United States Patent

Holm

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[54] **STRUCTURAL CONNECTIONS FOR BUILDING CONSTRUCTIONS**

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[52] **U.S. Cl.** **52/93,** 52/221, 52/236, 52/309, 52/586, 52/622, 52/495

[51] **Int. Cl.**.....**E04b 7/02,** E04h 1/02

[58] **Field of Search**.....52/93, 79, 90, 220, 221, 234, 52/236, 309, 404

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Primary Examiner—Frank L. Abbott

Attorney—Raymond C. Stewart and Joseph A. Kolasch

[57] **ABSTRACT**

Structural connections for the construction of buildings which provide interlocking sandwich wall and roof sections that are self-insulating and self-leveling. In addition, channel baseboards are provided which permit wiring after complete construction of the building. An interlocking beam and post assembly with an offset tongue portion allows two or more beams, joists or posts to be joined.

32 Claims, 18 Drawing Figures

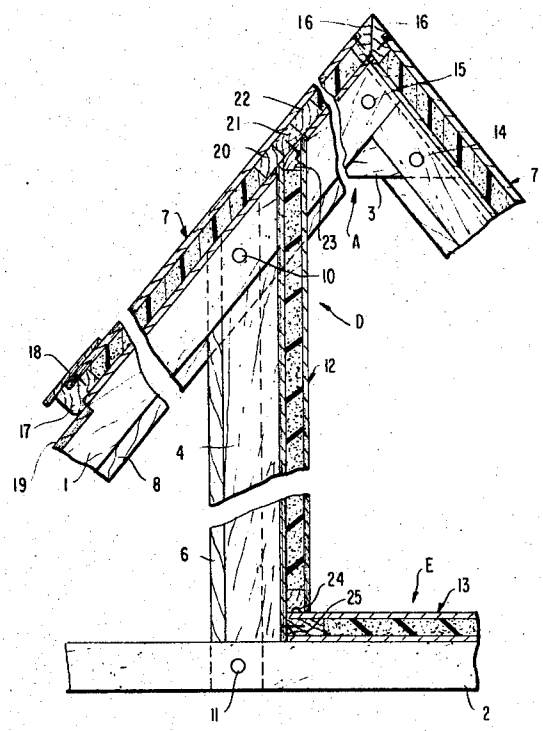


FIG. 1

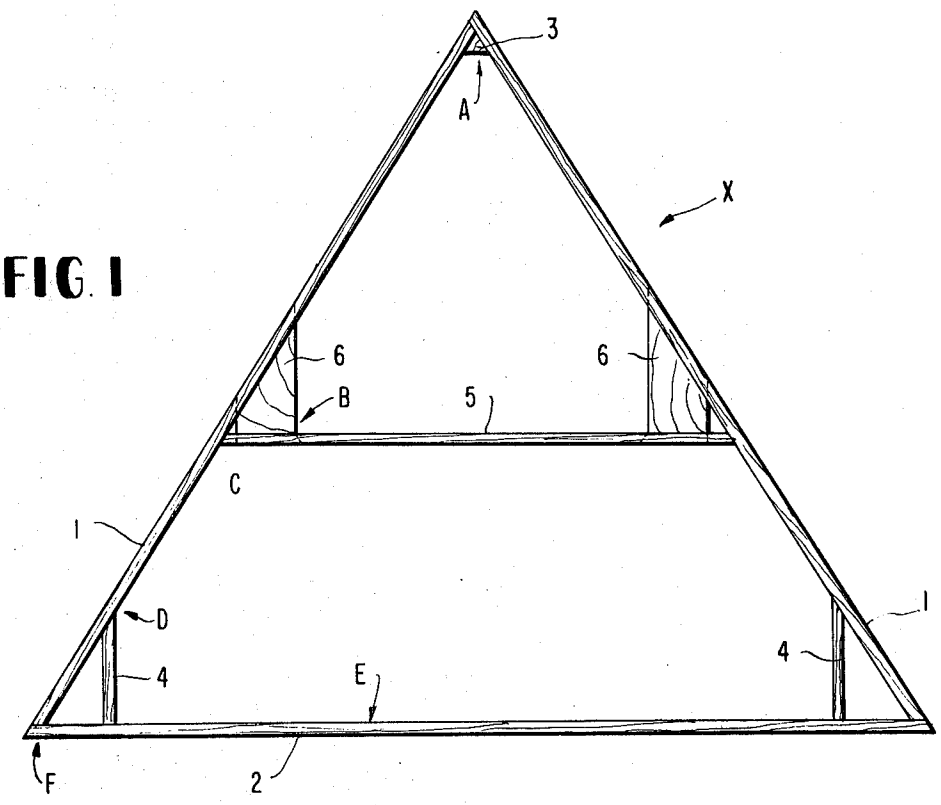


FIG. 2

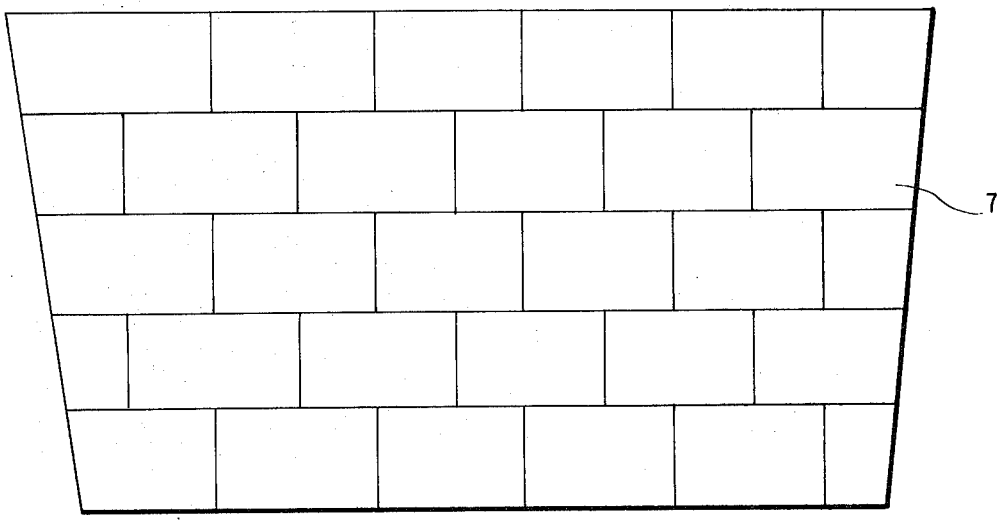


FIG. 3

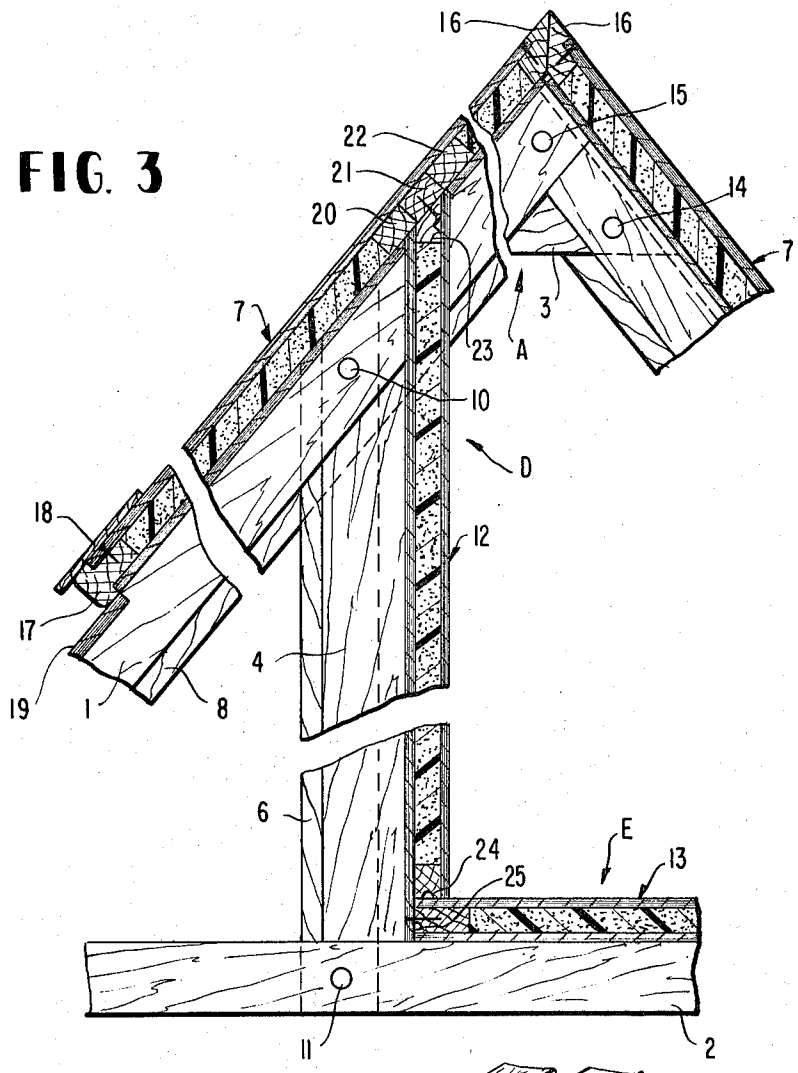
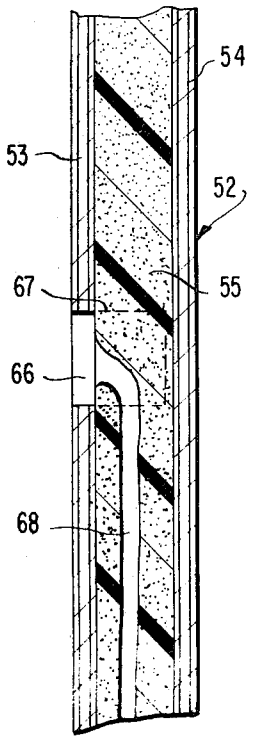


FIG. 13



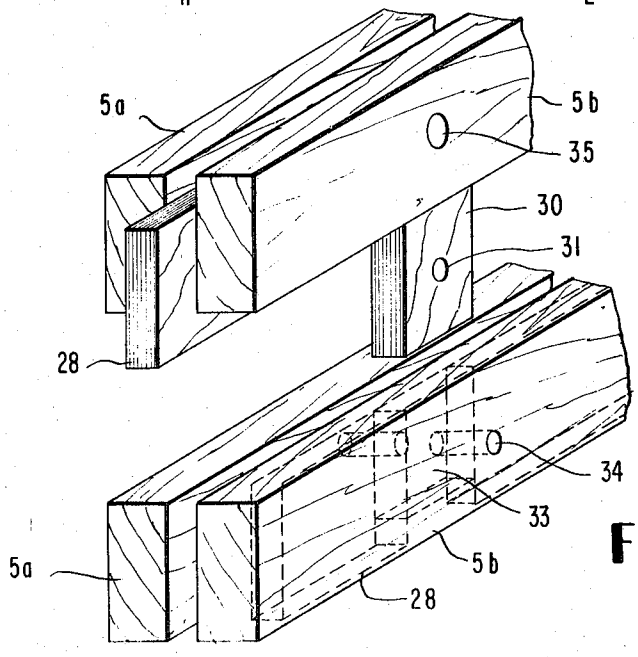
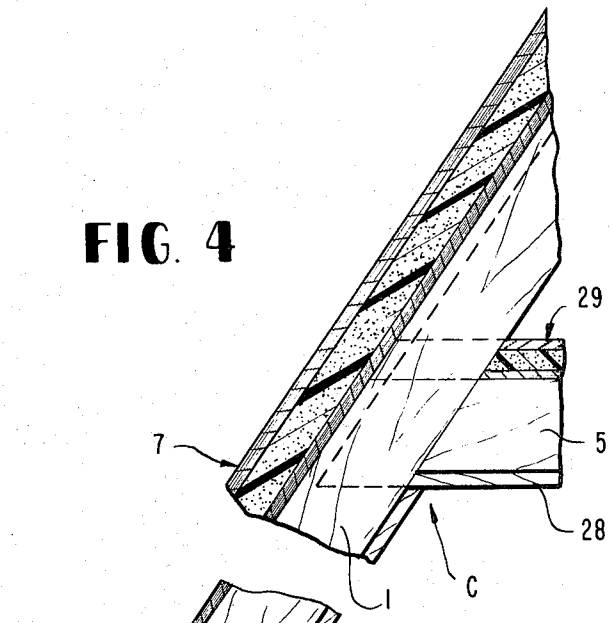


FIG. 6

FIG. 4



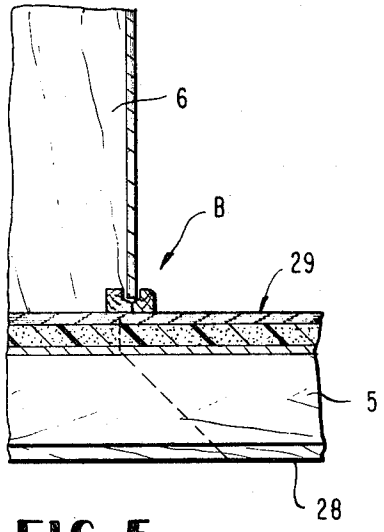


FIG. 5

FIG. 7

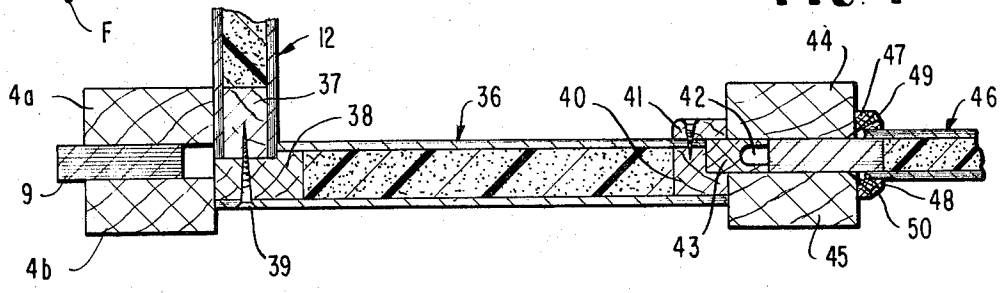


FIG. 7a

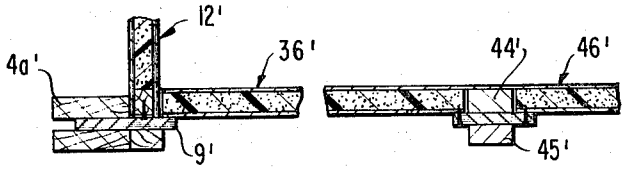
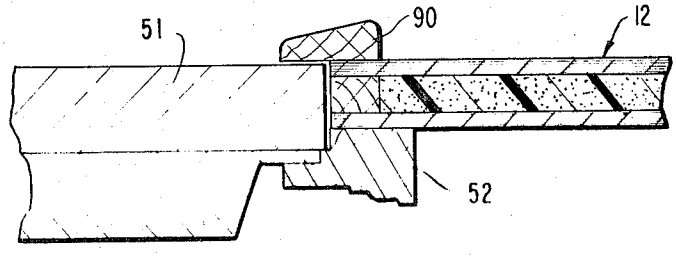


FIG. 7b



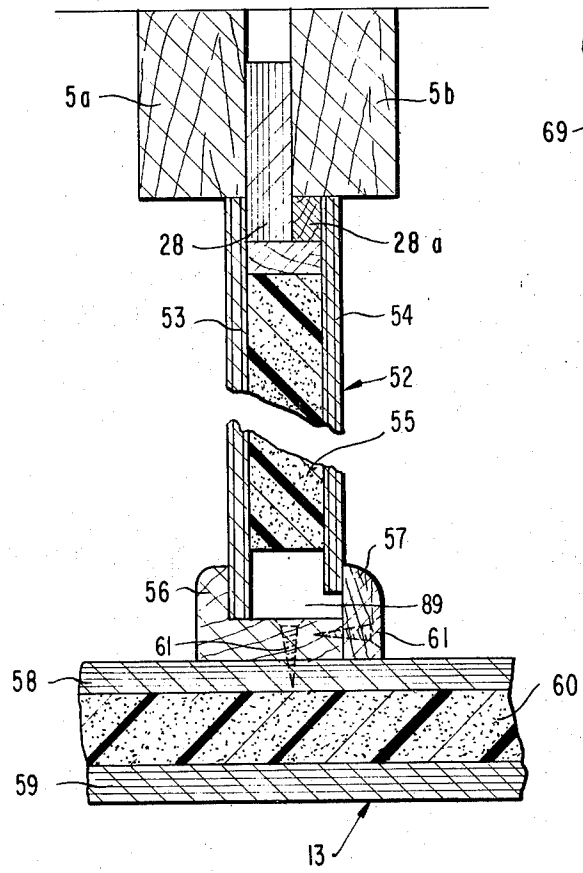


FIG. 8

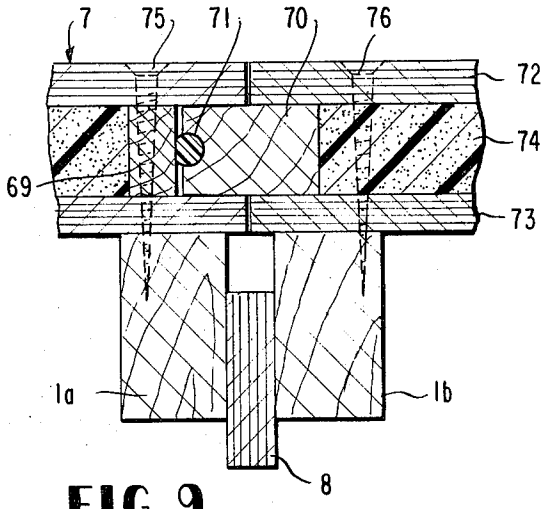


FIG. 9

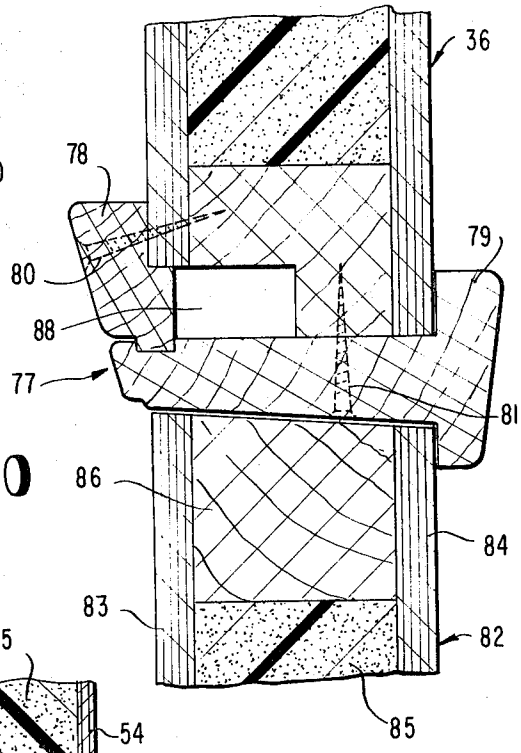


FIG. 10

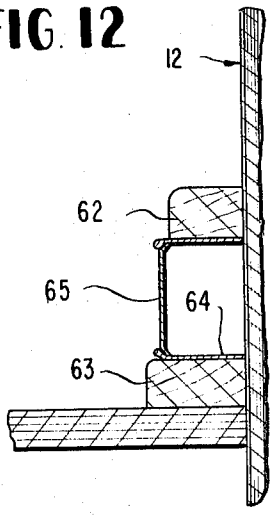


FIG. 12

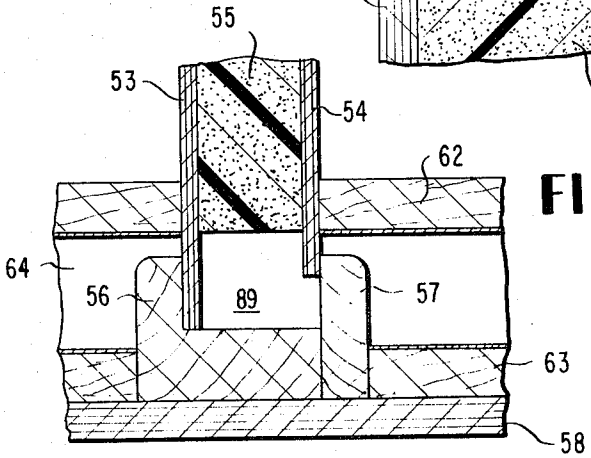
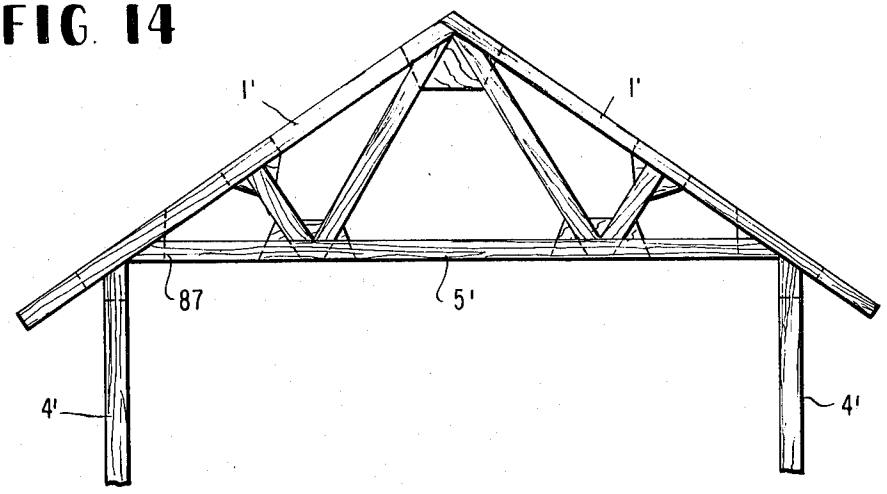


FIG. 11

FIG. 14



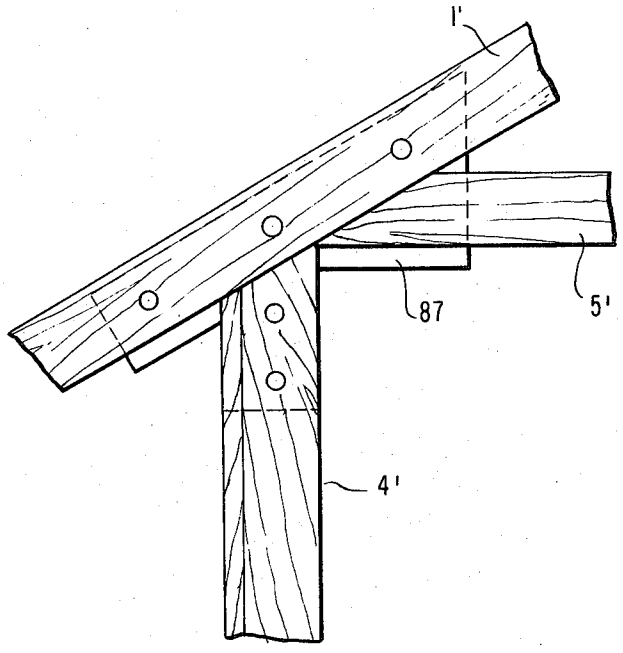


FIG. 15

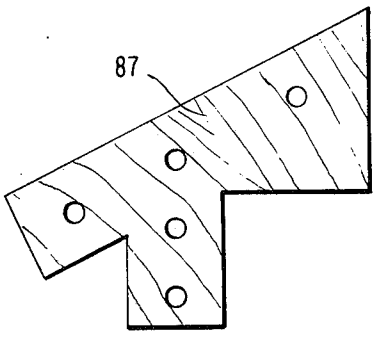


FIG. 16

STRUCTURAL CONNECTIONS FOR BUILDING CONSTRUCTIONS

BACKGROUND OF THE INVENTION

The present invention relates to structural connections for the construction of buildings, which connections provide interlocking sandwich wall and roof sections, and more particularly, to interlocking sandwich wall and roof sections which are both structural in nature and develop a great strength with less material than is normally used with ordinary constructional techniques. The interlocking sandwich wall and roof sections are self-insulating, are finished both on the interior and exterior sides, are weatherproof and air-tight, are simple to put together, and all the pieces thereof come pre-cut to accurate size. All the pieces of the structural connections are also self-leveling and self-plumbed.

It is known to construct, for instance, A-frame structures by using a ladder method for constructing the walls and beams, which method employs two-by-fours and two-by-eights connected together by using a given angle. However, this method is only suitable for A-frame structures.

It is also known that a tightenable cable can be employed for holding together a temporary or movable building. With such a conventional method, the side walls of the temporary building are joined together as the roof boards by an angular rabbet method to allow for slippage when tightened. This type of joint, however, requires a metal piece to hold the corners together and provide water-tightness.

It is also known to provide a metal frame which is designed to hold up a building and at the same time allow for wiring, plumbing, gas, etc. However, such an arrangement usually requires wiring and plumbing prior to the completion of the building. In some conventional structures, the wiring of the building requires pre-molding of the wiring into the wall sections, thus requiring pre-planning of electrical requirements prior to the construction. Therefore, the occupant finds it extremely difficult at a later date to add on electrical wiring for varying requirements.

SUMMARY OF THE INVENTION

It is the aim of the present invention to overcome the problems and disadvantages of the prior art constructions and to provide structural connections which greatly increase the speed and ease with which a building is put together.

The underlying problems are solved in accordance with the present invention by providing interlocking sandwich wall and roof sections, channel baseboards which permit wiring after complete construction of the building, and an interlocking laminated beam and post assembly.

The interlocking laminated beam and post assembly can be made from two-by-four inch material with a plywood gusset center or tongue that is offset so as to allow the joining of two or more beams or posts, thereby increasing the size as well as the strength of the beam or post. This assembly provides the advantage that the beams can be assembled in any length and eliminates the need for separate left-hand and right-hand structures since by reversing one structure it will interlock with any other structure. In addition, the joist,

vertical post and beam interlock to form a structural unit.

An advantage of the interlocking sandwich wall and roof sections is that it is structural in nature and develops great strength with less material than is normally used with ordinary constructural techniques. The walls and roof are self-insulating, and are finished both on the interior and exterior sides. Further, the sections are weatherproof and air-tight, are simple to put together and are self-leveling and self-plumbed. In addition, the sections are extremely simple to put together since all that is needed is a simple tool such as, for example, a power screwdriver.

It is an object of the present invention to provide an assembly which is self-leveling, self-squaring and which obviates any need for cutting material on the job site.

It is a further object of the present invention to provide a sandwich wall construction with a totally dry insulation, thus providing a constant K factor. In this connection, such an arrangement provides an interior and exterior moisture barrier.

It is also a further object of the present invention to provide the walls with a vinyl covering to eliminate the need for any painting thereof.

It is a still further object of the present invention to insulate the floors as well as the walls and ceilings. Even the interior walls would be insulated because of the material used, thereby eliminating noise and allowing the desired temperature differential between rooms.

It is a further object of the present invention to make practical the use of electrical heat because of the tightness of compression strips used in constructing the building.

It is still a further object of the present invention to provide a structural connection method which yields a maximum amount of strength with a minimum expenditure of materials, thus providing a great savings.

It is still a further object of the present invention to provide a roof that is totally dry before roofing material is put thereon because of the compression fittings in the roof.

It is still another object of the present invention to provide further maximum strength with minimum cost because of the ability to add one joist or beam section to another in joist assembly.

It is still a further object of the present invention to provide that the plumbing, heating, wiring, etc., can be added after the structure is complete, so that the wiring, for example, can be modified as requirements vary.

BRIEF DESCRIPTION OF THE DRAWINGS

These and further objects, features and advantages of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings which show, for purposes of illustration only, an embodiment of the present invention and wherein:

FIG. 1 is an elevational view of a frame assembly of the structure in accordance with the present invention;

FIG. 2 is a plan view of the roof sections looking in the direction of arrow X in FIG. 1;

FIG. 3 is a detail, partial, cross-sectional elevation view of the frame assembly with the wall sections and flooring at points A, D and E in FIG. 1;

FIG. 4 is a detail, partial, cross-sectional elevation view of the frame assembly at points C and F of FIG. 1;

FIG. 5 is a detail, partial, cross-sectional elevation view of the frame assembly at point B of FIG. 1;

FIG. 6 is a partial isometric view of the tongue and groove arrangement for assembling the joists in accordance with the present invention;

FIG. 7 is a detail, cross-sectional plan view of the frame assembly at a corner thereof;

FIG. 7*a* is a view similar to FIG. 7 showing a modified embodiment of the frame assembly at a corner and at the joint of two wall sections;

FIG. 7*b* is a partial cross-sectional plan view of the assembly at a window and outer wall panel with an installed storm window;

FIG. 8 is a partial, cross-sectional elevation view of an inside wall with the floor and ceiling connection;

FIG. 9 is a cross-sectional view of the interlock between the roof sections in accordance with the present invention;

FIG. 10 is a partial, cross-sectional plan view of the door assembly and jamb moulding of the structure in accordance with the present invention;

FIG. 11 is a partial, cross-sectional elevation view similar to FIG. 8, but showing channel means in an outside or exterior wall in communication with the open space in the interior wall;

FIG. 12 is a side view of the arrangement shown in FIG. 11;

FIG. 13 is a partial, cross-sectional elevation view of a wall section for accommodating an electrical switch and wiring;

FIG. 14 is an elevation view similar to FIG. 1 showing a modified embodiment of the frame assembly in accordance with the present invention employing a roof truss;

FIG. 15 is an enlarged detail of a portion of the roof truss in FIG. 14; and

FIG. 16 is a view of the gusset employed in the roof truss portion of FIG. 15.

DETAILED DESCRIPTION OF THE DRAWING

Referring now to the drawing, and in particular to FIG. 1, there is shown, by way of example, an A-frame assembly which includes beams 1 joined at an angle with respect to a floor joist 2 and connected together at the peak by a gusset or tie piece 3. Inside vertical post 4 is connected to the beams 1 and floor joist 2 for providing the necessary structural requirements. A ceiling joist 5 is provided intermediate the floor joist 2 and the gusset 3 so as to make provision for a second story in the structure. Vertical post 6 are connected with the beams 1 and the ceiling joist 5 for providing further structural rigidity of the frame assembly. As shown in FIG. 2, roof sections 7 are placed along the beams 1 and are joined thereto as will be described hereinafter in greater detail.

As seen in FIG. 3, roof section 7 is joined with the beam 1. The beam 1 actually consists of two portions 1A, 1B, as shown in FIG. 9, and an offset portion or tongue 8 which can be made from plywood or any other suitable material. Vertical post 4 also consists of two portions 4A, 4B, as shown in FIG. 7, and an offset portion or tongue 9 which also can be made of plywood or any other suitable material. The vertical post 4 is connected with the beam 1 and floor joist 2 by any suitable means, such as, for example, carriage bolts 10, 11. An outside wall section 12 is provided and rests upon flooring 13. The gusset or tie piece 3 is connected with the beams 1 by means of, for example, carriage bolts 14 and the beams themselves are joined at the peak by means of, for example, carriage bolts 15. The roof sections 7 are joined together at the peaks by means of ridge mouldings 16, which can be bi-partite or a unitary part joined to the roof sections by conventional means such as screws. The roof section nearest to the ground is provided with an end strip 17. In addition, roofing material 18 can be applied over the exterior surface of the roof sections for additional sealing as well as aesthetic reasons. At the termination of the roof sections, flashing 19 is provided along the beams 1. A spacer or spacers 20, 21, 22 are provided on the interior of a roof section 7. The outer wall section 12 is provided with a space 23 for connection with the roof section spacers by conventional means such as a wood screw. Compression strips 24, 25 are provided in the rails at the joint portion of the outer wall section 12 and the flooring 13 so as to provide the necessary sealing requirements.

Referring now to FIG. 4, it is seen that the flashing 26 from the flooring continues along the floor joist 2 so as to abut against the beam 1. A caulking strip 27 is provided between the flashing 26 and the tongue 8 for sealing purposes. The ceiling joist 5 actually consists of two portions 5A, 5B, as seen in FIG. 6, and an offset portion or tongue 28. To form a second floor, flooring 29 is placed on the ceiling joist 5 and is connected thereto by conventional means. FIG. 5 likewise shows the connection of the vertical post 6 to the ceiling joist 5 and the flooring 29.

In FIG. 6, it is seen how easily joist sections can be assembled so as to increase their length as well as their rigidity. Splines 30, which can be made from plywood or any suitable material, are placed at desired intervals along the joists or the beam. The spline 30 is provided with a bore 31 therethrough. A second joist 5 has a corresponding pocket 33 for spline 30 and bores 34 in joist portions 5A, 5B which align themselves with bore 31 for the reception of, for example, a carriage bolt 35 so as to be rigidly connected.

FIG. 7 shows a corner detail of the structure having outer wall sections 12 and 36. The end rails 37, 38 of wall sections 12, 36, respectively, are joined together, for example, by a wood screw 39. The other end of the wall section 36 is joined at an intermediate vertical post 44, 45, by end rail 40, spacers 41, 43 and a wood screw. The end of the spacer 43 which abuts against the tongue of the intermediate vertical post is provided with a channel or space for accommodating wiring or the like. On the other side of the intermediate vertical post, another wall section 46 can be provided. This section can be connected by mating engagement with the tongue of the vertical post as well as fillets 47, 48 joined to the post portions 44, 45 by conventional means such as screws 49, 50.

Any exterior wall panel can be cut to accommodate a window or a door. Rigid vinyl windows 51 fit in the cut-out with an exact fit using an exterior molding 52 and an interior molding 90 to seal and hold the window tightly to the wall as shown in FIG. 7*b*. In addition, FIG. 7a shows a modified form of the corner assembly and exterior wall joint connection, wherein parts similar to those in FIG. 7 are designated by the same but primed numerals.

FIG. 8 shows the connection between an inside wall section 52 between the ceiling joist 5 and the flooring 13. The wall section 52 is of sandwich construction consisting of plywood sheets 53, 54 covering a synthetic resin, such as Styrofoam, intermediate sheet 55. The wall section 52 is accommodated within a baseboard retainer 56 and a removable baseboard cap 57. The baseboard retainer 56 is joined to the flooring 13 by means of, for example, a wood screw 61. The flooring 13 likewise consists of a sandwich construction including plywood cover sheets 58, 59, which sandwich a Styrofoam sheet 60. The removable baseboard cap 57 is joined to the baseboard retainer 56 by conventional wood screws 61. The Styrofoam sheet 55, the baseboard retainer 56 and the retainer cap 57 define a channel 89 for accommodating wiring or the like. The other end of the wall section 52 is joined to the ceiling joist 5 by providing that the plywood cover sheets 53, 54 straddle the tongue 28 and the spacer 28A. In addition, conventional means can be employed for further joining the wall section 52 to the ceiling joist.

FIGS. 11, 12 and 13 show further details for accommodating electrical wiring within the structure. For example, the outer wall section 12 is provided with a channel member of plastic or other suitable material which is arranged between an upper molding member 62 and a lower molding member 63. The channel member 64 is of substantially U-shaped configuration and is provided with lips at the ends of the legs for retaining a removable cap 65. Where an interior wall section 52 abuts against an outer wall section 12, space 89 and the channel member 64 communicate with each other so as to accommodate any wiring. It can be readily seen that this arrangement allows wiring to be added at a later time depending upon the needs of the occupant. FIG. 13 shows that the outer sheet of the wall section 52 can be provided with an electric outlet hole 66 cut therein to accommodate an electrical switch or outlet box 67. A deeper box would have a surface extension ring around it to compensate for the thickness of the wall. The channel 68 communicates with the space 58 and can be formed by lowering a small soldering iron through the Styrofoam sheet, thereby forming a hardened wire space as the soldering iron drops into the baseboard space 89. On an outside wall, e.g., wall section 12, hole 68 can connect through the back side of channel member 64 which can be provided with knock-out portions to receive electrical connectors. This would be used, of course, to connect any outlets or switches on outside walls.

FIG. 9 shows the interlocking sandwich connection of the roof section at the beam 1. One end of the roof section is provided with a spacer 69, while the other end is provided with a spline tongue 70 having a groove at the outer end thereof to accommodate a compression strip 71 of, for example, soft plastic material. This tongue and groove arrangement of the roof sections provides the necessary sealing for the structure. As seen in FIG. 9, the roof sections are of sandwich construction wherein outer and inner cover sheets 72, 73 sandwich a Styrofoam sheet 74 therebetween. The roof sections are joined to beam portions 1A, 1B by means of, for example, screws 75, 76.

FIG. 10 shows the general arrangement of the door and jamb moulding. The wall section 36 is provided with jamb moulding 77 which can be of either bi-partite construction 78, 79 or of unitary construction. As seen in FIG. 10, the two members 78, 79 of the jamb moulding are joined to the wall section by means of screws 80, 81. The door section 82 is the cut-out piece replaced back into the opening after adding strip 86 at the end thereof in face-to-face relationship with the jamb moulding. The door section can also be of sandwich construction consisting of outer sheets 83, 84 which are made of plywood or any other suitable material and a Styrofoam sheet 85 therebetween. By using, for example, a ½ inch routing bit for the cut-out, an exact clearance can be established for the door. Thus, anyone can hang the door with a perfect fit using only a screw driver. In mounting the jamb moulding to the wall section, a channel 88 is produced for accommodating electrical wiring.

It should be quite clear from the above description that the beam, joist and post assembly can be done quickly with the aid of simple tools. Likewise, the interior of the structure can also be quickly accomplished without the need for employing complicated constructional techniques or great amounts of material.

As shown in FIGS. 14 to 16, the present invention can be used to erect any type of structure by taking appropriate measures. The beam 1' can be cut at a desired roof overhang point, thereby eliminating the triangular base section. The vertical post 4' is then extended to standard ceiling height but remains the same in terms of connection with the exception of a gusset 87, shown in FIG. 16, which can be an L or T gusset and which fits into a large pocket at the intersection of the rafter beam 5' and vertical post 4'. With the same structural variations, long distances can be spanned between the outside walls.

While I have shown and described embodiments in accordance with the present invention, it is to be clearly understood that the same is susceptible of numerous changes and modifications as will be apparent to one of ordinary skill in the art. I, therefore, do not wish to be limited to the details shown and described herein, but intend to cover all such changes and modifications.

I claim:

1. A building construction comprising:

a floor including a plurality of floor joists;

a roof including a plurality of pairs of beams and one end of the pairs of beams are connected with each other;

a plurality of vertical posts operatively connected between the beams and the floor joists;

exterior walls;

a ceiling including a plurality of roof section panels connected to the beams and each other;

wherein a least one of the beams, floor joists and posts include first and second members with a center core member containing an offset tongue sandwiched therebetween, said core portion being so disposed as to define male and female portions at the respective end and side portions of said first and second members;

and wherein the roof section panels comprise outer cover sheets sandwiching an insulating synthetic resin panel, each end of the roof section panels being provided with a groove, one of said ends having a spacer means which occupies a portion of

the groove and the other of said ends being provided with a spline tongue mean which projects outwardly therefrom for engaging in the groove of an adjoining roof section panel.

2. A building construction according to claim 1, wherein compression strip means is provided between the spacer means and tongue means of adjoining roof section panels.

3. A building construction according to claim 2, wherein the compression strip means consists of soft plastic strip material.

4. A building construction according to claim 3, wherein further means are provided over the assembled roof section panels for additional sealing.

5. A building construction comprising:

a floor including a plurality of floor joists;

a roof including a plurality of pairs of beams and one end of the pairs of beams are connected with each other;

a plurality of vertical posts operatively connected between the beams and the floor joists;

exterior walls;

a ceiling including a plurality of ceiling joists connected to the beams;

and a roof further including a plurality of roof section panels connected to the beams and each other;

wherein at least one of the beams, floor joists and posts include first and second members with a center core member containing an offset tongue sandwiched therebetween, said core portion being so disposed as to define male and female portions at the respective end and side portions of said first and second members.

6. A building construction according to claim 5, wherein the number of pairs of beams correspond to the floor joists and are connected thereto at the ends thereof so as to form an angle therebetween.

7. A building construction according to claim 6, wherein gusset means are provided for operatively connecting the beams, vertical posts and ceiling joists.

8. A building construction according to claim 2, wherein ridge molding means is provided for operatively connecting the other ends of the beam pairs together in a peak-like form.

9. A building construction according to claim 8, wherein said ridge molding means is of bi-partite construction.

10. A building construction according to claim 5, wherein carriage bolt means are provided for the operative connection of the beams and floor joists.

11. A building construction according to claim 10, wherein caulking strip means are provided between the floor and the beams.

12. A building construction according to claim 5, wherein the floor includes floor section panels comprising outer cover sheets sandwiching an insulating synthetic resin panel therebetween, and the exterior walls abut at the floor section panels with compression strip means being interposed therebetween.

13. A building construction according to claim 12, wherein the vertical posts are operatively connected at the floor and the beams by carriage bolt means, and the exterior walls abut against the vertical posts.

14. A building construction according to claim 18, wherein one end of the exterior walls is joined to the roof section panels.

15. A building construction according to claim 5, wherein the external walls are provided with upper and lower molding members with channel means located therebetween for accommodation of wiring and said building construction further including at least one interior wall having outer sheets and an insulating synthetic resin panel sandwiched therebetween, the interior wall being operatively connected with a ceiling joist and the floor, wherein the ceiling joist has two portions and an offset tongue portion and the interior wall outer sheets and the insulating panel being so arranged as to receive the offset tongue portion.

16. A building construction according to claim 15, wherein baseboard retainer means is operatively connected with the floor and a baseboard cap is removably connected with the baseboard retainer means, the baseboard retainer means and cap being substantially U-shaped in cross-section and receiving the interior wall therebetween so as to define a channel operatively communicating with the channel means of the exterior walls.

17. A building construction according to claim 16, wherein the exterior wall channel means is provided with removable cover means.

18. A building construction according to claim 5, wherein the ceiling joists are provided with a layer of floor section panels thereover, and a plurality of upper vertical posts are operatively connected with the beams and the ceiling joists.

19. A building construction according to claim 18, wherein the floor section panels comprise cover sheets and an insulating synthetic resin panel sandwiched therebetween.

20. An A-frame building comprising:

a floor having floor joists;

a pair of beams corresponding to each of the floor joists and connected thereto at one end while the other ends of each pair are connected with each other in a triangular manner;

vertical posts connected with the beams and the floor joists;

exterior walls abutting against the vertical posts and being provided with upper and lower molding members with channel means located therebetween;

ceiling joists located substantially parallel to the floor joists and intermediate the floor joists and apex of the beams;

roof section panels associated with the beams and each other so as to form the roof;

means interlocking the roof section panels with adjoining roof section panels;

the beams, the floor joists, and the vertical posts include first and second portions with an offset tongue portion sandwiched therebetween, and means provided at selected distances along the portions thereof for the operative connection of additional beams, floor joists and vertical posts, respectively;

and at least one interior wall being connected between a ceiling joist and the floor; and

baseboard retainer means operatively connected with the floor and a removable baseboard cap associated therewith;

wherein the baseboard retainer means and cap are substantially U-shaped in cross-section and receive therebetween the interior wall so as to define a channel operatively communicating with the channel means of the exterior walls.

21. An A-frame building according to claim 20, wherein the exterior walls, the roof section panels and the interior wall comprise cover sheets and an insulating synthetic resin panel sandwiched therebetween.

22. An A-frame building according to claim 21, wherein the interlocking means include one end of each of the roof section panels being provided with spacer means so as to define a groove and the other end of each of the roof section panels being provided with tongue means projecting outwardly therefrom for engaging in the groove of an adjoining roof section panel.

23. An A-frame building according to claim 22, wherein compression strip means is provided between the spacer means and tongue means of adjoining roof section panels.

24. An A-frame building according to claim 23, wherein ridge molding means are provided at the apex of the beams for the operative connection of the beams.

25. An A-frame building according to claim 24, wherein caulking strip means are provided between the floor and the beams, and one end of the exterior walls is joined to the roof section panels.

26. An A-frame building according to claim 25, wherein the ceiling joists are provided with a layer of floor section panels thereover, and a plurality of upper vertical posts are operatively connected with the beams and the ceiling joists.

27. The A-frame building of claim 21, wherein the cover sheets of the interior and exterior walls are provided with electrical outlet holes, said holes being adapted to receive a device which can melt the synthetic resin insulation thereby producing a conduit from the electrical outlet holes to the base-board channel.

28. The A-frame building of claim 21, wherein when a section is cut out of the interior or exterior walls to provide a door opening, a jamb molding is mounted in the opening and the cut out wall section is replaced into said opening to function as a door.

29. A building construction comprising:
a floor including a plurality of floor joists;
a roof including a plurality of pairs of beams and one end of the pairs of beams are connected with each other;
a plurality of vertical posts operatively connected between the beams and the floor joists;
exterior walls;
a ceiling including a plurality of ceiling joists connected to the beams; and
the roof further including a plurality of roof section panels connected to the beams and each other;
wherein the beams, the floor joists and the vertical posts include a first and a second portion and an offset tongue portion sandwiched therebetween and spline and pocket means are provided at selected distances along the portions for the operative connection of additional portions of adjoining portions of adjoining beams, floor joists and vertical posts for increasing the length and rigidity thereof;
and wherein the roof section panels comprise outer cover sheets sandwiching an insulating synthetic resin panel, each end of the roof section panels being provided with a groove, one of said ends having a spacer means which occupies a portion of the groove and the other of said ends being provided with a spline tongue means which projects outwardly therefrom for engaging in the groove of an adjoining roof section panel.

30. A building construction according to claim 29, wherein gusset means are provided at the joined ends of the pairs of beams for operative connection therewith.

31. A building construction according to claim 29, wherein carriage bolt means are provided for operatively connecting corresponding spline and pocket means of adjoining portions.

32. The building construction of claim 26, wherein pocket means are provided in the joined ends of the pairs of beams, said pocket means being adapted to receive said gusset means as an insert therein, and means provided for connecting the gusset means to the joined end portions of said beams.

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