March 15, 1932. J. C. BRODERICK 1,849,273

METAL UNIT BUILDING SYSTEM

Filed April 30, 1926 4 Sheets-Sheet 1

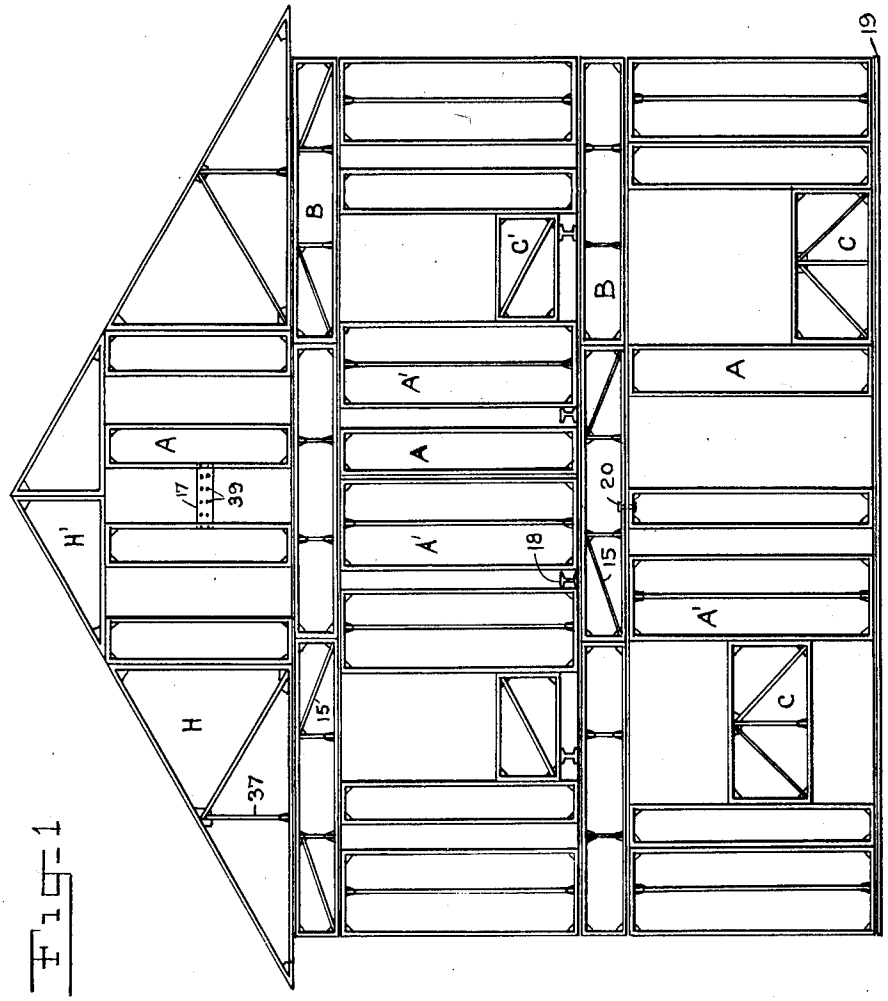


FIG-1

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METAL UNIT BUILDING SYSTEM

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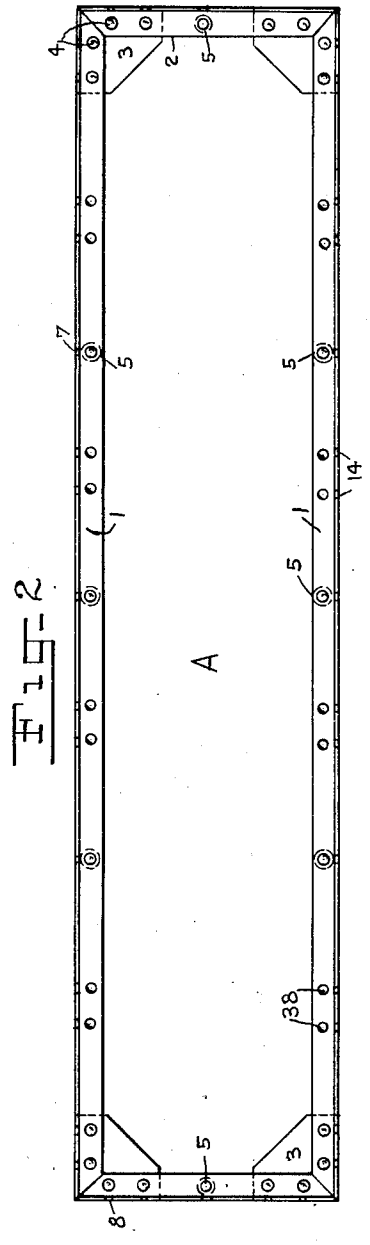


Fig. 2

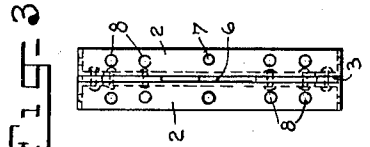


Fig. 3

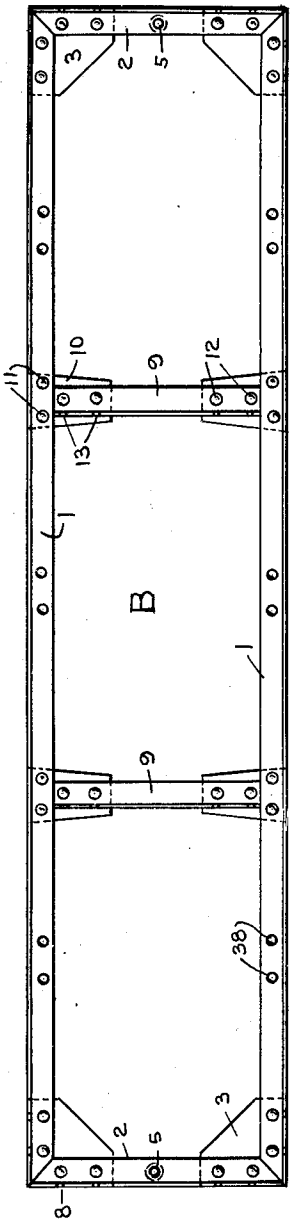


Fig. 4

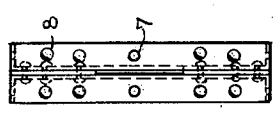


Fig. 5

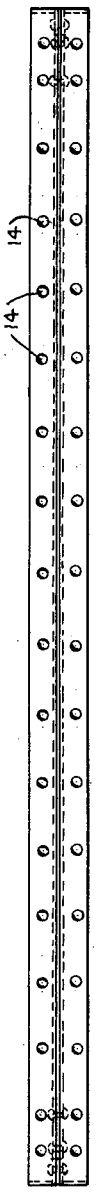


Fig. 6

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METAL UNIT BUILDING SYSTEM

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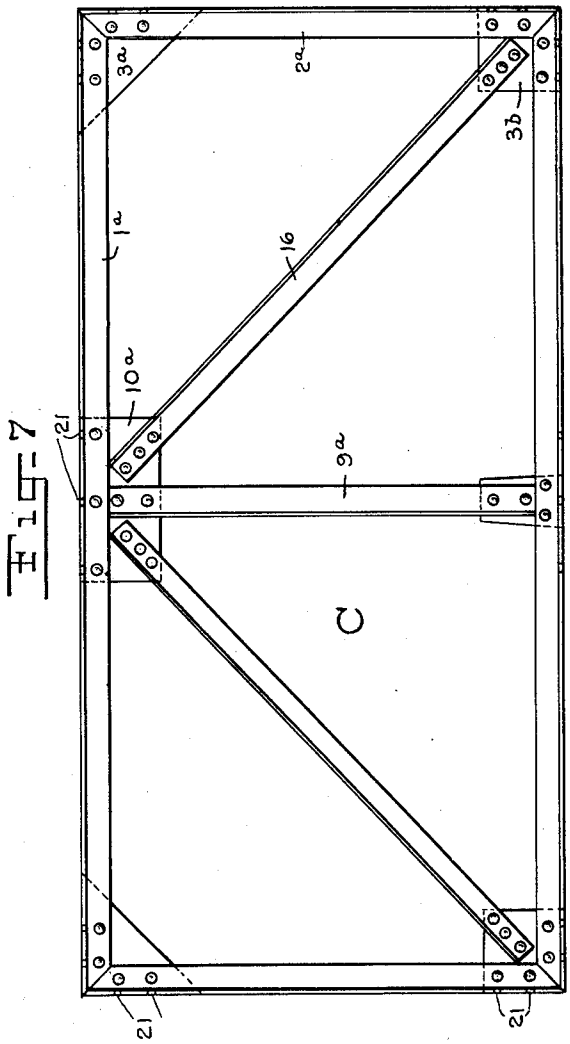


Fig. 7

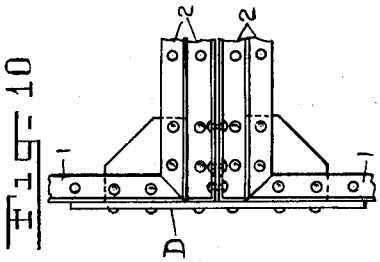


Fig. 10

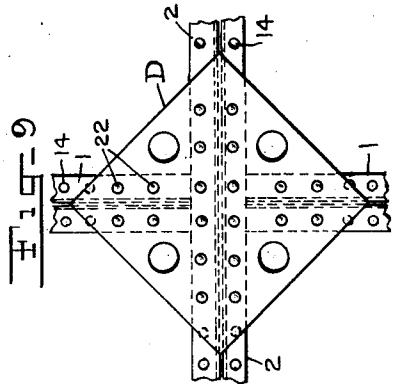


Fig. 9

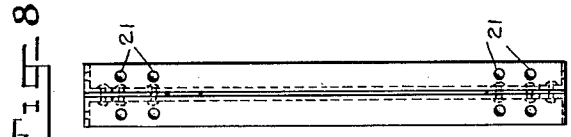


Fig. 8

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Fig. 11

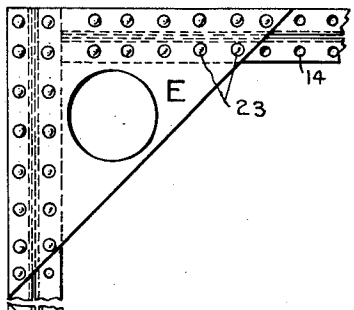


Fig. 13

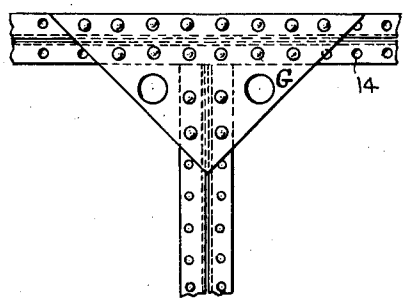


Fig. 12

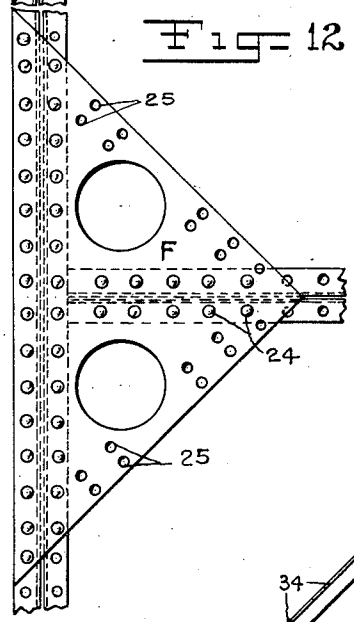


Fig. 15



Fig. 14

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Patented Mar. 15, 1932 1,849,273

UNITED STATES PATENT OFFICE

JOHN C. BRODERICK, OF NYACK, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO McCLINTIC-MARSHALL CORPORATION, OF BETHLEHEM, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

METAL UNIT BUILDING SYSTEM

Application filed April 30, 1926. Serial No. 105,859.

The improvements relate to the construction of buildings and more particularly to the framework thereof, and their object is, among others, to provide a system and a set of units to be used in connection therewith whereby buildings of various forms, dimensions and architectural details may be framed in metal at a very low cost for labor, materials and supervision, may be quickly and securely framed, and the frame given great strength and rigidity, and whereby the architect or other designer may plan a building, for residential or other purposes, of any desired type and form, and the builder may construct the frame of such building by having all of its parts, and exactly the required number of parts, made at the mill and thus avoid skilled labor and the use of metal cutting or working tools or power on the job. Other objects will be apparent to those familiar with building construction.

Although the construction of the frames of buildings of steel has been recognized as highly desirable for many years, and the advantages of such construction over wood or other framing have been well known for generations, the use of metal frames for residential buildings has very rarely been attempted, and has always involved a cost which in the great majority of cases is prohibitive. The principal reasons for this are that residences, particularly in suburban sections, are, and must be, in order to be attractive and marketable, given a great variety of architectural features, which requiring the working, cutting and fitting of the materials on the job, which adds enormously to the cost, and because it is often not feasible, even where the cost is not considered, to have the tools, power and equipment for this work at hand; that the erection of steel building frames requires the employment of highly paid and time consuming labor skilled in work of this character; and that if it is attempted to have the frames of such buildings fabricated at the mill, it involves a great amount of work on the part of the architect or engineer in planning, measuring and specifying all the parts required and also a great amount of expensive work and the use of special tools and machinery in making up the parts, to say nothing of mistakes and other discouraging incidents. The present system obviates all these disadvantages, and makes the construction of any ordinary residential building with a steel frame, having all the attendant advantages of such a frame, as easy and as cheap as the ordinary wood frame construction, or even cheaper.

The improvements are illustrated in the accompanying drawings, in which Fig. 1 is an elevation of a building frame constructed according to the present improvements;

Fig. 2 is a plan of the stud unit;

Fig. 3 is an end view thereof;

Fig. 4 is a plan of the girding unit;

Fig. 5 an end view thereof;

Fig. 6 a side or edge view of the same;

Fig. 7 is a plan of another unit called a filler;

Fig. 8 an end view thereof;

Fig. 9 is a plan of a cross wall or partition connection with connecting plate;

Fig. 10 an end-side view of a wall top and brace connection end plate shown in plan in Fig. 9;

Fig. 11 a corner construction;

Figs. 12 and 13 plans of wall and partition end constructions and braces;

Fig. 14 an elevation of a roof unit; and

Fig. 15 a vertical or horizontal edge view thereof.

The system consists essentially of vertical, horizontal and diagonal elements and connecting means, and further in the means and methods employed in assembling and securing these elements together to form the frame of a house or other building.

The stud member A of Figs. 2 and 3 is designed to be placed in vertical position anywhere in the building and to take the place of ordinary wood studding or other upright frame members. It can be used, however, for any purpose and in any part of the building to which it can be applied advantageously. It consists of sides and ends, forming a rectangular frame, both side and end members being formed of angle bars 1 and 2 respectively placed side to side and riveted together. Their ends are mitred and fitted together, and connected by the angle

corner plates 3 interposed between their ends, the three parts being secured together by means of rivets 4 passed through the opposed flanges of the angles and through the plate in each instance. The corner plate may be of triangular or other shape, but is so formed, as shown in Fig. 2, that it extends inside the corners of the frame and forms a web or brace giving the rectangular skeleton frame of the stud A great strength and rigidity against all stresses and strains. As the corner plates space the bars or angles forming the frame, rivets 5 intermediate the corners are provided and washers 6 interposed between the angles, the rivets passing through the angles and washers, so as to space and brace these intermediate portion. Perforations 7 in the outer flanges of the angles which are normal to the riveted flanges are also provided for the reception of connecting bolts to secure the stud A to other parts. These perforations are located opposite the rivets 5, so that a strong and rigid connection, which will resist twisting, spreading and other strains will be formed. The outer flanges may also be provided with one or more perforations between the corners and the nearest rivets and between the rivets in the medial part of the longitudinal angles, as shown in Fig. 6, in connection with the girding element, and such perforations at the corners are shown at 8.

These stud units, and the other units hereinafter described, are designed to be made up complete at the mill or other fabricating plant, and may be made of any desired size and proportions. It is a characteristic of the present improvements, however, that they may be made in standard sizes and kept in stock at the mill or by dealers, and used without alteration for the production of buildings of various proportions, types and architectural modifications. Thus the units A may be made in 2, 3, 5, 6 and 8 foot lengths, so that by superposing one upon another studs varying from 6 to 16 feet in height may be provided, which supplemented by the girder elements B will give any desired height of a story of the building. In Fig. 1 the scale is approximately four feet to the inch, and the studs, which are approximately 8 feet in length, supplemented by the girder members, which are approximately 18 inches in width, will give a height of about 8½ feet for the first and second stories, whereas the attic, employing 6 foot studs will have a minimum height in the finished central area of about 6 feet. The studs may also be made double width as shown at A′ in Fig. 1, by running a straight angle bar longitudinally through the middle thereof and securing it in the manner hereinafter described for securing the cross braces of the girder elements.

The girder unit or "girt" B is primarily the horizontal member of the frame, but like the stud A may be used for other purposes and in other positions. It is composed of the angles 1 and 2 and corner plates 3 of the same construction and secured together in the same manner as in the stud unit shown in Figs. 2 and 3. In order to give it greater compressive strength, however, cross braces 9 are provided between its ends, and these braces are secured to the sides of the frame by plates 10 having one end interposed between the angles forming the side of the frame and secured thereto by rivets 11, so as to act as a brace and spacer as well as a connection for the cross pieces, and secured to the ends of the braces by rivets 12. The braces 9 are angle bars and are provided with perforations 13, which may be employed to lace or otherwise attach metal lath or filling members of cork or asbestos or other material. The laterally projecting webs or flanges of the angles forming the hollow frame are provided with perforations 14, which may be of any desired size, shape, number and spacing, and are designed to enable the builder to secure any other unit therto at any desired location along the length of the unit. It is important, however, that the size and spacing of the perforations in all the units shall be uniform, so that when one unit is placed so as to abut against another the perforations of the two units can be made to register and a plurality of fastening bolts passed through such perforations to unite the units.

The girder units B may also be provided with diagonal truss rods 15 (Fig. 1), and preferably about one-half of them are, these diagonal bars being riveted at one end to a corner plate and at the opposite end to the plate 10, which may made of sufficient width to receive the necessary connecting rivet or rivets.

The filling unit C is primarily intended to be placed between the studding units and to form a rigid connection filling the space which has been left in a wall or partition framed with the units A and B, below a window or above a door opening. In Fig. 1 the unit C at the left is placed for a high window, and at the right is placed for a low window. Where the space is relatively narrow, or so located that the filling member will be subjected to relatively low stresses, a filler with a single diagonal strut such as C′ may be employed. This unit is also made in the form of a hollow rectangular frame formed of pairs of angle bars 1*a*, 2*a*, secured together at the corners by plates 3*a*, the construction corresponding with that of the elements A and B. It also has a cross brace 9*a* secured in manner similar to the cross brace 9, the middle plate 10*a* being made wider to provide means for attaching the diagonal struts 16 riveted thereto at one end and at the other end to a corner plate 3*b*, which is merely an extension of the form of corner plate 3. It

will be seen that all the corner plates and intermediate spacing and bracing plates of the elements A, B and C are angular. This makes it possible for the mill to form them by making straightcuts through sheet material. If desired, they may all be of triangular or rectangular form. The forms shown are carried to save a small amount of metal, but where the conditions are such that the saving of labor involved or the elimination of special equipment is more important than the small metal saving the making up of all the parts in one of these forms will be advisable. Thus, it will be seen that a shop equipped with power shears and a riveter can keep in stock sheets or strips of metal and angle bars of any length and make up any desired number of the units A, B and C in any desired sizes and proportions without employing any other machinery than that mentioned or any other basic operations than the cutting and riveting operations referred to.

Where the opening is relatively narrow, and the strength of the structure does not require greater bracing a straight brace 17 may be employed to space the studs A, as shown at 17 in Fig. 1. Short studs may also be used to form a wall frame or interior partition by off-setting or by alternating them and having first one extending from the bottom up and then one extending from the top down, each stud being secured at or near its inner end to two adjacent studs. Various further modifications in the construction illustrated in Fig. 1 may also be made within the scope of the present improvements, as the studs and other units are so constructed that they can be used practically universally for the construction of wall and partition frames.

Where the load to be carried by a floor makes it advisable I-beams 18 may be placed on the girder brace and secured thereto through perforations receiving bolts which extend through the beams and the perforations of the members on which they are placed. The perforations in the ends of the units A will receive bolts set in the foundation and extending through a sill such as 19, and the girt units B are fastened to the tops and bottoms of the studs by means of bolts, preferably with flat shanks, such as 20 extending through the spaces between the angles of both, as well as by as many bolts as may be desired through their flange perforations.

The filler units C have perforations 21 in the lateral flanges of their angles, which correspond in size and position with the perforations of the units A and B. The latter at their ends have perforations spaced about ¼th inch, which on a scale of 1 inch to the foot would indicate perforations on 3 inch centers, while the intermediate perforations are spaced about one-half inch, which would indicate 6 inch centers. The making of perforations for the reception of connecting bolts more numerous near the ends is a special arrangement, and if desired the bolt holes may have the same spacing throughout, which may be either the short or the long spacing indicated, or any other satisfactory spacing. The length of the corner plates will be sufficient to receive the desired number of bolts, and their perforations will correspond to those of the angle flanges. These perforations in all cases will be so placed that those in one unit will register with those in the other unit, and if for any reason those of one unit are made more numerous than those of another, they will be arranged in multiples. Thus if the perforations of one unit are on three inch centers, those of all the other units will be on 3, 6, 9 or 12 inch centers. The perforations shown are merely illustrative of the system whereby the uniting of the units at any point throughout their respective lengths to other units is provided for.

As the punching of the rivet holes is merely a matter of setting the punches in a punching machine, in the mill, the number and location of the holes is not a matter of material importance so far as the fabrication of the units is concerned. It is desirable, however, to have the perforations as few in number as the operation of the system requires, since having them too numerous would slightly reduce the strength of the unit.

The unit D, shown in Figs. 9 and 10, is adapted to be applied to the tops of partition or wall intersections, and bolted to the angle flanges of both wall tops as shown at 22. These bolts are passed through the perforations 14 of the girt members and through registering bolt holes in the units D. The top of the partition shown in these figures is formed by intersecting girt units B, and one unit extends through between the abutting vertical ends of two others, but the tops of the partitions may be the tops of the stud members A, where girt elements are not employed, as where the height of the second story is 8 feet and an 8 foot stud unit is employed to frame the walls and partitions.

The corner brace unit E consists of a plate having perforations registering with the perforations 14 of the girt units through which bolts 23 are passed to secure the parts together, and brace them.

The unit F is primarily intended to be used at the end of a partition where it joins a wall or other partition and consists of a triangular plate with perforations registering with those of the partition forming members to receive connecting bolts 24.

The unit G is a triangular plate similar to the unit F but with approximately one-half the base of the latter. This is intended to be used where interior partitions are joined with the end of one partition abutting against the

side of another. All of the elements D, E, F and G are rectangles or right angle triangles and are provided with circular cut-out portions to reduce their weight.

It will be seen that the unit F has perforations along its sides. These are formed for the purpose of making it applicable to all the uses of the units D, E, F and G, if it is desired to so use it, the perforations 25 being adapted to receive the bolts 24 when it is used in the place of the unit E. When it is used in place of the unit D it will extend over and be connected with three of the four walls, and will in most cases be sufficient to brace the structure against all the stresses and strains to which it may be subjected.

The trussed roof unit H is also in the form of a right angle triangle. In the drawings (Fig. 14) it has an angle of 45 degrees so as to give the roof a corresponding slope or pitch. Its three sides are made up in the same manner as the units A, B and C, and a strut or stay 26 connects the corner plate 27 and the chord 28, while plates 29 and 30 secure its acute angled corners. This unit may be made to have its top chord rise from the base at an angle of 30 degrees more or less, so that two of these units will answer all the ordinary requirements of roof construction. By having the member 28 pivoted to the base and made in sections with bolted bracing plates at its joints it may be made adjustable to any desired angle. In this case the vertical side 31 would also need to be jointed so that it could receive and be connected with the upper end of the member 28, and be secured thereto by plates and rivets passed through its perforations 32 and the perforations 33 of the latter. In this case also the ends of the stay G would need to be pivoted, and the stay made telescopic.

The three sides of the unit H have perforations 34 in their lateral flanges, by which they may be connected with other parts of the building, those of the diagonal member 28 being adapted to receive connecting members for the purlins. The other sides, however, may form the rafters, and the base of the unit, in which case the perforations of these sides will carry the purlin system. The inner flanges of the side 28 and base 35 have rivet holes 36 for attaching braces or other members. In Fig. 1 the roof unit is shown provided with a vertical brace 37, and other internal braces may be used if desired. The units H′ forming the ridge are of the same form as the units H but have no interior braces. Where the triangular roof units are made of small size, and are not required to carry a heavy load this can be done. It will be seen also that where the roof units are made like the unit H shown in Fig. 14 any number of them may be combined to form a trussed rafter having any desired length which is a multiple of the length of the chord 28. Thus by placing another unit inverted with the side 31 fixed to the side 31 of Fig. 14 then mounting another unit H thereon with its side 35 fixed to the side 35 of the second unit, a rafter double the length of that shown in Fig. 14 will be formed.

Where for any reason small fractions of the dimensions of the elements, which cannot be taken care of by arrangement of the elements are necessary this can be done by inserting plates or strips of metal between the spaced angles forming the units and spacing them apart as indicated in connection with the member 17 (Fig. 1) these plates or strips being secured by bolts passing through holes therein and through corresponding holes in the inside flanges of the angles forming the units. As this will very rarely be required, it is not necessary to provide these inside flanges with bolt holes—such as 36—since they can be made in both flanges and connecting strips or plates by the use of a hand drill-bit.

It will be seen from the foregoing that the system and set of units provided by the present improvements accomplish all the advantages heretofore mentioned, among others; that it is adaptable to all the various forms and dimensions of building construction, and that simply by numbering the various units according to their nature, and their size, it will only be necessary for the architect or engineer to specify and the builder to order from the mill a certain quantity of the various units, to supply materials which can be assembled on the job without the use of steel working tools of any character and by unskilled labor, to completely frame the structure.

It will be seen that each story of the building frame as well as the entire frame when formed according to the improvements is in effect a trussed structure and is braced against all the stresses, loads and strains to which such a structure may be subjected.

The inside flanges of one or all of the units A, B and C may also be provided with bolt holes, such as those indicated at 38 (Figs. 2 and 4) and connecting plates uniformly perforated, as indicated at 39 (Fig. 1) provided. This will obviate entirely the necessity for using a hand drill in the few cases where it might otherwise have to be employed.

Various modifications of the details shown and described may be made without departing from the scope of the invention. Thus U-bars or T-bars may be employed instead of the angle or L-bars described and shown, and bars of other cross section may also be employed, in the formation of the units, with or without gusset plates, as the invention in its broader aspects is not limited to this or other details of construction.

I claim:

1. A skeleton wall comprising a plurality of hollow rectangular oblong metal frame units constructed and arranged to form studs, plates, girders and other parts of a building frame, each unit composed of angle bars secured together along one flange and having bolt holes in other flanges adapted to receive means for securing the said unit to other similar units on a plurality of sides of a said unit, said bolt holes being placed at regular intervals along the flange, and bracing and spacing plates between the said angle bars extending beyond the flanges of said bars and into the space surrounded by the frame.

2. A skeleton wall comprising a plurality of hollow rectangular oblong metal frame units constructed and arranged to form studs, plates, girders and other parts of a building frame, each unit composed of angle bars secured together along one flange and having bolt holes in other flanges adapted to receive means for securing the said unit to other similar units on a plurality of sides of a said unit, said bolt holes being placed at intervals along the flange, and bracing and spacing plates between the said angle bars extending beyond the flanges of said bars and into the space surrounded by the frame and bracing members secured to said extending portions of one unit and extending from one side of the frame to the other.

3. A skeleton wall comprising a plurality of hollow rectangular oblong metal frame units constructed and arranged to form studs, plates, girders and other parts of a building frame, each unit composed of angle bars secured together along one flange and having bolt holes in other flanges adapted to receive means for securing the said unit to other similar units on a plurality of sides of a said unit, said bolt holes being placed at regular intervals along the flange and bracing and spacing plates between the said angle bars extending beyond the flanges of said bars and into the space surrounded by the frame.

4. A frame for a building comprising a plurality of walls each formed of a plurality of units joined edge to edge, each of said units consisting of side and end bars secured together, cross-bars extending between opposite bars to form a rigid truss frame, openings in the sides and ends of each frame adapted to register with corresponding openings in the sides and ends of adjacent frames, and means for permanently securing said adjacent frames together at said openings.

Witness my hand this 10th day of April, 1926, at New York, in the county of New York, State of New York.

JOHN C. BRODERICK.