Oct. 14, 1958 W. O. BENNING 2,855,635

FACTORY ASSEMBLED HOUSING AND INSTALLATION THEREOF

Filed Feb. 29, 1956 3 Sheets-Sheet 1

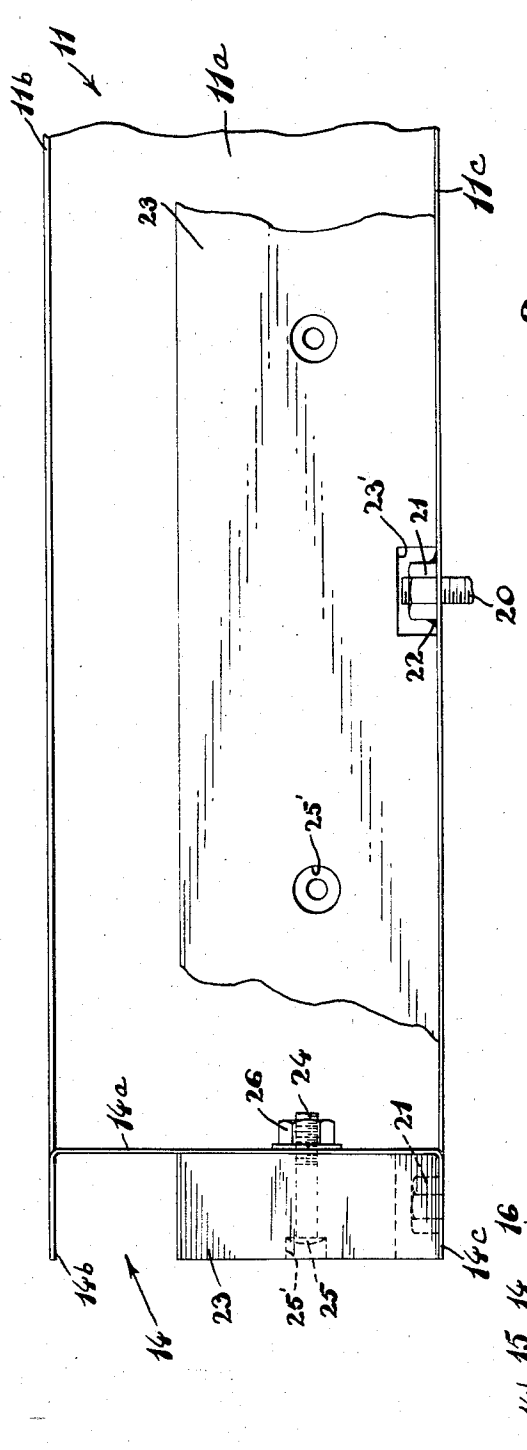

Fig. 2.

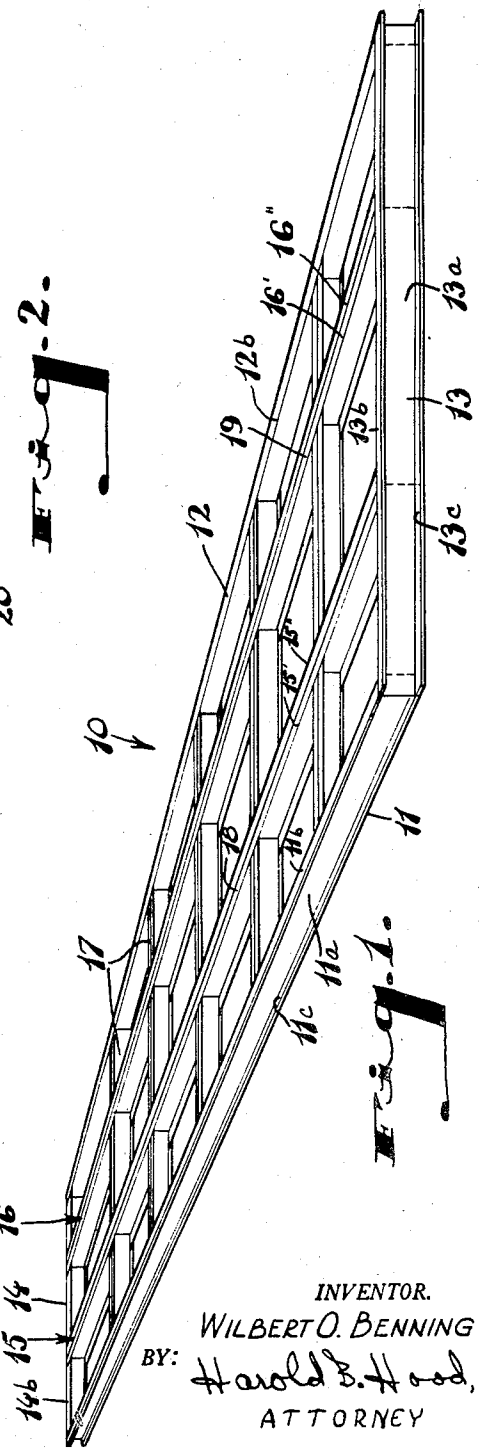

Fig. 1.

INVENTOR.
WILBERT O. BENNING
BY: Harold B. Hood,
ATTORNEY

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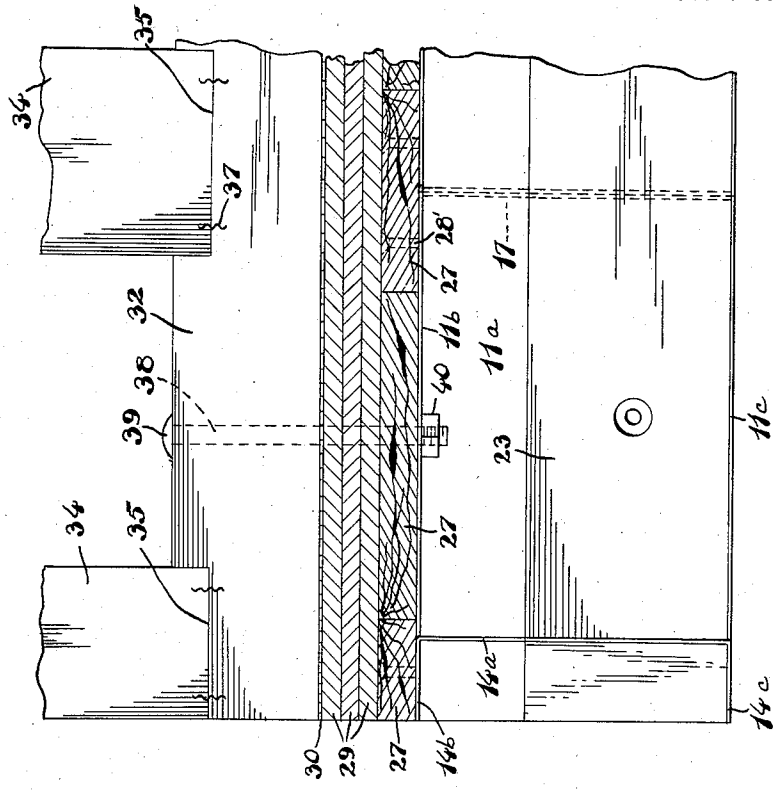

Fig. 3.

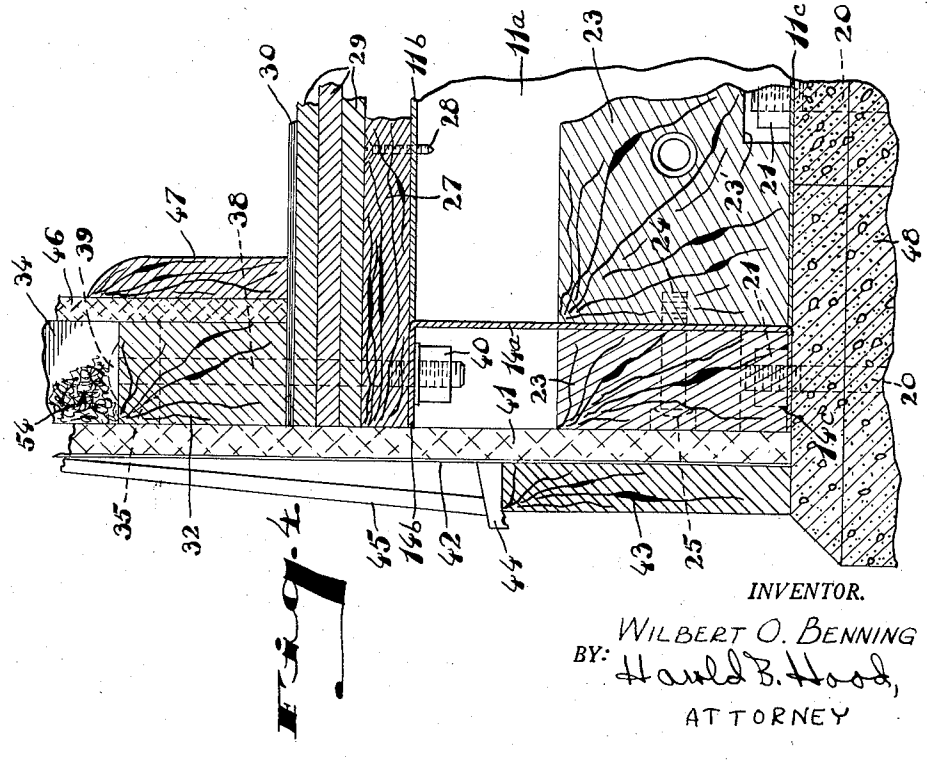

Fig. 4.

INVENTOR.
WILBERT O. BENNING
BY: Harold B. Hood,
ATTORNEY

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FACTORY ASSEMBLED HOUSING AND INSTALLATION THEREOF

Filed Feb. 29, 1956 3 Sheets-Sheet 3

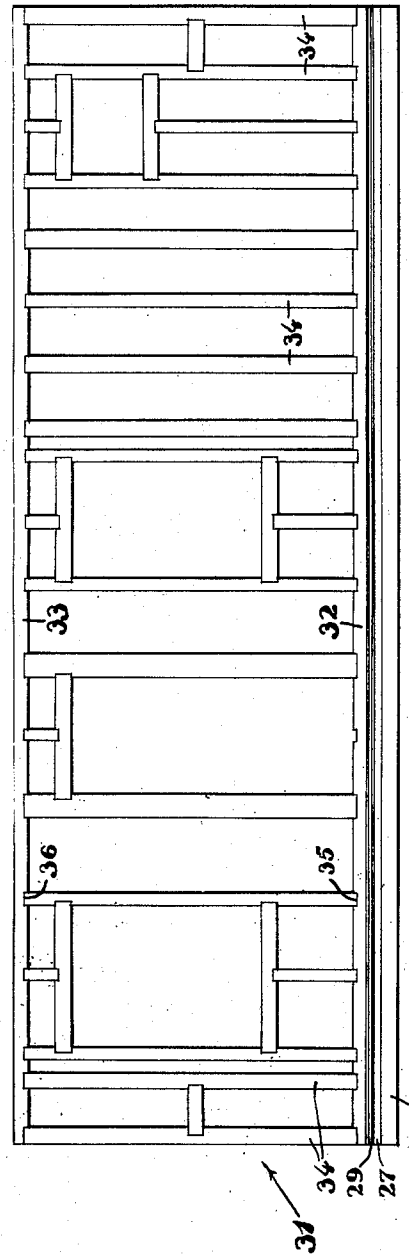

Fig. 5.

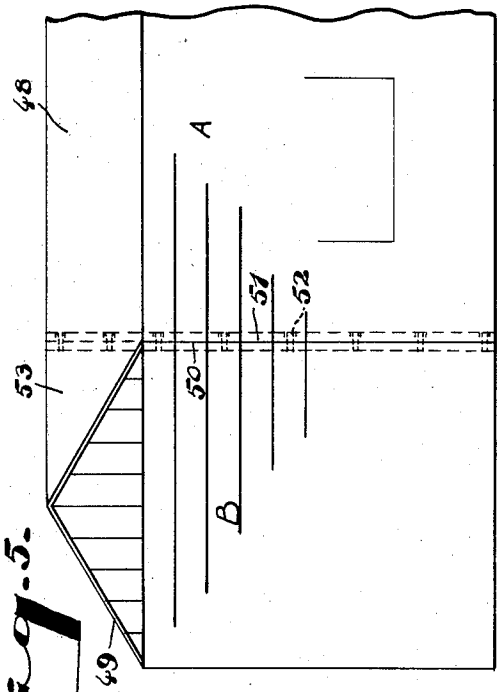

Fig. 6.

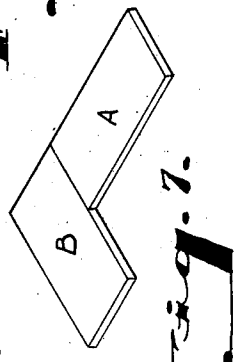

Fig. 7.

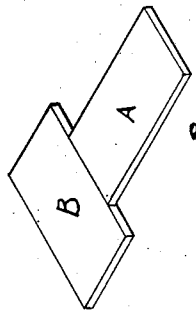

Fig. 8.

INVENTOR.
WILBERT O. BENNING
BY: Harold B. Hood,
ATTORNEY

United States Patent Office 2,855,635 Patented Oct. 14, 1958

2,855,635

FACTORY ASSEMBLED HOUSING AND INSTALLATION THEREOF

Wilbert O. Benning, South Whitley, Ind.

Application February 29, 1956, Serial No. 568,504

11 Claims. (Cl. 20—2)

The present invention relates to improvements in building construction, and is primarily concerned with the provision of details of construction adapted for factory operation, whereby a housing unit may be assembled from standard parts, transported after assembly to a pre-selected site, and there disposed upon a prepared foundation; the details of construction being such as to result in a building having rigidity, strength and permanence characteristics at least as good as, and in some respects superior to, the corresponding characteristics of conventional buildings erected by old fashioned procedures at the building site.

It may be said that the primary object of my invention is to provide a building construction of such character that a unit may be erected, finished interiorly and exteriorly, and furnished completely, with many built-in features, at a factory site; and yet may be transported, as a unit or units, after such completion, to be deposited upon a foundation, either as a single unit or as a plurality of interconnected units in any one of a number of different arrangements. A further object of the invention is to construct a building of unusually high quality material and workmanship, in such a way and with such means as to permit its sale at a relatively low price. To this end, buildings designed in accordance with the present disclosure may be erected on a coordinated production line.

A further object of the invention is to provide an unusually substantial and rigid building, using steel girders and steel joists as a base frame upon which may be erected studding, sheathing, siding, roofing, flooring, insulation, dry-wall inside walls, trim, vapor barrier, electrical and plumbing supplies of conventional characteristics.

A feature of the present invention is the integrated base frame upon which the rest of the building is erected and supported. Such a frame, on and around which the building is erected, is constructed in such a manner as to provide a means for attaching or detaching specially designed equipment, disclosed in detail in my copending application Serial No. 568,503, filed February 29, 1956, for Running Gear for Houses, and the like, whereby the completed structure may be readily transported from the factory to a predetermined site, leveled by detachable leveling jacks at the site, and detached from the towing vehicle, after which a foundation wall may be constructed, at least partially of settable plastic material, and embedding anchoring devices or stakes, which are rigidly associated with the base frame, in such plastic material.

To the accomplishment of the above and related objects, my invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

Fig. 1 is a perspective view of a base frame constructed in accordance with the present invention;

Fig. 2 is a fragmental elevation of one corner of the frame, showing filler elements associated therewith, parts being broken away for clarity of illustration;

Fig. 3 is an elevation, drawn to a still larger scale, showing the same corner of the frame after assembly therewith of flooring means and a wall frame;

Fig. 4 is a section, drawn to an enlarged scale after completion of a wall and showing a fragment of a foundation;

Fig. 5 is an elevation of a wall frame, drawn to a reduced scale, and mounted on an element of the base frame;

Fig. 6 is a fragmental elevation showing two interconnected building units; and

Figs. 7 and 8 are diagrams showing two of the many possible arrangements in which a plurality of such units may be joined together at the permanent site.

Referring, now, to Fig. 1, it will be seen that I have illustrated a novel base frame for a factory-assembled building. The frame **10** comprises a pair of side members **11** and **12** and a pair of end members **13** and **14**, arranged and secured together to define a closed rectangle. Obviously, though it is desirable, it is not essential that each of the members **11, 12, 13** and **14** shall be straight, as shown; it is not essential that the closed figure defined by the assembled members shall be a rectangle; and it is not essential that only four members be thus assembled to define the selected closed figure. It is, however, a feature of the invention that each of the assembled members defining the closed figure shall be channel-shaped in cross section, and that said members shall be arranged to present their webs toward the interior of the closed figure, with their flanges or legs projecting outwardly, whereby a perimetral channel extends throughout the perimeter of the closed figure. Thus, the side member **11** has its web **11*a*** disposed in a vertical plane, while its upper and lower flanges or legs **11*b*** and **11*c*** project substantially horizontally outwardly from the base of the channel. Similarly, the web of the member **12** is disposed in a vertical plane and its upper and lower flanges (only the upper one **12*b*** of which is shown) extend horizontally outwardly; the member **13** has its web **13*a*** vertically disposed and its flanges or legs **13*b*** and **13*c*** project horizontally outwardly; and the member **14** is similarly arranged, with its web **14*a*** disposed in a vertical plane and presented toward the interior of the frame and its upper and lower flanges or legs **14*b*** and **14*c*** projecting horizontally outwardly. The members **11, 12, 13** and **14** are secured together in any suitable fashion, but preferably these members are formed of steel and are welded together.

Brace means is provided to span the interior of the closed frame, from end to end. As shown, I provide two girders **15** and **16**, each of which is composed of a steel channel member **15'** or **16'** and a steel channel member **15''** or **16''**, said channel members being arranged with their webs in vertical abutment, and being suitably secured together, and to the members **13** and **14**, for instance, by welding.

Other brace means, spanning the interior of the frame transversely with respect to the brace means **15** and **16**, and indicated by the reference numeral **17**, is likewise provided. The elements of the brace means **17** will preferably be likewise constructed from pairs of channel elements secured together with their webs in abutment.

It will be seen that the frame elements **11, 12, 13** and **14** provide, through their flanges **11*b***, **12*b***, **13*b*** and **14*b***, horizontal supporting surfaces lying substantially in a common plane; and that the brace means **15** and **16** likewise provide horizontal supporting surfaces **18**, substantially in the same plane while the brace means **17** provide horizontal supporting surfaces **19** substantially in the

same plane. The reason for this arrangement will appear as the description proceeds.

The lower flange of the members **11**, **12**, **13** and **14** are perforated at suitable intervals in their lengths for the reception of stakes **20** so proportioned and arranged that a substantial length of each stake projects downwardly below the common plane of said lower flanges. Preferably, each such stake may be a bolt threaded throughout its length; but, no matter what form the stakes take, each will preferably be threaded at least near its upper end for association with a nut **21** supported upon the upper surface of the lower flange of the associated frame member. Preferably, each such nut **21** will be welded in place, as indicated at **22** in Fig. 2. Obviously, as an alternative, the lower flanges of the frame members could be provided with thickened regions formed with tapped apertures for the reception of the threaded upper ends of the stakes **20**; but, through the expedient of welding nuts **21** in place in registry with each flange perforation, I find it possible to use standard steel channel members, thereby reducing the cost of the construction. It will be obvious that, by using threaded bolts to constitute the stake means, I provide for limited vertical adjustment of each stake relative to the frame **10**.

Filler means, of some material adapted for retentive penetration by nails, screws, and the like, is secured in place in the channel of each of the frame members **11**, **12**, **13** and **14**. Advantageously the filler means for each channel may be a wooden beam **23**; and I prefer that the thickness of the filler means shall be substantially equal to the depth of the channel in which it is secured. I prefer to perforate the web of each frame member, at spaced intervals in its length, and to perforate the beam **23** in registry with the web perforations; and to secure the beam in place by passing through the registering perforations, bolts **24** having heads **25** received in counterbores **25'** in the outer surface of each beam **23**, each bolt carrying a nut **26** at its inner end to bear clampingly against the inner surface of the web of the associated frame member.

Strips of hardwood, or similar material, as indicated at **27**, are now secured in place on the upper surfaces of the upper legs of the frame members **11**, **12**, **13** and **14**; and similar strips **27** are secured in place on at least some of the surfaces **18** and **19** of the brace means **15**, **16** and **17**. Advantageously, said strips **27** may be secured in place by self-tapping screws **28** passed through preformed, countersunk bores **28'** in the strips **27**.

Thereupon, one or more layers of subfloor **29** may be laid upon the strips **27** and secured thereto in any suitable fashion, preferably by nailing, and thereafter a floor **30** of any suitable material, preferably vinyl, rubber or asphalt compositions, may be secured in place on the subfloor. As is most clearly shown in Figs. 3 and 4, I prefer to extend the subfloor and the flooring to the perimetral limits of the frame **10**, for reasons which will appear.

Now, wall frames, such as the frame indicated generally by the reference numeral **31** in Fig. 5 will be assembled with the floored base frame **10**. Such wall frames will preferably be constructed in accordance with the disclosure of my copending application Serial No. 553,041 filed December 14, 1955 for Building Construction and Method; and each such wall frame will comprise a sill **32**, a plate **33**, and vertical studding **34** spanning the sill and plate, each stud having one end snugly received in a notch **35** in the sill and its other end snugly received in a notch **36** in the plate, and secured in place therein by suitable means such as, for instance, the fastening elements **37** indicated in Fig. 3. This construction provides an extremely strong and rigid wall frame; and the sill **32** of each such frame will be provided, at spaced intervals, with a bore which, when the wall frame is associated with the base frame, with its sill **32** substantially

in registry with the upper flange or leg of the corresponding frame member, will accommodate a bolt **38** extending through the sill, through the flooring through the subflooring, through the strip **27** and through a registering perforation in the flange, for instance **11***b*, of the associated base frame member, for instance **11**. Each bolt **38** is provided with a head **39** or similar abutment to bear upon the upper surface of the sill **32**; and each bolt carries, at its lower end, a nut **40** to bear upon the lower surface of the upper flange of the corresponding base frame member. By this means, the wall frames are securely and rigidly attached to the base frame; and, when each wall frame is connected, by any suitable means, at each end to the adjacent ends of the two adjacent walls, the four wall frames and the base frame complement each other to produce an unusually strong and rigid construction.

Sheathing **41** of any suitable type may now be secured as, for instance, by nailing, to the wall frames to provide external closure therefor. As is clearly illustrated in Fig. 4, the sheathing **41** will overlie the lower flanges of the base frame members; and, in accordance with conventional practice, it will extend upwardly to an extent sufficient to overlie, also, the plates **33** of the several wall frames. Each sheathing element will be secured as, for instance, by nailing, to the corresponding filler **23**, to the studs **34** and, if desired, to the sills **32**, plates **33**, strips **27**, and subfloor **29**. Preferably, felt sheet or other suitable material **42** will be applied to the outer surface of the sheathing **41**. Then an exterior base strip **43** will preferably be secured in place and will be topped by a drip cap **44** or the like; and thereafter siding **45** of any desired type will be applied to each wall.

The interiors of the walls will preferably be finished with dry wall material **46**; and an interior baseboard **47** will usually be provided. Preferably, insulation material such as rock wool, indicated at **54** in Fig. 4 will be filled into the spaces between the sheathing **41** and the dry wall **46**, and between the studs **34**. A roof structure of conventional construction will be secured to the upper edges of the wall frames **31** to complete the building unit.

Before internal finishing of the wall units, wiring and plumbing equipment will be installed in accordance with the disclosure of my copending application Serial No. 553,041, above identified; and after completion of the walls, beds, night stands, vanities, chests of drawers, clothes closets, etc. of desired characteristics may be installed.

In accordance with the disclosure of my copending application Serial No. 568,503, filed February 29, 1956, for Running Gear for Houses, and the like, suitable elements (not shown) for attaching running gear, a towbar and jacks may be secured to the lower surface of the base frame **10**, whereby the completed unit may be conveniently transported to a preselected site where a partially-completed foundation will have been constructed. Upon arrival at the site, the completed building unit will be properly located in registry with the partially-completed foundation. Thereupon, a foundation wall, at least partially formed of settable, plastic material such as concrete, will be built up to a predetermined level; and the building unit will be lowered, by operation of the above mentioned jacks, to move the stake means **20** into the mass of settable, plastic material and to locate the lower flanges of the frame members in contact with the upper surface of the completed foundation wall. Alternatively, the building unit may be so lowered to a preselected level and the foundation wall may then be built up to the level of the lower flanges of the frame members, thus embedding the stake means **20**, all as suggested hereinabove. The unit is allowed to remain in this position until the settable material has attained a compressive strength sufficient to support the unit; and

thereafter, the jacks are removed and the installation is completed.

It will be apparent that two or more of such units may be installed in any one of several different arrangements to cooperate with each other in providing, in effect, a single structure. Thus, in Fig. 7 I have diagrammatically illustrated a unit A having one end wall **50** attached to a side wall **51** of a similar unit B near one end of the latter to provide an L-shaped structure; and in Fig. 8 I have indicated a unit A having one end wall attached to a side wall of a unit B midway between the ends of the latter to provide a T-shaped structure. Any suitable means, such as indicated at **52**, may be provided for securing the two units together. As is suggested in Fig. 6, a filler unit **53** may be provided to extend between the roof unit **48** of the element A and the roof unit **49** of the element B.

Of course, a third unit might be added to the arrangement of Fig. 7 to complete a U-shaped structure; and, in that case, screening might extend between the ends of the arms of the U, and the patio space defined by the three units and the screening could, if desired, be roofed.

Using five units, the U-shaped arrangement might be converted into an H-shaped structure to provide a maximum of living space.

It will be obvious that the details of construction which have thus been illustrated and described provide an unusually sturdy, solid, permanent structure which nevertheless lends itself to factory production, easy transportation, and ready installation at the site of use. It will further be clear that, although the unit, once installed, is intended to remain permanently at its site, its structure is such that it may be transported to a new site without being dismantled, such transportation involving only destruction of the settable plastic foundation wall after reinstallation of leveling jacks such as those used in the original installation, and reinstallation of the running gear and tow-bar previously described.

A single unit of the character above described is highly adaptable as housing for college students, construction workers, or for motel units; while multiple units may be combined, as described above, for more luxurious living. The factory built units may be stocked in reasonable volume at the factory, for quick delivery and installation upon suitable foundations, to save many months of time and loss of income which are inevitable in, for instance, motel installations under conventional methods of construction. Further, factory methods of construction, made possible by the present concept, inherently provide for greater selectivity of fine materials, better supervision and inspection of workmanship, and precision construction leading to improved quality of product at lowered costs. While the constructional details involved in the concept make it possible to build complete units at the factory and to transport completed units to the intended site, the product of the present disclosure is by no means to be confused with so-called "prefabricated" structures which must be reassembled at the location by the erection of panels, sections, partitions etc. and the installation at the site of plumbing, electrical work, plastering, painting, and heating means; nor is the present concept to be confused with presently-known types of mobile housing units or expandible or collapsible structures including hinged elements which necessarily result in flimsy buildings. The unit of the present invention, on the contrary, is substantial, strong and rigid, comparing most favorably in permanence and resistance to natural forces, with structures erected, in accordance with conventional practice, from materials assembled at the site.

I claim as my invention:

1. A base frame for a building comprising a pair of side members and a pair of end members, said members being arranged and secured together to define a four-sided figure, each of said members being channel-shaped in cross-section with its web facing toward the interior of said figure and its legs extending outwardly with respect to said figure, and filler means of material capable of retentive penetration by nails received and secured between the legs of each member, said filler means for each member comprising a wooden beam whose thickness corresponds generally to the depth of its corresponding channel, bolt means penetrating each beam and the web of its associated member to secure said beam in its channel, and stake means secured to, and projecting outwardly beyond, one leg of each member.

2. The base frame of claim 1 in which each stake means comprises a threaded rod penetrating its associated member leg, and a nut threadedly mounted on an end of each such rod and bearing upon the inner surface of its associated leg, each beam likewise bearing upon said leg surface and being formed, in its edge adjacent such member leg, with a recess accommodating such nut and stake end.

3. A building comprising a base frame formed to provide an outwardly-opening, perimentral channel, filler means of nail-receiving material disposed in said channel, substantially throughout the perimentral length thereof, vertical studding supported from said base frame at spaced intervals about the perimeter of said base frame, sheathing nailed to said filler means and to said studding to define enclosing walls, and siding nailed to the exterior side of said sheathing to finish said walls.

4. The building of claim 3 including sill means interposed between said base frame and said studding and directly supporting said studding, and means vertically penetrating said sill means and the adjacent leg of said channel to secure said sill means rigidly to said base frame.

5. The building of claim 4 in which said last-named means comprises a plurality of bolts, each having abutment means bearing upon the upper surface of its associated sill means and each carrying, at its lower end, a nut bearing upon the lower surface of its associated channel leg.

6. A building including a base frame comprising a pair of metal side members and a pair of metal end members, said members being arranged and secured together to define a closed figure, metal brace means spanning the interior of said figure, other metal brace means spanning the interior of said figure and arranged transversely with respect to said first-named brace means, each of said members and each of said brace means being formed to provide a substantially vertical web and a substantially horizontal flange adjacent the upper edge of its web, wooden runner means disposed on the upper surface of the flange of each member, wooden runner means disposed on the upper surface of the flanges of at least some of said brace means, means penetrating said runner means and their respective flanges to secure said runner means to said flanges, a subfloor secured to said runner means by fastener means penetrating said subfloor and entering said runner means, and flooring secured to said subfloor by fastener means penetrating said flooring and entering said subfloor.

7. A building including a base frame comprising a pair of metal side members and a pair of metal end members, said members being arranged and secured together to define a closed figure, metal brace means spanning the interior of said figure, other metal brace means spanning the interior of said figure and arranged transversely with respect to said first-named brace means, each of said members and each of said brace means being formed to provide a substantially vertical web and a substantially horizontal flange adjacent the upper edge of its web, wooden runner means disposed on the upper surface of the flange of each member, wooden runner means disposed on the upper surface of the flanges of at least some of said brace means, means penetrating said runner means and their respective flanges to secure said runner means to said flanges, a subfloor secured to said runner means

by fastener means penetrating said subfloor and entering said runner means and extending to the perimetrally-outer edges of said member flanges, flooring secured to said subfloor by fastener means penetrating said flooring and entering said subfloor, said flooring being perimetrally coextensive with said subfloor, sill means supported on said flooring and substantially registering with said member flanges, and a plurality of bolts penetrating said sill means, said flooring, said subfloor, said first-named runner means and said member flanges, each bolt having abutment means bearing upon the upper surface of its associated sill means and carrying, at its lower end, a nut bearing upon the lower surface of its associated member flange.

8. A building including a base frame comprising a plurality of metal channel members arranged and joined together to define a closed figure presenting an outwardly-opening, perimetral channel defined by upper and lower, outwardly-extending, substantially horizontal legs, wooden filler means disposed and secured in said channel and having a thickness substantially equal to the depth of said channel, metal brace means spanning the interior of said figure, other metal brace means spanning the interior of said figure and arranged transversely with respect to said first-named brace means, each brace means comprising a channel element having upper and lower, substantially horizontal legs, wooden runner means disposed on the upper surface of the upper leg of each of said members, wooden runner means disposed on the upper surface of the upper legs of at least some of said brace means, means penetrating said runner means and the legs on which they are respectively disposed to secure said runner means to said legs, a subfloor screwed to said runner means and extending to the perimetrally outer edges of said member legs, flooring secured to said subfloor and perimetrally coextensive with said subfloor, sill means supported on said flooring and substantially registering with said member legs, a plurality of bolts penetrating said sill means, said flooring, said subfloor, said first-named runner means and the upper legs of said members, each bolt having abutment means bearing upon the upper surface of its associated sill means and carrying, adjacent its lower end, a nut bearing upon the lower surface of its associated member upper leg, vertical studding supported upon, and secured to, said sill means at spaced intervals about the perimeter thereof, sheathing nailed to said wooden filler means and to said studding to define enclosing walls, and siding nailed to the exterior side of said sheathing to finish said walls.

9. A building including a base frame comprising a pair of side members and a pair of end members arranged and secured together to define a rectangle, each of said members being a metal channel arranged to present its web toward the interior of said rectangle and having its upper and lower legs extending perimetrally outwardly, wooden filler means disposed in the channels of said members and having a thickness substantially equal to the depth of said channels, brace means spanning said rectangle from end to end, other brace means spanning said rectangle from side to side, each brace means comprising a channel element having upper and lower, substantially-horizontal legs, wooden runner means disposed on the upper surface of the upper leg of each of said members, wooden runner means disposed on the upper surface of the upper legs of at least some of said brace means, means penetrating said runner means and the legs on which they are respectively disposed to secure said runner means to said legs, a subfloor screwed to said runner means and extending to the perimetrally outer edges of said member legs, flooring secured to said subfloor and perimetrally coextensive with said subfloor, a wall structure for each of said members, each wall structure comprising a sill, a plate, vertical studding spanning, and rigidly secured to, said sill and plate at spaced intervals in the length thereof, the sill of each wall structure being disposed on said flooring substantially in registry with the legs of the corresponding channel member, a plurality of bolts for each wall structure, each bolt penetrating the sill of a wall structure, said flooring, said subfloor, said first-named runner means and the upper leg of its associated channel member, and each bolt having abutment means bearing upon the upper surface of its associated sill means and carrying, adjacent its lower end, a nut bearing upon the lower surface of its associated member upper leg, sheathing nailed to said wooden filler means and to said studding to define enclosing walls, and siding nailed to the exterior side of said sheathing to finish said walls.

10. The building of claim 9 in which each element of the vertical studding has one end snugly received and secured in a notch in its associated sill and has its other end snugly received and secured in a notch in its associated plate.

11. A building comprising a foundation constructed, at least in part, of a settable, plastic material, and a base frame including a pair of side members and a pair of end members, said members being arranged and secured together to define a closed figure, each of said members being channel-shaped in cross-section with its web presented toward the interior of such figure and its legs extending outwardly with respect to said figure, filler means, of material capable of retentive penetration by nails, received between the legs of each member, and stake means secured to, and projecting downwardly beyond, the lower leg of each such member, said stake means extending into, and being gripped by, said foundation settable material when said frame is positioned upon said foundation to be supported thereby.

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