United States Patent [19]

Castle

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[54] **ALUMINUM BUILDING**

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[52] **U.S. Cl.** **52/92,** 52/57, 52/299, 52/300

[51] **Int. Cl.** **E04b 7/04**

[58] **Field of Search** 52/90, 92, 57, 300, 299

[56] **References Cited**

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Assistant Examiner—Leslie A. Braun
Attorney, Agent, or Firm—Sughrue, Rothwell, Mion, Zinn & Macpeak

[57] **ABSTRACT**

An all aluminum building having an assembly system using extruded structural members having unique cross-sectional configurations which allow the structural support members to be completely constructed on the building site and which interlock and fit together in such a manner as to form an easily assembled, yet structurally sound building without requiring the use of special construction techniques. The extruded structural support members are used in conjunction with prefabricated aluminum sheet panels for constructing the roof and side walls of the building.

5 Claims, 6 Drawing Figures

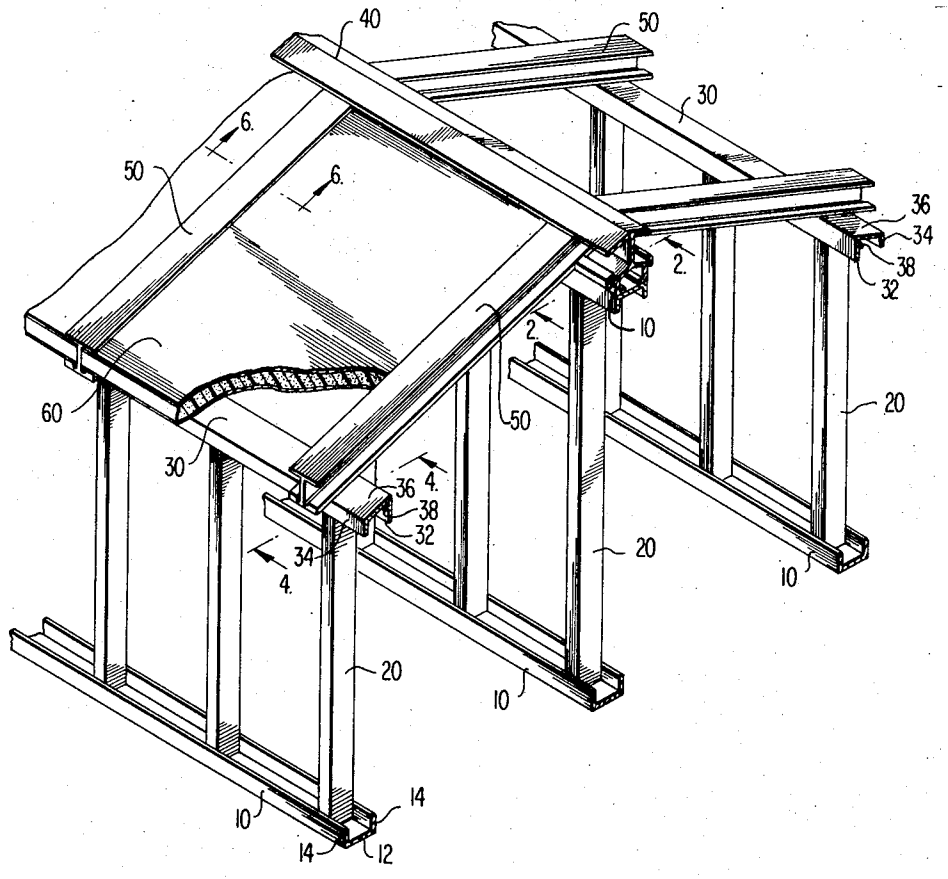


FIG. 1

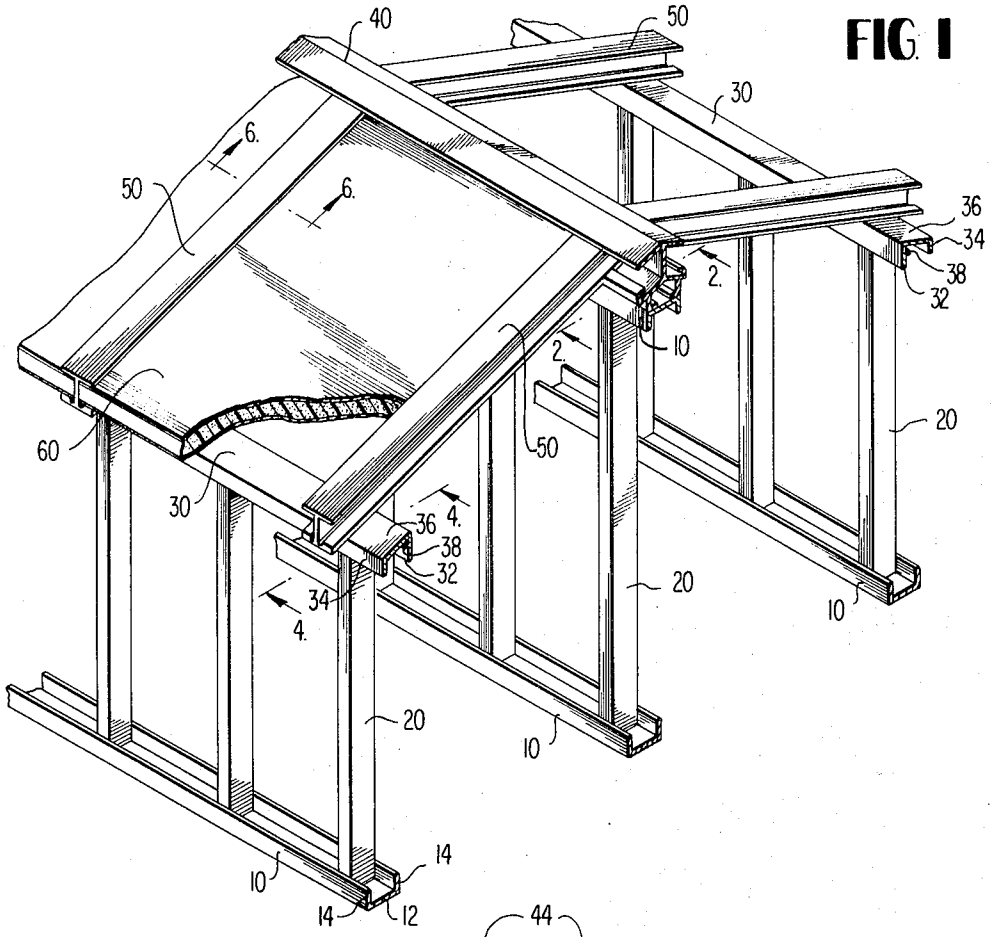

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FIG. 2

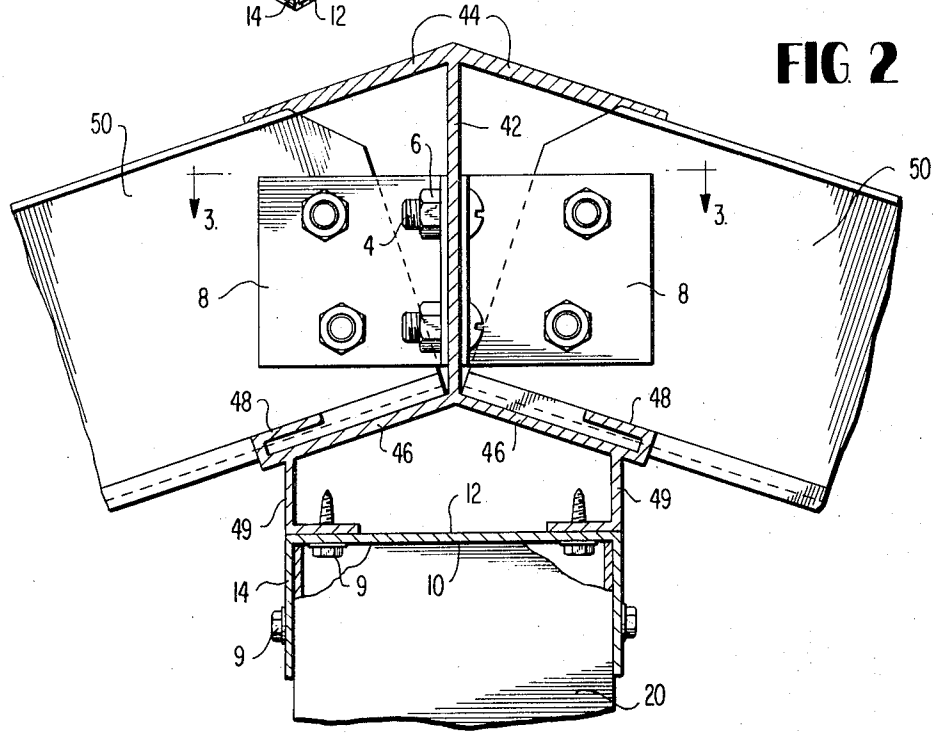

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FIG. 4

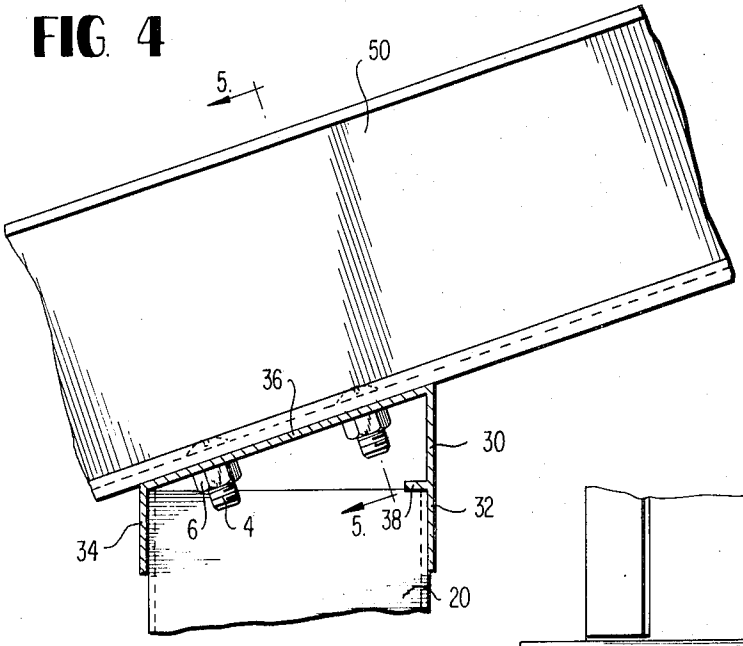


FIG. 3

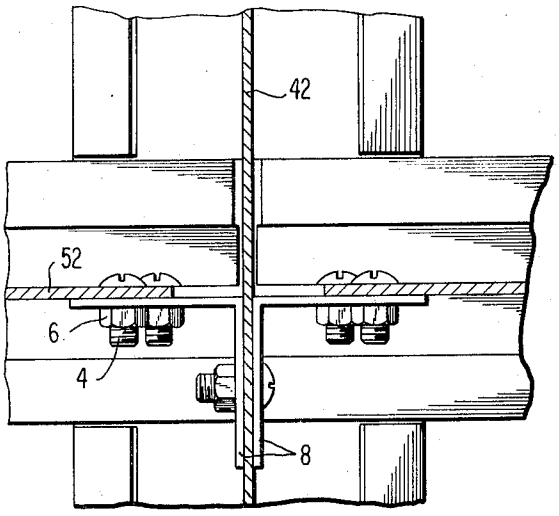
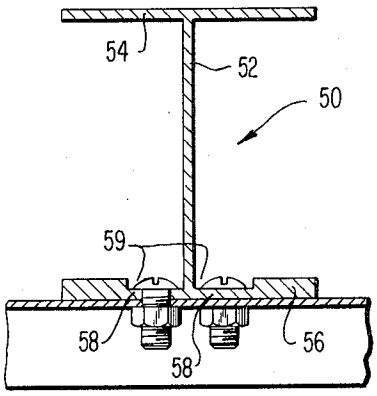


FIG. 5



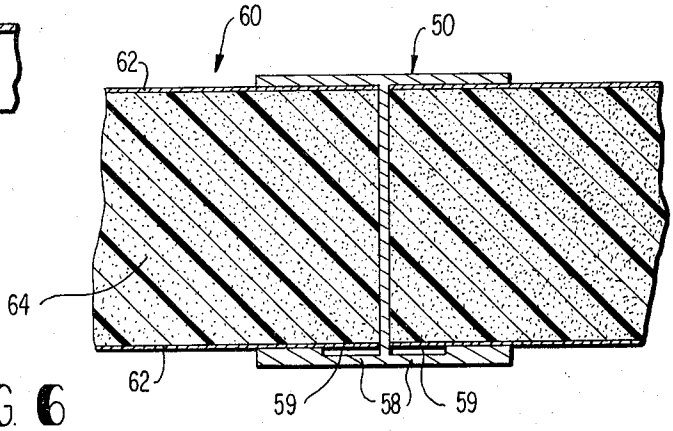


FIG. 6

ALUMINUM BUILDING

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an all aluminum building construction formed of extruded support members having specific cross-sectional configurations for permitting easy assembly by simple, specialized assembly steps, which allow the building to be completely constructed on the building site.

2. Description of the Prior Art

Conventional building structures of the prior art, generally, employ the use of wooden framing members for forming the base plates of walls, vertical wall supporting studs, rafters, and ridge beams. These conventional structures require a considerable amount of time and effort to construct, since the wooden framing members must be nailed together by hand after being manually cut to shape. One improvement in the conventional methods of building construction has been the use of precut lumber for fabricating the building.

More recently materials other than wood have been proposed for use as framing members in building construction. It has been proposed to construct building framing members from steel, plastic, and aluminum.

However, the framing members constructed from these materials have generally had a conventional rectangular or L-shaped cross-sectional configuration, making it difficult to construct a rigid building structure. Furthermore, the construction of a building with structural members formed of these materials has been very time consuming and costly, due to the particular manner in which the framing members must be joined to achieve structural integrity, and the particular types of connecting members which must be used.

More recently, the concept of prefabricated modular building construction has been developed. This concept incorporates the idea of prefabricating portions of the building, including complete walls, roofs, windows, door sections, etc. in a factory, transporting the prefabricated sections to the building site and assembling the sections in the manner required to construct the building. However, in the past, such prefabricated structures have had the drawbacks of poor structural integrity, as well as very high cost involved in the factory assembly of the prefabricated sections, the transporting of the large sections to the building site and the cost involved to assemble the prefabricated structures. Additional drawbacks to the prefabricated building concept of the prior art is the fact that customed designed buildings cannot be assembled at the building site, since the design and arrangement of each building is predetermined at the factory and is dependent solely upon the prefabricated sections available at the building site.

SUMMARY OF THE INVENTION

The present invention seeks to overcome the problems of the prior art building construction techniques by using structural framing members having unique cross-sectional configurations formed by an extrusion process at a site away from the building site. The unique cross-sectional configurations of the structural components enable the framing to be secured together in a particular manner to form a structurally sound building, while enabling the building to be custom built on the building site without being dependent upon particular preassembled structural components.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective cut-away view of a portion of a building structure employing the structural components of the present invention;

FIG. **2** is a cross-sectional view taken along lines **2—2** of FIG. **1** illustrating the manner in which the rafters are secured to the ridge beam of the building;

FIG. **3** is a cross-sectional view taken along line **3—3** of FIG. **2**, showing a top view of the connection of the rafters with the ridge beam;

FIG. **4** is a cross-sectional view taken along line **4—4** of FIG. **1** showing the manner in which the rafters are supported by and attached to the vertical wall studs;

FIG. **5** is a cross-sectional view taken along line **5—5** of FIG. **4**, showing drainage channels formed in the rafters; and

FIG. **6** is a view taken along line **6—6** of FIG. **1**, showing the manner in which the roof panels are inserted into the rafters and illustrates the position of the rafter drain channels relative to the roof panels.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. **1**, a building constructed according to the present invention and using the structural members thereof is constructed in a generally conventional manner at the building site. The building rests on U-shaped base channels **10** secured to the building foundation (not shown) and which form the load support member for vertical wall studs **20**. The wall studs **20** are capped by a top cap **30** which, in turn, support the rafters **50** extending outwardly from a ridge beam **40** of the building. The ridge beam **40** is supported by center wall studs **20**, which are topped with an inverted base channel member **10**, as shown in FIGS. **1** and **2**.

The unique cross-sectional configurations of the structural framing members according to the present invention will now be described with reference to FIGS. **1, 2, 4** and **5**. As shown in FIG. **1**, the base channel **10** is formed as a continuous aluminum extrusion having a generally U-shaped cross-sectional configuration. The base channel **10** includes a horizontal base plate or flange member **12**, with side flanges **14** attached to each longitudinal edge thereof and extending at right angles to the base plate **12**. The width of the base channel member **10** between the interior surfaces of the side flanges **14** is slightly larger than the width of the longest side of the vertical wall studs **20** to accommodate the end of the wall studs **20** therewithin, as shown in FIGS. **1** and **2**.

The vertical wall studs **20** are formed as a continuous extrusion from aluminum material and have a hollow rectangular cross-sectional configuration. The external dimensions of the extruded vertical studs **20** are essentially the same as the external dimensions of conventional 2 × 4 framing lumber used in conventional building construction.

Referring now to FIG. **4**, the top caps **30**, which are placed across the tops of the vertical wall studs **20** to support the rafters **50** are formed as a continuous aluminum extrusion having a long side wall or flange **32** and a short side wall or flange **34**. A connecting and support flange **36** is joined to one edge of each of the long and short side flanges **32** and **34**, respectively, and forms an angle therewith corresponding to the desired

angle of the building roof, such that the remaining edges of the side flanges **32** and **34** lie in the same horizontal plane upon assembly of the building. A protrusion or lip **38** is formed longitudinally along the interior surface of the long side flange **32** at right angles thereto, the height of the protrusion or ridge **38** being essentially the same as the interior height of the short flange **34**, such that a wall stud **20** will contact both the protrusion **38** and the surface of the angled flange **36** adjacent its point of connection with the short side flange **34**, as shown in FIG. **4**.

The ridge beam **40** of the present invention has a vertical central support flange **42**, as shown in FIG. **2**. Top side flanges **44** extend outwardly from the top edge of the vertical central support flange **42** and form an angle therewith corresponding to the desired angle of the roof. Bottom side projections or flanges **46** extend from the remaining lower longitudinal edge of the central support flange **42** in parallel relationship with the top side flanges **44**. The dimension between the interior surfaces of the upper and lower side flanges **44** and **46** is essentially the same as the exterior height of the rafters **50** to permit the insertion of the rafters **50** between the flanges **44** and **46** during construction of the building.

Each of the bottom side flanges **46** of the ridge beam **40** has a first L-shaped flange **48** formed along its outer edge and extending inwardly toward the vertical central support flange **42** in parallel relationship with the flanges **46**, as seen in FIG. **2**. Sections of the first L-shaped flanges **48** are notched and removed from the ridge beam **40** at those points along the ridge beam **40** where a rafter **50** is to be placed to allow the ends of the rafters **50** to be inserted between the flanges **44** and **46**, as shown in FIGS. **1** and **2**. The L-shaped flanges **48** act to locate the rafters **50** axially along the ridge beam **40** and prevent the rafters from sliding along the ridge beam **40** during assembly of the building.

The ridge beam extrusion **40** also includes downwardly and inwardly extending second L-shaped flanges **49**, shown in FIG. **2**, which serve to secure the ridge beam **40** to a base channel **10**, as will be described hereinafter.

The rafter extrusion shown in FIG. **5**, is also continuously extruded of aluminum material and includes a vertical central flange **52** having upper and lower transverse flanges **54** and **56** formed at its edges at right angles to central flange **52**. The lower transverse flanges **56** have an inner portion **58** of reduced thickness on each side of and adjacent to the vertical central flange **52** to form channels **59**. The channels **59** form drains channels between each of the roof panels **60** inserted into the channels formed by the flanges of the rafters **50**, as shown in FIG. **6**.

The roof and wall panels **60** are of a sandwich construction having thin aluminum sheet metal skins **62** attached to a polystyrene sheet **64** by any suitable means, such as an adhesive or the like. The aluminum sheet metal skins **62** are approximately 0.032 inches thick. The polystyrene core **64** may be formed by any suitable method, such as by foaming a styrene material in a known manner. The roof panels **60** are cut to fit tightly between two adjacent rafters **50**, as shown in FIG. **1**. As will be seen from FIG. **6**, the edges of the panels **60** abut the vertical central flange **52** of the rafter extrusion **50**, with the channels **59** formed by the reduced thickness portion **58** of the lower flange **56** assisting in the drainage of any water which might leak around the edges of the panels **60**.

The manner in which a building employing the structural members of the present invention is constructed will now be described with reference to the various FIGS. Following the construction of a suitable foundation (not shown) for the building, the base channels **10** are secured thereto by any suitable means, such as by bolting to the foundation. The base channels **10** are positioned with the open side facing upward so that the vertical wall studs **20** may be inserted therein. The top caps **30** are then cut to the desired length.

After the top caps **30** have been cut, the vertical wall studs **20** are set in place in the base channels **10**, and the top caps **30** placed thereon. The top caps **30** are then secured to the vertical wall studs **20** by any suitable means, such as riveting, sheet metal screws, bolting, or spot welding, with the studs **20**, in turn, being secured to the base channels **10** in a likewise manner. If desired, the top caps **30** can be secured to the vertical wall studs **20** prior to placing the studs **20** on the base channels **10**.

Following the raising of the exterior walls, the windows are framed with sections of base channel extrusions **10** cut to length, with all doors being framed with sections of vertical wall stud extrusion members **20**.

After all doors and windows have been framed, suitable aluminum thermal wall sheeting is used to sheet the entire interior and exterior of the framing system. Such aluminum thermal sheeting is formed in the same manner as the roof panels **60**, but has a smaller thickness dimension, on the order of 3/16th of an inch.

Following the sheeting of the framed building, the ridge beam member **40** is placed on a load supporting wall having an inverted base channel **10** placed over the top ends of the vertical wall studs **20**, as shown in FIGS. **1** and **2**, of the drawings. The ridge beam extrusion **40** is secured to the inverted base channel **10** by any suitable means, such as sheet metal screws **9**, as shown in FIG. **2**, with the inverted base channel **10**, in turn, being secured to the vertical studs **20** by similar means, such as sheet metal screws **9**. The inverted base channel **10** can be attached to the ridge beam **40** before being placed over the ends of the wall studs **20**, if desired.

Following the attachment of the ridge beam **40** to a load supporting wall, the rafters **50** are inserted between the upper and lower flanges **44** and **46** of the ridge beam **40** at predetermined points therealong, following the notching and removal of the L-shaped flanges **48** from the area of the lower flange **46** on which the rafter **50** will rest. The notching and removal of the flanges **48** of the ridge beam **40** can be done before or after the ridge beam **40** has been installed. The rafters **50** are secured to the ridge beam **40** by any suitable means. In the preferred embodiment, angle brackets **8** are used. One flange of the angle bracket **8** is bolted to the vertical flange **52** of the rafter **50** by suitable bolts and nuts **4** and **6**, and the remaining flange is attached to the vertical central support flange **42** of the ridge beam **40** by bolts **4** and nuts **6**.

The ends of the rafters **50** resting on the angled flange **36** of the top caps **30** are attached thereto by means of bolts **4** and nuts **6**, or any other suitable method, such as riveting, welding, or the like.

The sandwich roof panels **60** are then inserted into the channels formed between the flanges **54** and **56** of

the rafters **50** to complete the enclosing of the building. Special trim and gutters are then placed on gable ends in the roof fascia and windows of the awning type, which may be horizontal or single hung, are positioned in place. If desired, conventional aluminum clapboard siding can then be installed on the building exterior and wood grain paneling or any other desired panel configuration can be attached to the interior walls to complete the building.

As will be seen from the foregoing description, the structural features of the present invention enable a building to be quickly and easily assembled at the building site, while eliminating the high cost of production and transportation of prefabricated building sections. Furthermore, the structural features of the present invention permit a custom designed building to be fabricated without relying on special preconstructed panels, forms or sections.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. The combination of a building structure formed of a plurality of extruded members, comprising:

a U-shaped base channel adapted for attachment to a foundation;

a plurality of wall stud members having a generally rectangular hollow cross-section positioned vertically within said U-shaped base channel;

a three-sided elongated cap member positioned over the uppermost ends of said vertical wall stud members, said three-sided elongated member having two parallel sides and a third side joining said two parallel sides, one of said parallel sides having a width greater than the width of said opposite parallel side, the width of said parallel sides being determined to position said third side at a selected angle corresponding to the roof angle of said building;

a horizontal longitudinal ridge beam, said ridge beam including a vertical central support flange, top and bottom side flanges extending from each edge of said vertical central support flange on both sides of said central support flange, said top and bottom side flanges extending from the same side of said vertical central support flange being positioned parallel to each other and forming an angle with said vertical central support flange corresponding to the selected angle of the roof of said building, the bottom outwardly extending side flanges of said ridge beam having first L-shaped flanges formed along their outer edges and extenting upward and inward toward said central support flange to form a U-shaped channel along the outer edges of said bottom side flanges, and second L-shaped flanges formed on the bottom surfaces of said bottom side flanges in the longitudinal direction, said second L-shaped flanges having one flange lying in planes parallel to the plane of said vertical central support flange and the other flange formed at right angles to said first flange extending inwardly, the distance between the outer vertical surfaces of said L-shaped flanges corresponding to the width of said U-shaped base channel;

said longitudinal ridge beam being secured to the flat surface of a further U-shaped base channel, said further U-shaped base channel, in turn, being positioned on the top end surfaces of a plurality of upstanding vertical wall stud members to form a vertical support for the ridge beam of a building being constructed;

and rafter members for supporting the roof of said building being positioned between said ridge beam and said cap members forming the top edge of an exterior wall, said rafter members being of an I-beam cross-sectional configuration, the height of said rafter members being equal to the perpendicular dimension between the two parallel edges extending from one side of said ridge beam, said U-shaped channel of said ridge beam being notched to accommodate the end of said rafters positioned adjacent said ridge beam, said rafters being rigidly attached to said ridge beam and to said cap to form a stable building structure.

2. A building structure formed of extruded members as claimed in claim **1** further comprising, a plurality of planar sheets positioned between each of said rafters to form the roof of said building, the opposite longitudinal edges of each of said sheets lying in channels formed between the flanges extending on each side of said rafters, each of said panels being secured to said rafters to form a rigid roof structure.

3. A building construction as claimed in claim **2**, wherein said sheets forming the roof of said building comprise a sheet aluminum skin laminated to each side of a panel core formed of expanded polystyrene, and including adhesive for permanently attaching each of said aluminum skins to the surfaces of said expanded polystyrene cores.

4. A building structure as set forth in claim **1**, wherein each of the bottom flanges of said rafter has a reduced thickness portion along the length thereof adjacent the upstanding section of said rafter, said reduced thickness sections forming drainage channels in said rafters to prevent the leakage of water into the interior of said building.

5. A building structure as set forth in claim **1**, wherein said means to secure said structural members to each other includes L-shaped angle brackets having one flange bolted to the upstanding vertical portion of said rafter and the second flange secured to the vertically upstanding portion of said ridge beam.

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