Feb. 2, 1971 D. A. LOWE 3,559,357

MODULAR BUILDING SYSTEM

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Fig. 1A

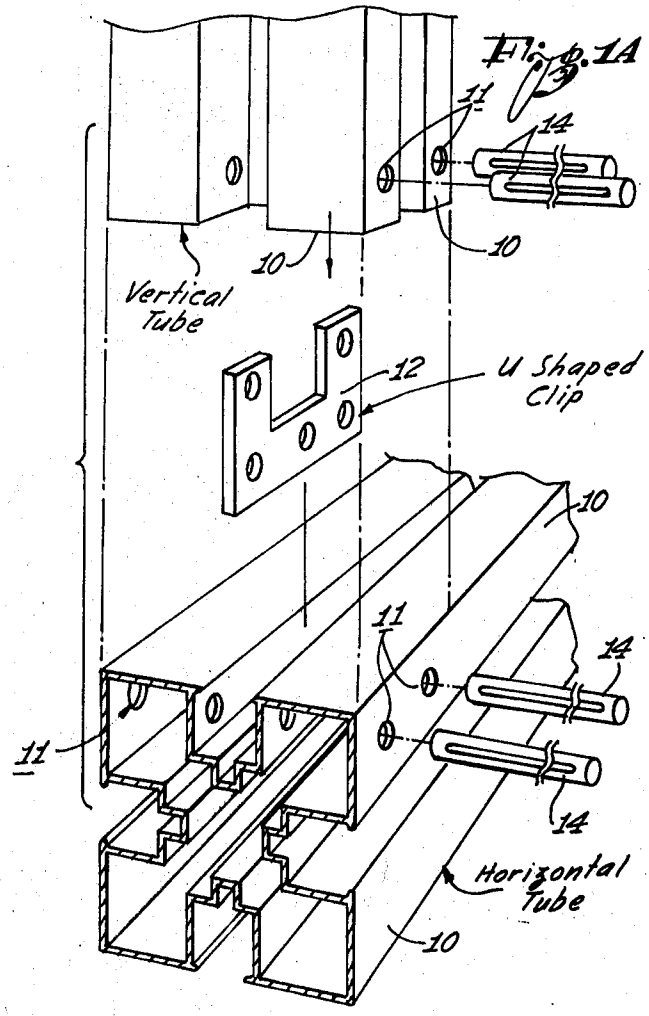


Fig. 1B

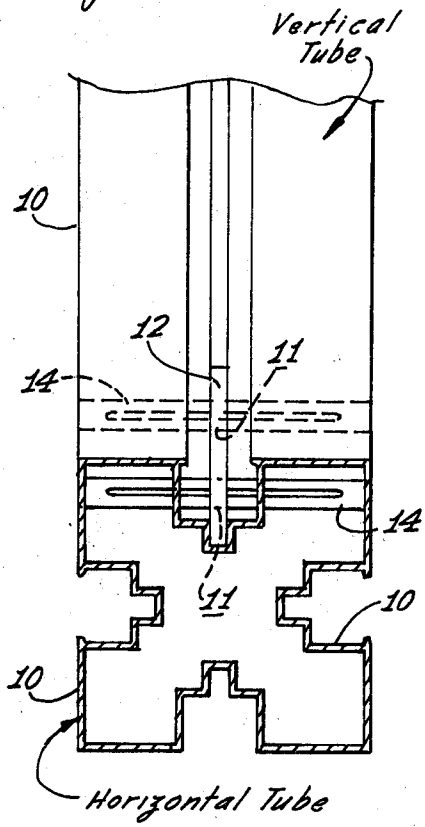
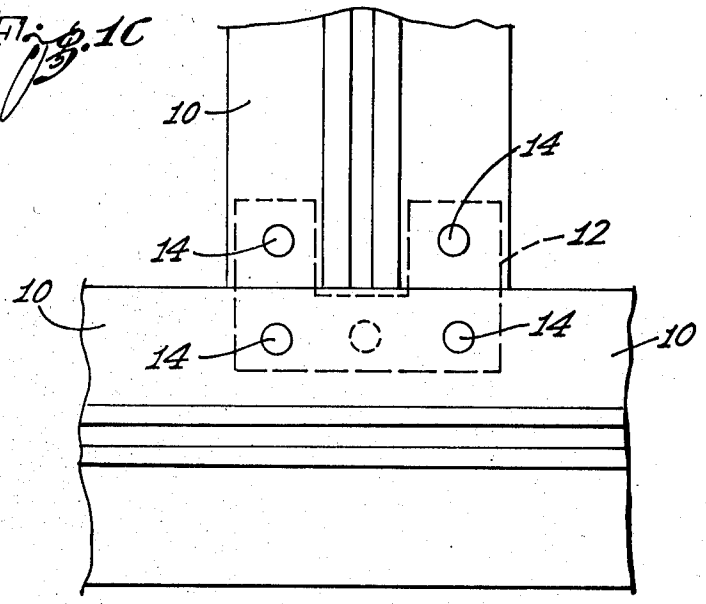


Fig. 1C



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Feb. 2, 1971 D. A. LOWE 3,559,357

MODULAR BUILDING SYSTEM

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Fig. 2A

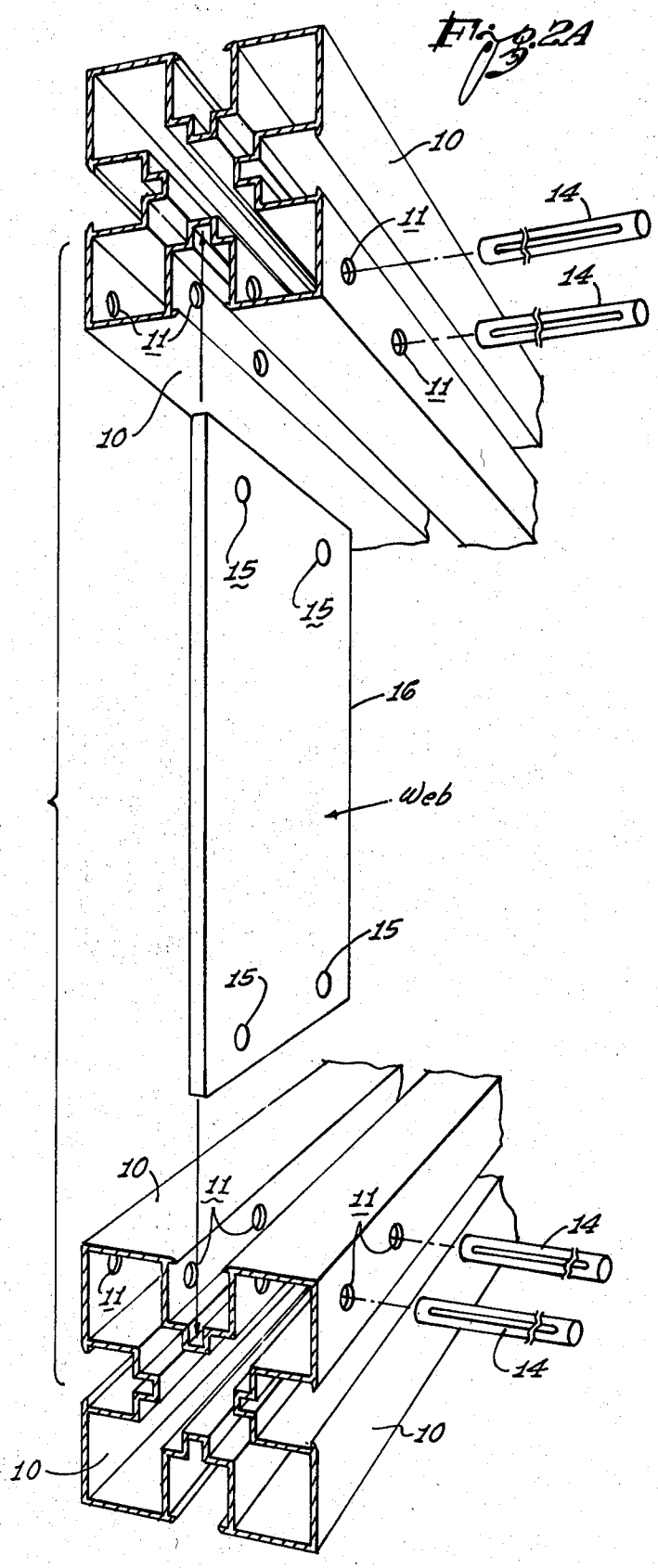

Fig. 2B

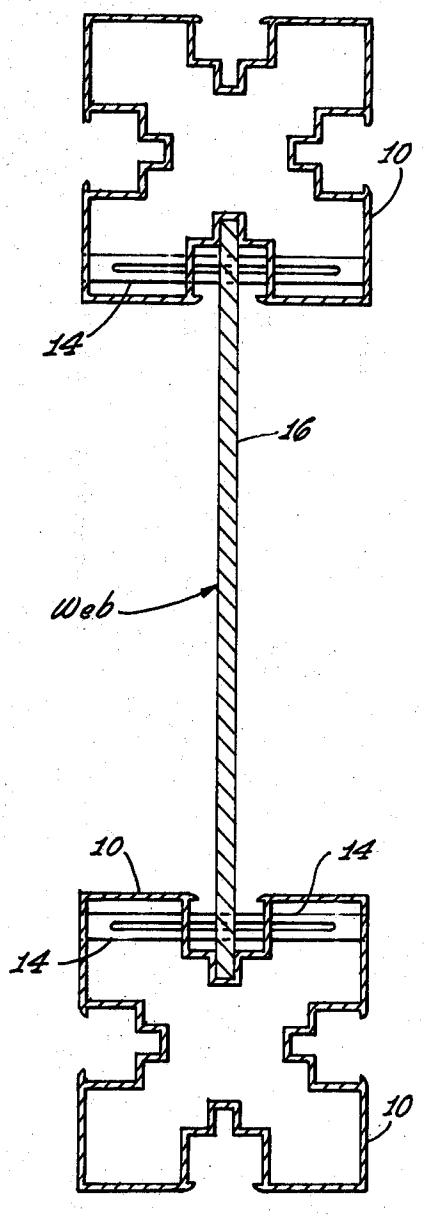

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Fig. 3A

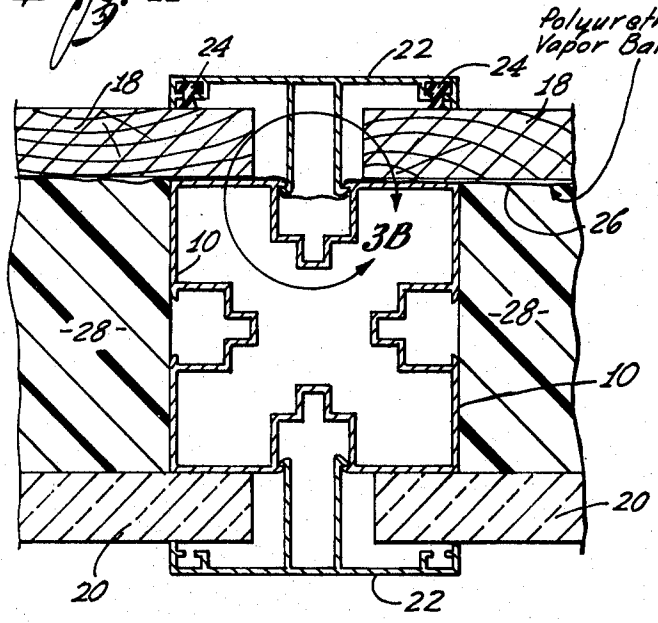


Fig. 3B

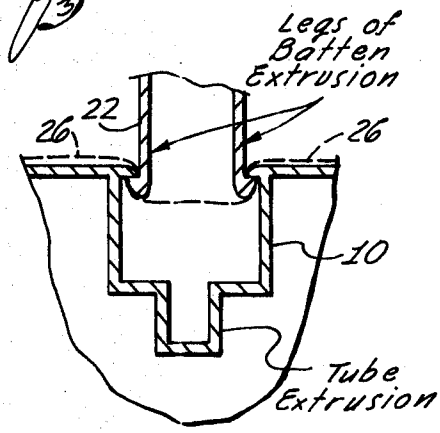
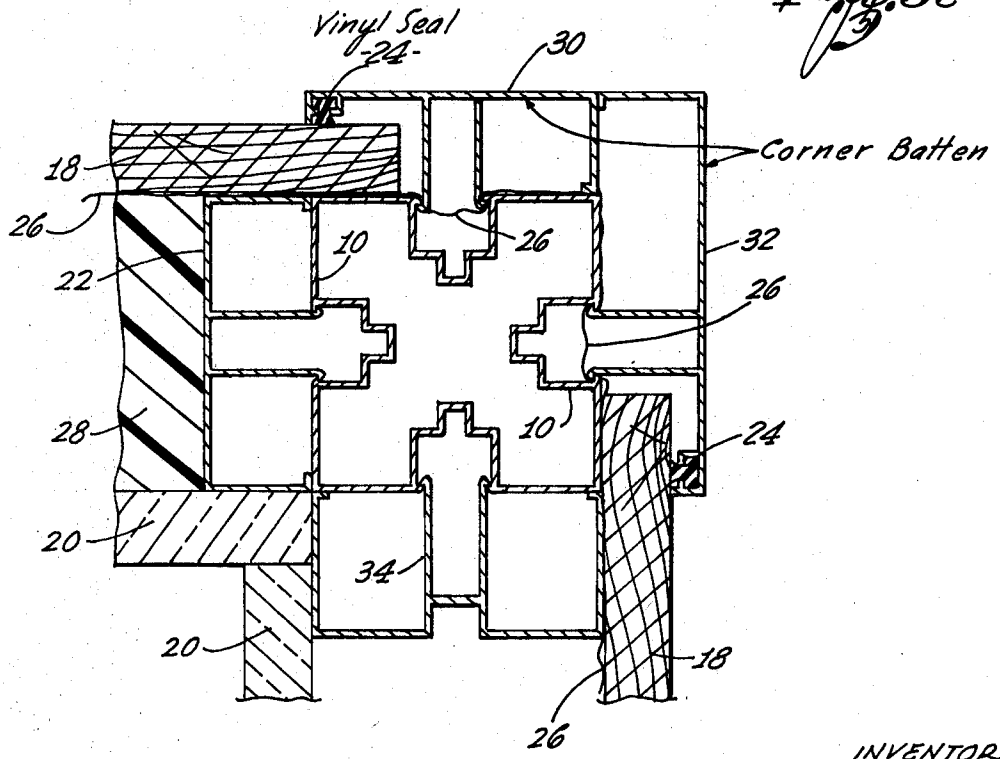


Fig. 3C



INVENTOR:
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MODULAR BUILDING SYSTEM

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Fig. 4

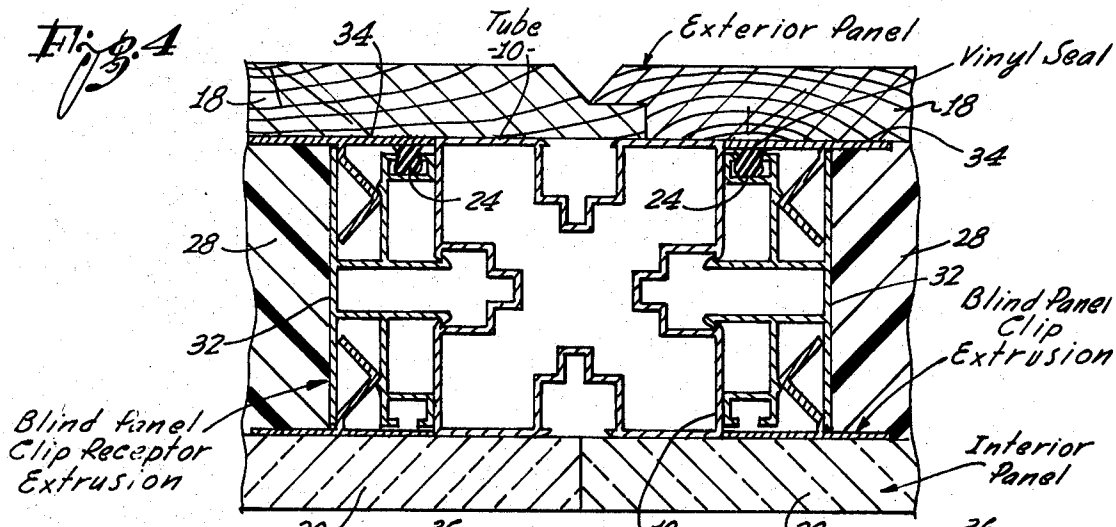


Fig. 5A

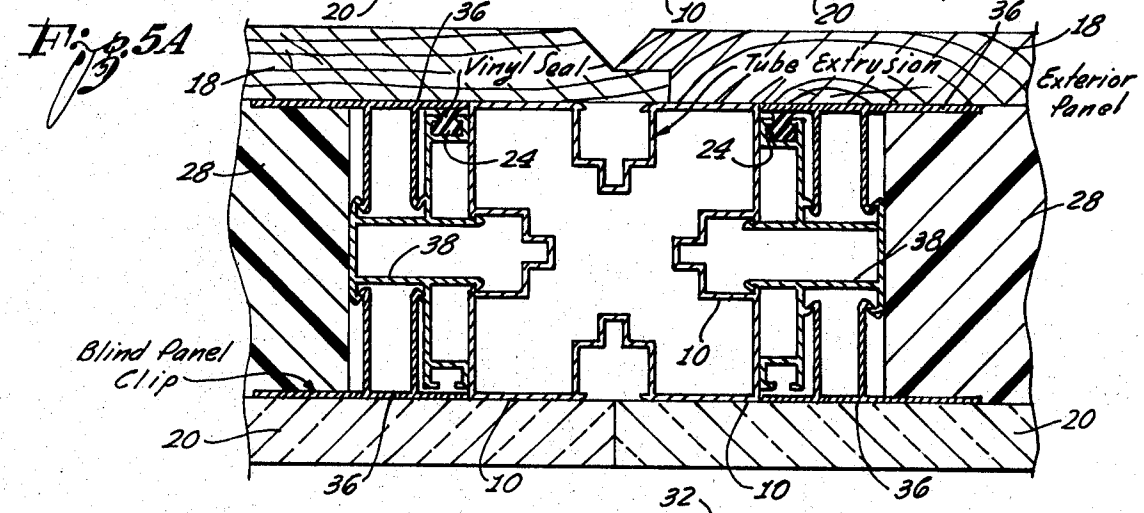
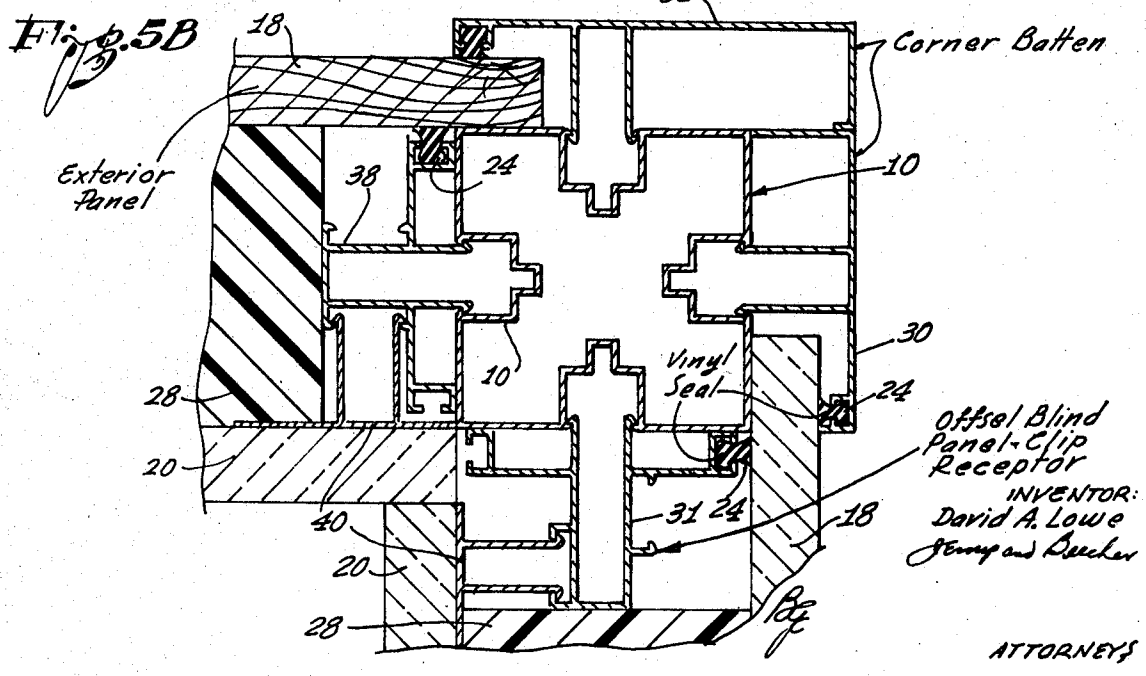


Fig. 5B



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MODULAR BUILDING SYSTEM

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Fig. 6A

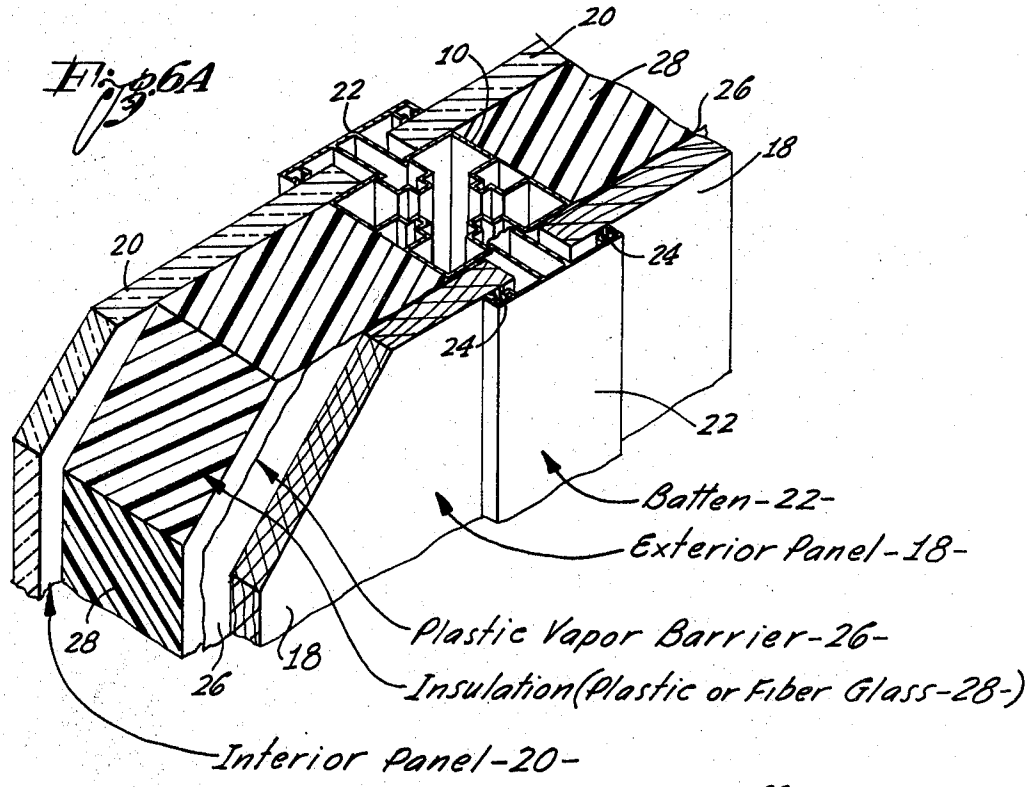
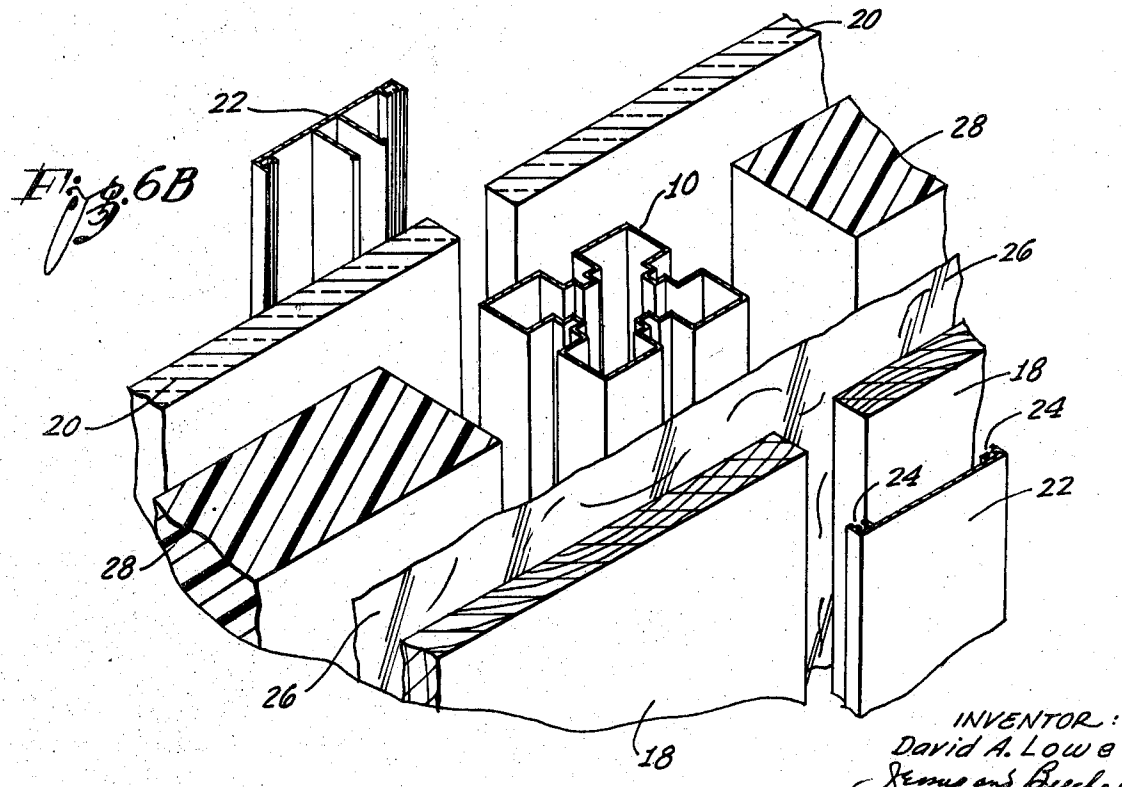


Fig. 6B



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By

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Feb. 2, 1971 D. A. LOWE 3,559,357

MODULAR BUILDING SYSTEM

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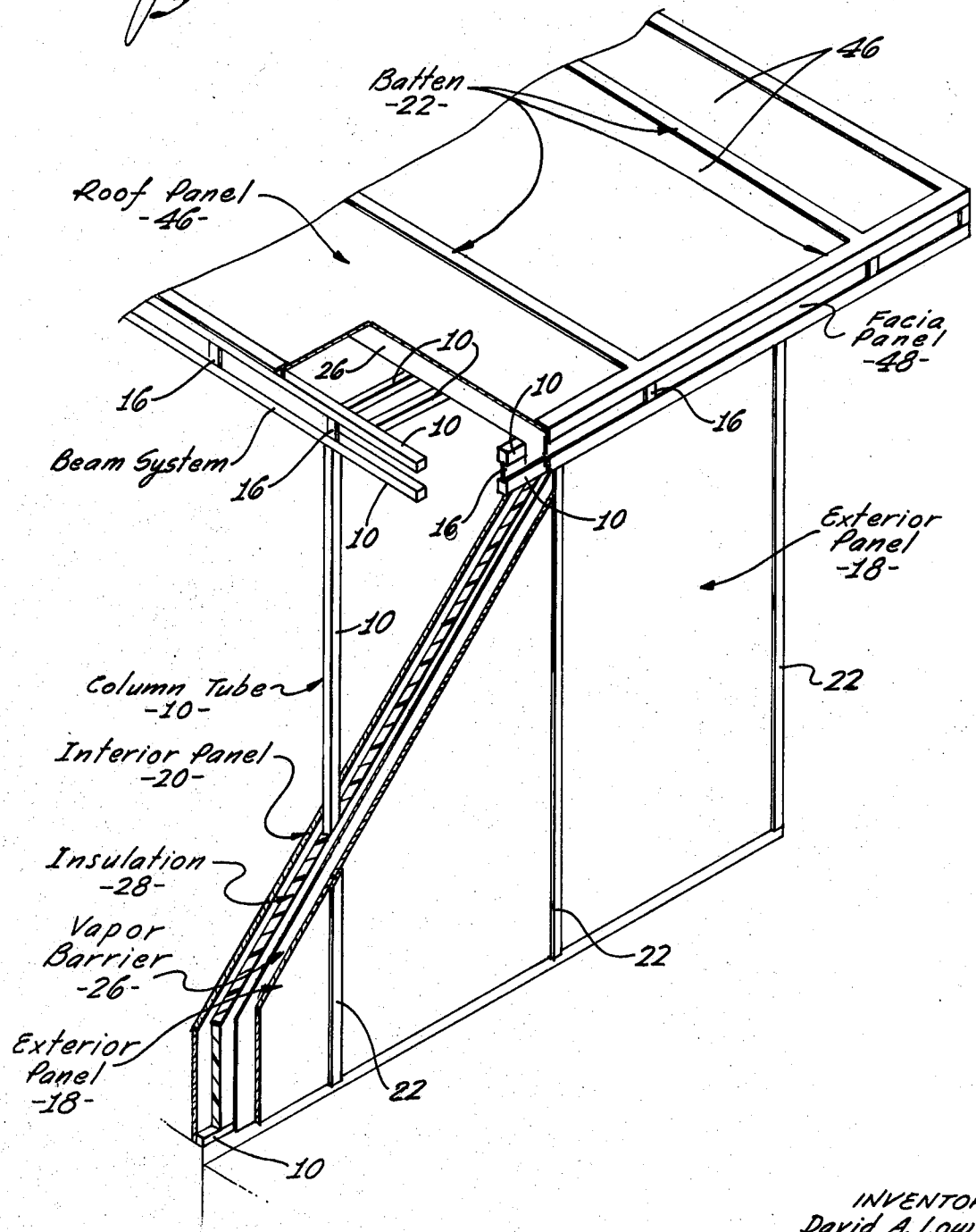
Fig. 7



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Feb. 2, 1971 D. A. LOWE 3,559,357

MODULAR BUILDING SYSTEM

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Fig. 8A

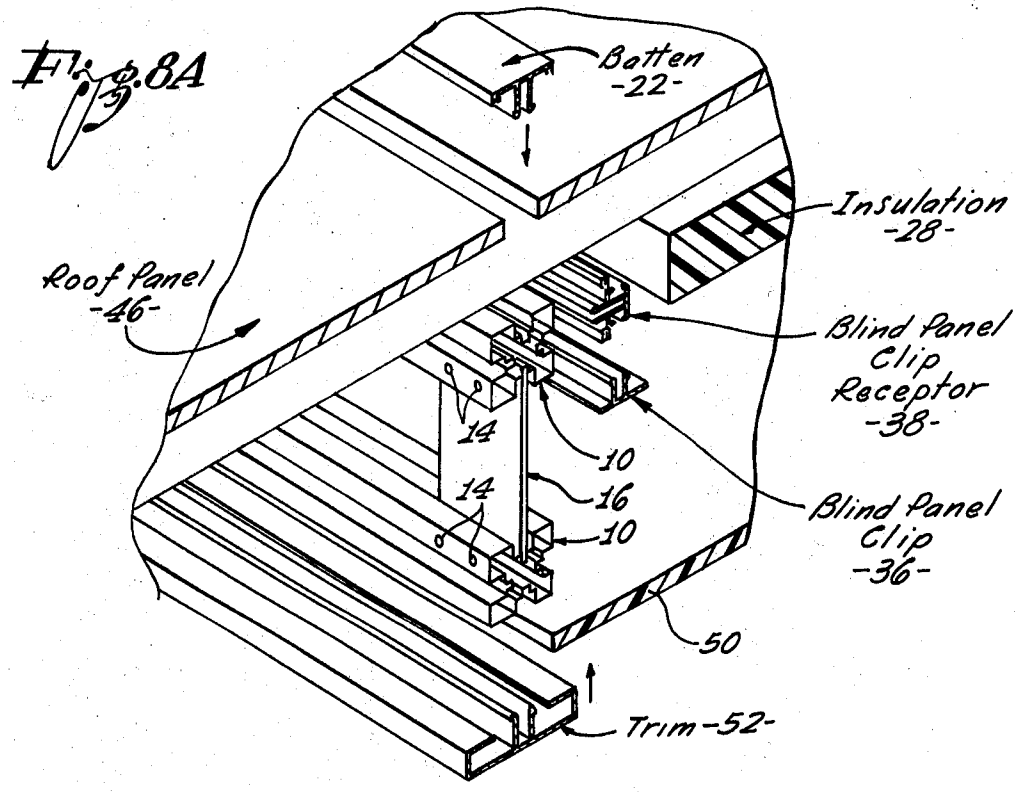
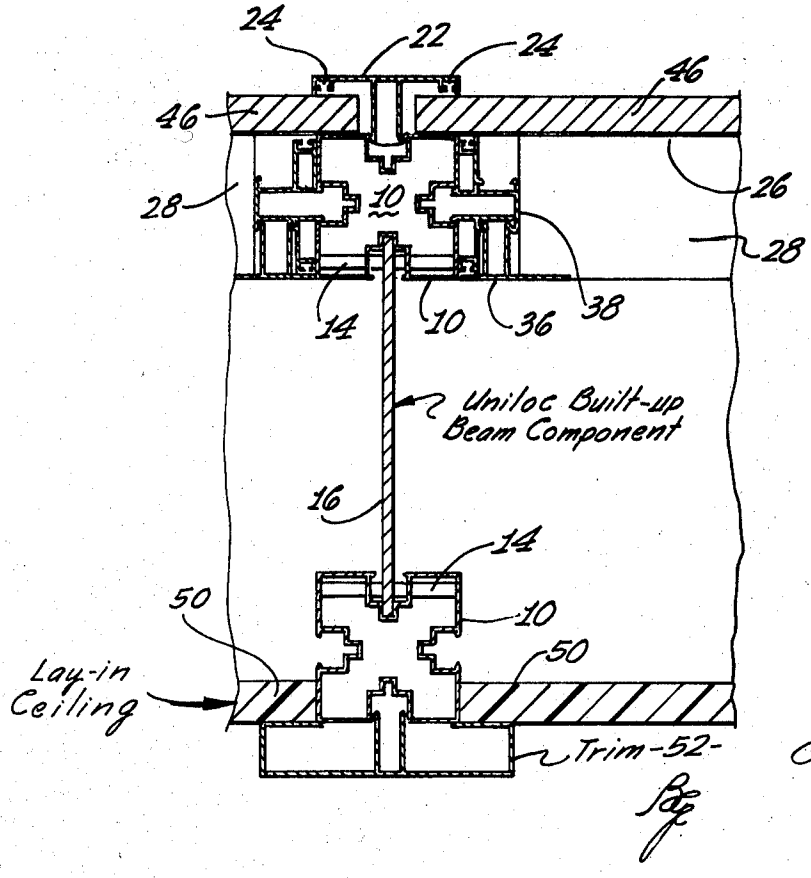


Fig. 8B



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United States Patent Office

3,559,357

Patented Feb. 2, 1971

3,559,357

MODULAR BUILDING SYSTEM

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Int. Cl. E04b 1/08, 1/48
U.S. Cl. 52—282 5 Claims

ABSTRACT OF THE DISCLOSURE

A modular building system is provided which includes extruded structural framing formed of metal or plastic, in which the individual tubular members have a rectangular multilateral configuration, and may be quickly and conveniently interconnected with one another and with other structural elements in a snap engagement or by structural pins. The resulting structure is a low cost modular building system, accommodating individual parts as removable, relocatable, replaceable, and additive, as required, for technological mass production, and easy transportation and assembly.

BACKGROUND OF THE INVENTION

Modular building systems in general are known to the art. However, most of the prior art building systems of the modular type have been strictly utilitarian and functional in appearance, and thus have been unacceptable for residential and other purposes where aesthetic values are important. In addition, the prior art building systems have for the most part been difficult to assemble, and have presented serious maintenance problems. However, the ever-increasing material and labor costs involved in the present day building construction, renders it imperative that a low cost modular building system be devised which are acceptable and suitable for residential purposes. The improved building system of the present invention has been provided to answer such criteria.

The modular building system of the invention, as mentioned above, is susceptible to mass production and is, therefore, economical to manufacture. The system is also easy to assemble on the site, requiring no special tools, so that labor costs are held to a minimum. Moreover, the building system of the invention is strong and durable when assembled, and yet may be easily demounted, modified, or added to. A feature of the building system of the invention is the utilization of a minimum of different types of basic components.

Briefly stated, the improved modular building system of the invention is low cost, may be mass produced, and is ligth and durable. Only three basic tools are required to assemble a structure in a practice of the invention, and these are a ball peen hammer, a screw driver and a rubber mallet.

The framing tubular members of the structure of the invention may be precut; and the trim, door frames, window frames, and the like, may be snapped into place in a matter of seconds. When assembled, the resulting building is not subject to termites, dry rot, mildew, rust or any other deleterious influences to which usual building structures are exposed. Moreover, and as will be described, a plastic film, such as polyurethane, may be incorporated into the panels of the structure of the invention, and held firmly in place, to form a moisture barrier, on either side of the wall of the structure or on both sides.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a perspective exploded representation of extruded tubular members configured in accordance with the concept of the invention, and illustrating the manner in which the tubular members may be connected together;

FIG. 1B is an elevation section of the tubular system FIG. 1A, as taken from the left-hand end of FIG. 1A, for example;

FIG. 1C is an elevation of the tubular system of FIG. 1A, and taken, for example, from the right-hand side in FIG. 1A;

FIG. 2A is a perspective exploded representation of the manner in which the extruded tubular members of FIG. 1A, for example, may be formed into a beam system;

FIG. 2B is a cross section through the beam system of FIG. 2A taken, for example, from the right-hand end of FIG. 2A;

FIG. 3A illustrates the manner in which the tubular members of the invention may be used as columns, and also shows external and internal battens which cover the joints between the exterior panels and the interior panels in accordance with one embodiment of the invention. FIG. 3A being a section of a portion of the wall of a particular structure;

FIG. 3B is a detail, within a circle designated 3B in FIG. 3A, and showing on a somewhat enlarged scale the manner in which a vapor barrier plastic film is locked between the exterior panel and usual insulating members;

FIG. 3C is a view like FIG. 3A, but showing the tubular members used in conjunction with corner battens at one corner of the building structure;

FIG. 4 illustrates the manner in which the tubular framing members may be used in conjunction with a blind panel clip system;

FIG. 5A is a view like FIG. 3A, but showing the tubular member used as a column in a blind panel clip system;

FIG. 5B is a view like FIG. 3C, and showing the tubular member used as a column for a corner detail in a blind panel clip system;

FIG. 6A is a section through a wall of the structure, and illustrating the manner in which the tubular member may be used as a column within the structure;

FIG. 6B is a view like FIG. 6A, but showing the various components on an exploded basis;

FIG. 7 is a perspective representation, partly in section, and showing the actual details of a house constructed in accordance with the concepts of the invention;

FIG. 8A is a perspective exploded view showing the roof and ceiling of the house of FIG. 7; and

FIG. 8B is a cross-sectional detail of the roof and ceiling assembly of FIG. 8A.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

As shown by the representations of FIGS. 1A and 1B, for example, the framing system of the invention may be made up of a plurality of multilateral tubular members **10** having the illustrated configuration. Each tubular member includes a front longitudinal groove or channel extending along each face, and a smaller groove or channel in the floor of the first channel. The tubular members **10** may be formed of extruded aluminum, or plastic, or other suitable material.

The horizontal tubular member **10**, for example, may be supported on a floor either as shown, or by means of an additional strip, as will be described, to extend horizontally, as shown. The upright tubular member **10** may extend vertically, and may serve as a column for the structure.

The tubular members **10** have holes **11** formed in them which are aligned with one another, and with corresponding holes **13** in a U-shaped clip **12**, when the clip is inserted in place in the smaller channel of the horizontal tubular member **10**. The U-shaped clip **12** is held in place on the horizontal tubular member **10** by means, for example, of structural pins designated **14**.

The structural pins **14** are grooved or slotted as shown, and are tapered, so that when the pins are driven into the holes **11** and **13**, they are firmly retained in place, and there is no tendency for the pins to come loose. However, if so desired, the pins **14** can be driven out of the members, in order to dismantle the structure. With the U-shaped clip **12** and the pins **14** in place, it will be appreciated that the upright column formed by the upright tubular member **10** is firmly and rigidly supported on the horizontal tubular member **10**, as shown in FIGS. 1B and 1C.

The beam system for the structure, as shown in FIGS. 2A and 2B, may be formed of a pair of parallel tubular members **10** separated by a flange or web **16**. The flange **16** may be formed of aluminum or other appropriate material. The flange **16** has holes **15** in it which receives the structural pins **14** so that the beams are held in a rigid unitary system. As shown in FIG. 2B, for example, the beams are composed of a lower horizontal tubular member **10** and an upper horizontal tubular member **10**, separated by the vertical web or flange **16**, with the assembly being held in a rigid assembled condition by the structural pins **14**. The dimensions of the web **16** are selected to meet different span requirements of the resulting beam.

In FIG. 3A, for example, the tubular member **10** is used as a column at an intermediate position in the wall of a particular structure. The exterior panels of the structure are designated **18**, and they extend partially across one face of the upright tubular member **10**. The interior panels are designated **20**, and they extend partially across the opposite face of te upright column formed by the tubular member **10**.

A pair of battens **22** which, likewise, may be formed of extruded aluminum, or other appropriate material, are snapped into the corresponding grooves in the upright tubular member **10**, as shown. The battens **22** and the edges of the larger grooves in the tubular member **10** are formed with a hook-like configuration, as shown, so that the battens may be received with a snap action into the respective grooves.

A vinyl seal **24** may be provided between the external batten **22** and the exterior panels **18**. In addition, a film **26** formed of polyurethane, or other suitable plastic material, may be interposed between the exterior panels **18** and the column formed by the tubular member **10**, as a continuous water or vapor barrier, the film being locked between the batten **22** and the member **10**, as best shown in FIG. 3B, as a continuous barrier, and without any fracture of the film itself. When serving as a vapor barrier the film is preferably placed on the warm side of the wall to prevent condensation on the film. However, the film may also be used on the weather side of the wall as a water barrier.

Appropriate insulating blocks **28** of plastic or fiberglass, for example, may be interposed between the exterior panels **18** and the interior panels **20**, along the length of the walls, and between successive columns formed by the tubular members **10**. The exterior panels **18** may be formed of any available and appropriate building material, as may be the interior wall panels **20**.

As mentioned above, the tubular member **10** is shown in FIG. 3C as a corner column, and corner battens **30** and **32** having the illustrated configuration are snapped into place into the grooves in the tubular member, so as to complete the corner of the building. The corner battens **30** and **32** may also be extruded aluminum, or other appropriate material. A batten **22** may be snapped into the left hand side of the tubular member **10** in FIG. 3B. Likewise, a batten **34** of the same or different configuration, as shown, may be interposed between the insulation block **28** and the lower side of the tubular member **10** in FIG. 3C. The battens **22** and **34** serve as supports for the wall panels **20** which may be attached to the battens, by means, for example, of screws **25**.

It will be observed in FIG. 3C that the plastic film **26** continues unbroken around the corner of the building so as to provide a continuous moisture seal. As mentioned above, the film may be on the inside of the wall, if so desired.

A slightly different type of system is shown in FIG. 4, in which the cover battens are not used, and a blind panel clip system is utilized instead. The exterior panels **18** in FIG. 4 are shaped differently from FIG. 3A, for example, so as to interlock with one another across the face of the corresponding tubular member **10**. Likewise, the interior panels **20** abut onto one another across the opposite face of the column formed by the upright tubular member **10**.

A first blind panel clip receptor extrusion **32** is snapped into the left hand side of the tubular member **10** between the tubular member and the corresponding insulation block **28**, and a similar blind panel clip receptor extrusion **32** is snapped into the right hand side of the tubular member **10**. These latter extrusions may likewise be formed of aluminum, or other appropriate metal or plastic. A second blind panel clip extrusion **34** is interposed between the exterior panel **18** and the remaining components, on each corner of the column assembly, as shown. The latter extrusion may also be formed of aluminum, or other appropriate material. The blind panel clips **34** are attached to the exterior and interior panels, by means of suitable adhesive, screws, or other suitable fasteners or combination of fasteners.

The representation of FIG. 5A is also a blind panel clip system, similar to the system shown in FIG. 4. However, the system of FIG. 5A uses slightly different blind panel clip extrusions designated **36** which are adhesively or otherwise, attached to the exterior and interior panels, and which clip into sockets formed by further blind panel extruded clip receptors **38** which, in turn, fit into the grooves in the side of the columns formed by the tubular members **10**.

FIG. 5B shows a corner detail of a similar blind panel clip system to that shown in FIG. 5A. The latter assembly includes a corner batten **40** in conjunction with a corner batten **30** which is snapped into the top and right hand side of the tubular member **10**. A blind panel clip receptor extrusion **38** is used between the insulation block **28** and the left hand side of the tubular member **10**, and a further extrusion **40** is received in the extrusion **38** to form a clip for the inner panel **20**. A similar extrusion **40** is used in conjunction with another clip **38** in the lower side of the tubular member **10**, as shown in FIG. 5B.

FIG. 6A is a view like FIG. 3A, but showing with greater clarity, the composition of a typical wall utilizing the concepts of the invention; and FIG. 6B is a view, as mentioned, similar to FIG. 6A, but with the components shown with an exploded representation. FIG. 7, as mentioned above, shows a further detail of a house utilizing the concepts of the invention, and particularly showing the manner in which the roof may be attached to the side walls of the structure.

In FIG. 7, the vertical tubular members **10** form the columns in the framing, and the upper horizontal tubular members **10** are intercoupled, in the manner described in conjunction with FIGS. 2A and 2B, to form beams. The battens **22** may be used between the roof panels **46**, for example, as shown in FIG. 7. The plastic film vapor barrier **26** may also extend across the under side of the roof panels, as shown. Exterior, exposed, extruded plastic or metal corner battens **30**, **32** may be used at wall corners to fasten the wall panels **18** and **20**, as required. Exterior, exposed, extruded plastic or metal snap-in trim members of proper configuration are used at wall corners, door and window heads, jambs, mullions and sills, as well as soffits and facia panels **48**.

The roof and ceiling construction of the structure is shown in greater detail in FIGS. 8A and 8B. The roof

system, as shown in FIG. 7 and FIGS. 8A and 8B, is developed by the use of the roof panels **46** of any known and suitable type of roof panel material, these being supported by beams formed by the tubular members **10** and intermediate webs **16**. The roof panels are fastened to the upper tubular elements **10** by means of battens **22**, and by the use of the vinyl seals **24**. As mentioned above, the water vapor barrier formed by the plastic film **26** is also used on the roof structure as shown. Plastic or fiberglass insulation blocks **28**, for example, are supported under the roof panels **46**, by means of blind panel clips **36** which, in turn, are supported by the clips **38**, as also shown. The ceiling system **50** is supported adjacent the lower tubular member **10** by means, for example, of appropriate extruded trim clip members **52**, or by any other means.

The invention provides, therefore, a four-sided uniform structural tubular ssytem in the form of the tubular members **10**, which may be utilized as columns or beams, or space frame members, with snap-in attachment characteristics for utilization in an unlimited number of architectural design and product material systems.

The various tubular members in the framing system are intercoupled with one another, and with the webs **16** in the beam structures, by means of pins **14** which are grooved and tapered, as described above. This means that the entire framing structure is constructed either by snapping component parts into the grooves in the tubular members **10**, or by the use of the tapered pins **14**. The tubular members **10** in conjunction with the web or flange member **16** provide for beam systems allowing for various structural loading and snap designs. The exterior wall panel system may be provided with snap-in trim attachment elements to provide a means for fastening the wall panel systems together, as well as for providing a continuous exterior plastic film water seal as described above.

The product items accommodated by the four-sided uniform structural tubular system **10**, allowing for a complete modular snap-together system, include the following: mouldings, mullions, jambs, heads, ceiling systems, soffit systems, insulation, wall panels, floor panels, ceiling panels, roof panels, roof systems, heating, ventilating and air conditioning systems and components, electrical conduit, wiring, panels, switches, receptacles, windows, doors, closets, wardrobes, cabinet systems, partitions fixed and movable), stairs, railings, built-in furniture systems, plumbing systems, structural, floor, wall and roof systems, weatherproof roof and wall panel ceiling systems, sound isolation wall panel systems, incombustible and fire rated wall systems, continuous watertight, vapor barrier systems.

The invention provides, therefore, a low cost modular building system accommodating all individual parts as removable, relocatable, replaceable, and additive, as required for modern technological mass production, transportation and assembly.

What is claimed is:

1. A building structure including:

a plurality of elongated tubular members, each of said tubular members having a generally rectangular configuration, and each having a longitudinal first channel formed in each face thereof and a longitudinal smaller second channel in the floor of each of said first channels, and each face thereof having holes extending therethrough and through the walls of said first channel, a first group of said tubular members extending horizontally as beams and supports, and a second group extending vertically as columns;

a plurality of U-shaped clips between said tubular members and of said first plurality and corresponding ones of said tubular members of said second plurality, and having holes therein;

and pins extending through said holes in said tubular members and in said U-shaped clips to hold said clips and tubular members in an assembled condition with said clips extending into said smaller second channels in said tubular members.

2. The combination defined in claim **1** in which said pins are slotted and tapered to provide a positive fastener for said tubular members and said U-shaped clips.

3. The combination defined in claim **1** in which a pair of said tubular members extend horizontally and parallel to one another and spaced one over the other, and which includes a plurality of web members extending into the smaller second channels in said horizontal tubular members and separating said tubular members from one another to form a beam system.

4. The combination defined in claim **3** in which said web members have holes therein, and which includes further ones of said pins extending through said holes in said web members and in said last-named tubular members to hold said tubular members and said web members in an assembled condition.

5. The combination defined in claim **1** in which said pins are slotted and tapered to provide a positive fastener for said tubular members and said U-shaped clips.

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U.S. Cl. X.R.

52—236, 656, 730; 287—189.36