the joint interconnecting successive members.

FIGURE 2 shows how adjacent members **1** are fastened to a framing **10** by inserting the heads **7** of the anchoring bolts into the recesses **5'** of the grooves and tightening wing nuts **6** after correctly positioning members **1**.

FIGURE 3 shows how the members **1** can be fitted together and clamped against a plate **11** to form a hollow sliding or partition which can be filled, for instance, with insulating material. The elements used are the structural members **1** of FIGS. 1 and 2, and also the mode of interconnecting adjacent members of a course or strake is identical therewith, the only difference in installation

being the manner of their attachment to plate **11**. In fact, plate **11** runs on the top of the lateral flanges formed by said legs and bends and is therefore directly fastened to the latter. In FIG. 3 hooks **12** are used, whose ends press bends **8** and **9** together and against plate **11** when nut **13** is tightened on the threaded shank of said hooks.

FIGURE 4 shows the use of structural members **1** as component parts of a concrete floor. Here again the members **1** are interconnected in the already described and illustrated manner, whereafter concrete is filled into the spaces defined by the bottom plates **2** and legs **3**, **4**, up to a convenient level. Members **1**, together with their flanges and T-shaped raised portions, constitute therefore both the casting forms and reinforcements of said floor. Steel reinforcement rods **17** may be secured to members **1**, prior to pouring of the concrete, by means of suitable fasteners **16** hooked beneath bends **8** and looped around steel reinforcement rods **17**. Obviously the channels **5** may serve, even in this case, various purposes, such as the fastening of suspended ceilings, chandeliers, aerators etc. This use of laminated roofing elements for floor construction is absolutely novel in the art and rendered possible by the particular configuration imparted to the structural members of the present invention.

Many different shapes and embodiments can be imparted to said structural members, without departing from the scope of the present invention. Some are shown in FIGS. 5 to 7. These differences concern the cross-sectional shapes and disposition of the grooves and bends. Thus structural member **18**, as shown in FIG. 5, has an internal bend **19** and an external bend **20** presenting a step **21**. Member **22** in FIG. 6 presents rounded bend tops **23** and **24**, while its grooves **25** present a central upper recess **25'**.

Member **26** in FIG. 7 has an internal bend **27** and an external bend **28** with a polygonal cross-section, while its grooves **29** present a rounded top **29'**.

It is understood that these and other modifications, which are obvious to those skilled in the art, are all encompassed within the scope and spirit of the invention.

What is claimed is:

**1.** A structural member constituted of sheet material, for roofings, sidings, partitions, flooring and the like, said member comprising a central body portion having opposite sides and a flange portion at each of the sides of said central body portion, said flange portions each comprising an upstanding leg on the central body portion and a terminal molding portion on the upstanding leg, said molding portion including a first lateral branch portion connected to the upstanding leg and extending parallel to the central body portion, a depending branch portion connected to the end of the first branch portion and extending parallel to the upstanding leg, a second lateral branch portion connected to the end of the depending branch portion and extending parallel to the first lateral branch portion at a distance closer to the central body portion than said first lateral branch portion whereby said lateral branch portions and said depending branch portion define a step arrangement, and a second depending branch portion connected to the end of the second lateral branch portion and extending parallel to the upstanding leg such that said molding portion defines with its respective leg a channel which opens downwardly in a direction towards the central body portion, said second depending branch portion having a free lower edge defining with said respective leg an opening into the channel corresponding to the maximum width of the channel, each flange portion at one side of the member having a shape complementary to the shape of the flange portion at the other side of said member and facing in the same direction with the molding portion of each flange extending laterally from the same side of their respective upstanding legs wherein only one said molding portion overlies said central body portion to permit interengaged coupling of complementarily shaped flange portions of two identical members to form a batten type joint, the latter flange portions being engageable by the insertion of one flange portion into the toher through the said opening into the channel thereof, and a plurality of spaced raised portions in said central body portion of generally T-shape defining T-shaped channels having openings at the underside of said central body portion.

**2.** A roofing structure comprising a plurality of structural members assembled in side-by-side relation, each member being constituted of sheet material and comprising a central body portion having opposite sides and a flange portion at each of the sides of said central body portion, said flange portions each comprising an upstanding leg on the central body portion and a terminal molding portion, said molding portion including a first lateral branch portion connected to the upstanding leg and extending parallel to the central body portion, a depending branch portion connected to the end of the first branch portion and extending parallel to the upstanding leg, a second lateral branch portion connected to the end of the depending branch portion and extending parallel to the first lateral branch portion at a distance closer to the central body portion than said first lateral branch portion whereby said lateral branch portions and said depending branch portion define a step arrangement, and a second depending branch portion connected to the end of the second lateral branch portion and extending parallel to the upstanding leg such that said molding portion defines with its respective leg a channel which opens downwardly in a direction towards the central body portion, said second depending branch portion having a free lower edge defining with said respective leg an opening into the channel corresponding to the maximum width of the channel, each flange portion at one side of the member having a shape complementary to the shape of the flange portion at the other side of said member and facing in the same direction with the molding portion of each flange extending laterally from the same side of their respective upstanding legs wherein only one said molding portion overlies said central body portion to permit interengaged coupling of complementarily shaped flange portions of two identical members to form a batten type joint, the latter flange portions being engageable by the insertion of one flange portion into the other through the said opening into the channel thereof, and a plurality of spaced raised portions in said central body portion of generally T-shape defining T-shaped channels having openings at the underside of said central body portion, said members being assembled with the flange portions of each member interengaged in the channel of the complementary flange portion of the adjacent member, a plate, said members resting on said plate, and a plurality of fastener means securing the individual members to said plate, said fastener means each comprising a fastener including an enlarged head portion accommodated in a respective T-shaped channel.

**3.** A wall structure comprising a plurality of structural members assembled in side by side relation, each member being constituted of sheet material and comprising a central body portion having opposite sides and a flange portion at each of the sides of said central body portion, said flange portions each comprising an upstanding leg on the central body portion and a terminal molding portion, said molding portion including a first lateral branch portion connected to the upstanding leg and extending parallel to the central body portion, a depending branch portion connected to the end of the first branch portion and extending parallel to the upstanding leg, a second lateral branch portion connected to the end of the depending branch portion and extending parallel to the first lateral branch portion at a distance closer to the central body portion than said first lateral branch portion whereby said lateral branch portions and said depending branch portion define a step arrangement, and a second depending branch portion connected to the end of the second lateral branch

portion and extending parallel to the upstanding leg such that said molding portion defines with its respective leg a channel which opens downwardly in a direction towards the central body portion, said second depending branch portion having a free lower edge defining with said respective leg an opening into the channel corresponding to the maximum width of the channel, each flange portion at one side of the member having a shape complementary to the shape of the flange portion at the other side of said member and facing in the same direction with the molding portion of each flange extending laterally from the same side of their respective upstanding legs wherein only one said molding portion overlies said central body portion to permit interengaged coupling of complementarily shaped flange portions of two identical members to form a batten type joint, the latter flange portions being engageable by the insertion of one flange portion into the other through the opening in the channel thereof, and a plurality of spaced raised portions in said central body portion of generally T-shape defining T-shaped channels having openings at the underside of said central body portion, said members being assembled with the flange portions of each member interengaged in the channel of the complementary flange portion of the adjacent member, a plate resting on the uppermost of said first lateral branches of the interengaged flange portions, means securing the plate to the assembled members by the engagement of the plate and the interengaged flanges of the assembled members, said plate defining cavities between itself and the assembled members and filling material in said cavities completely filling the same.

4. A floor structure comprising a plurality of structural members assembled in side by side relation, each member being constituted of sheet material and comprising a central body portion having opposite sides and a flange portion at each of the sides of said central body portion, said flange portions each comprising an upstanding leg on the central body portion and a terminal molding portion, said molding portion including a first lateral branch portion connected to the upstanding leg and extending parallel to the central body portion, a depending branch portion connected to the end of the first branch portion and extending parallel to the upstanding leg, a second lateral branch portion connected to the end of the depending branch portion and extending parallel to the first lateral branch portion at a distance closer to the central body portion than said first lateral branch portion whereby said lateral branch portions and said depending branch portion define a step arrangement, and a second depending branch portion connected to the end of the second lateral branch portion and extending parallel to the upstanding leg such that said molding portion defines



with its respective leg a channel which opens downwardly in a direction towards the central body portion, said second depending branch portion having a free lower edge defining with said respective leg an opening for the channel corresponding to the maximum width of the channel, each flange portion at one side of the member having a shape complementary to the shape of the flange portion at the other side of said member and facing in the same direction with the molding portion of each flange extending laterally from the same side of their respective upstanding legs wherein only one said molding portion overlies said central body portion to permit interengaged coupling of complementarily shaped flange portions of two identical members to form a batten type joint, the latter flange portions being engageable by the insertion of one flange portion into the other through the opening in the channel thereof, and a plurality of spaced raised portions in said central body portion of generally T-shape defining T-shaped channels having openings at the underside of said central body portion, said members being assembled with the flange portions of each member interengaged in the channel of the complementary flange portion of the adjacent member, reinforcement rods extending across the interengaged flange portions, means connecting the reinforcement rods to the interengaged flange portions, said assembled members defining cavities therein, and concrete in said cavities to a level overlying the reinforcement rods.


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