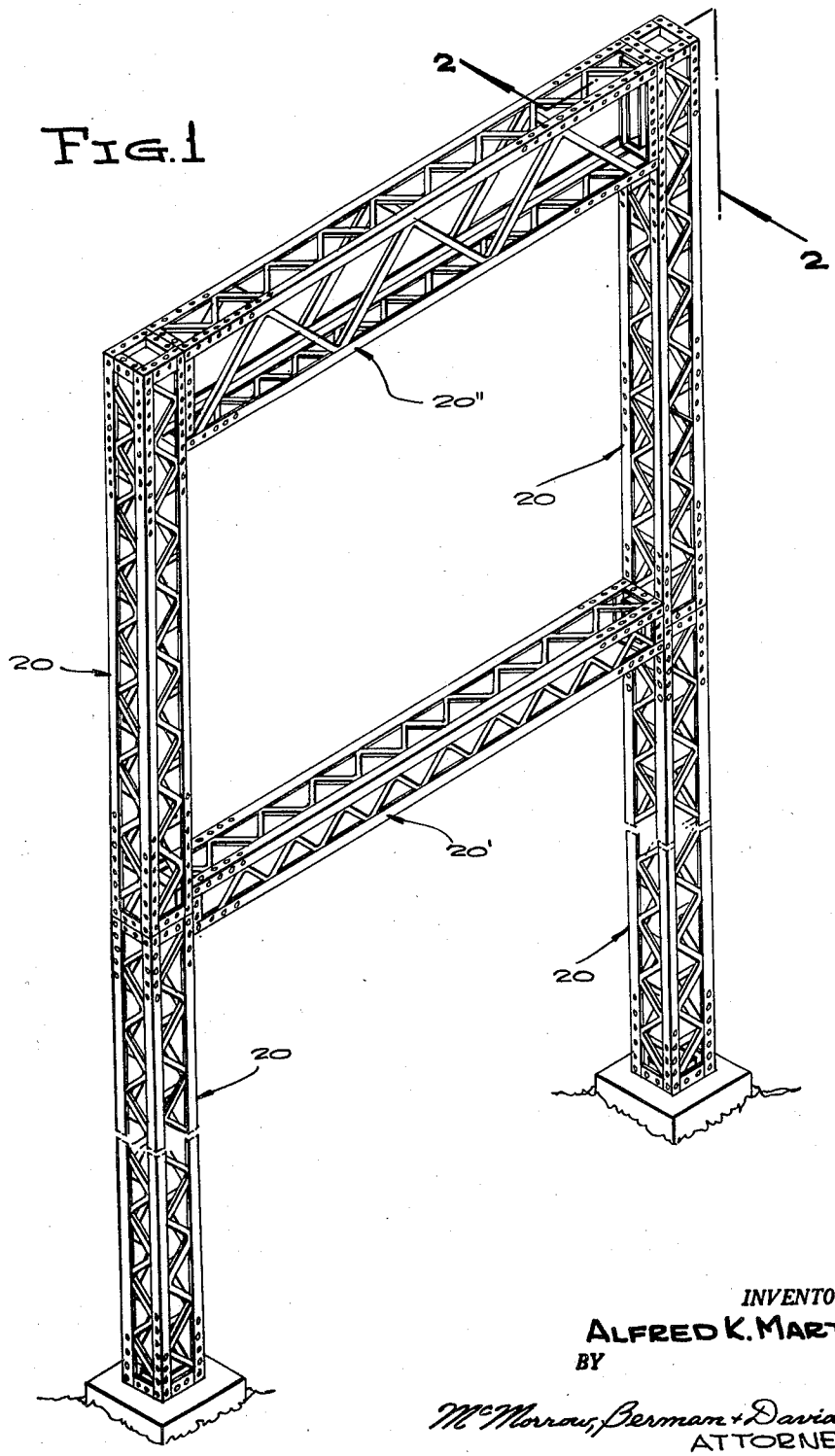
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METAL STRUCTURAL UNIT

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FIG. 1



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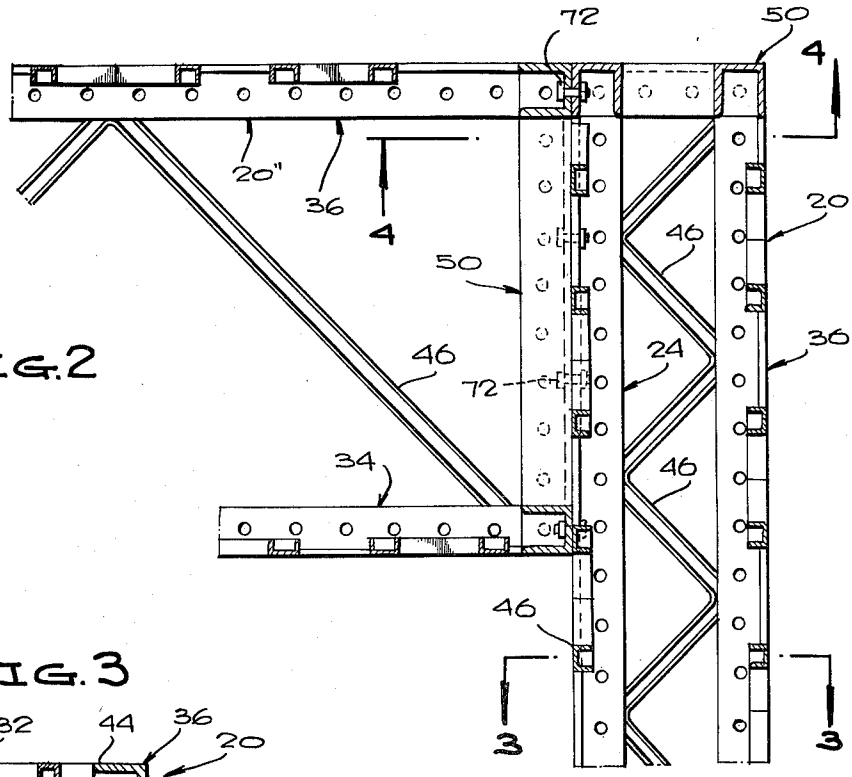


FIG. 2

FIG. 3

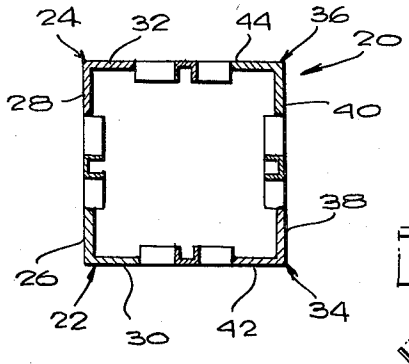
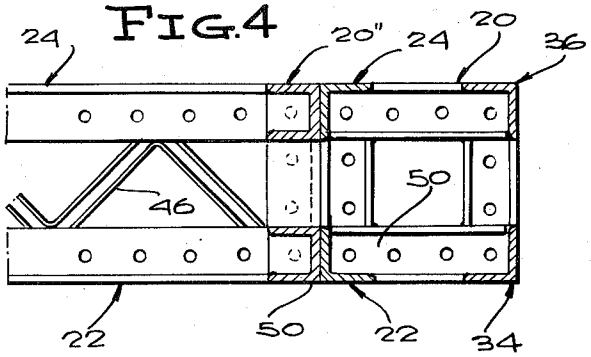


FIG. 4



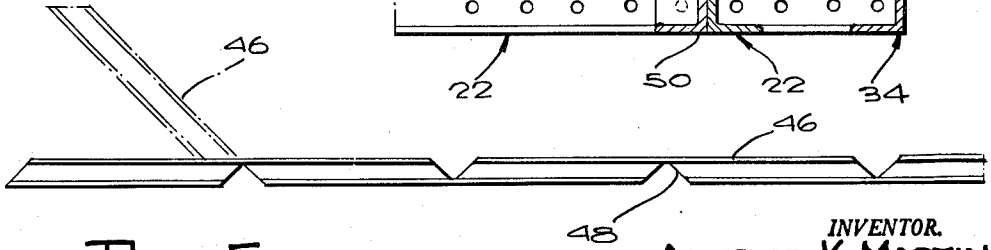


FIG. 5

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FIG. 6

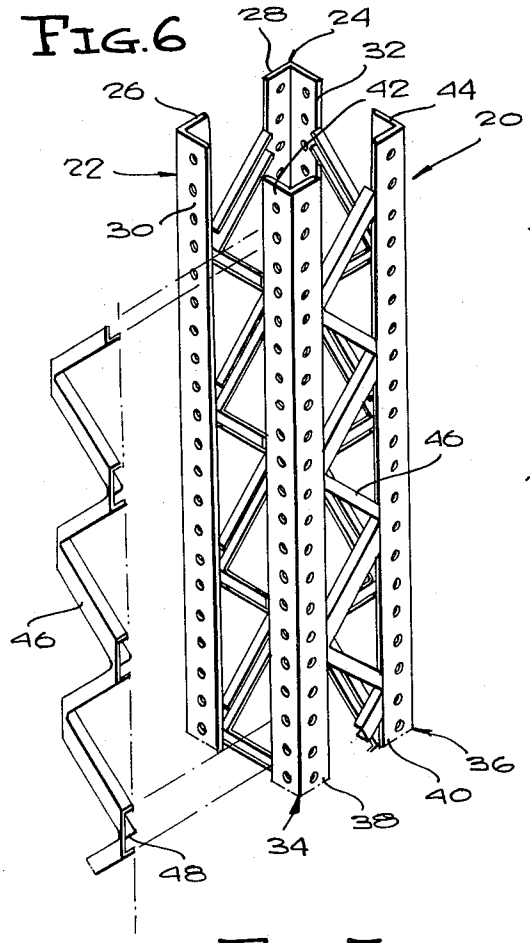


FIG. 8

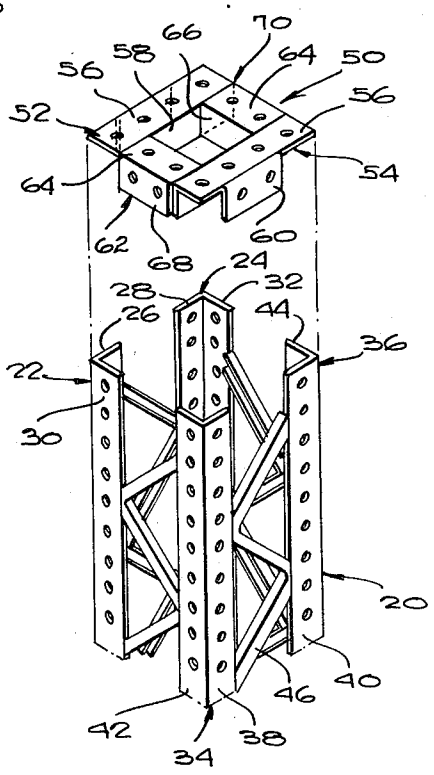
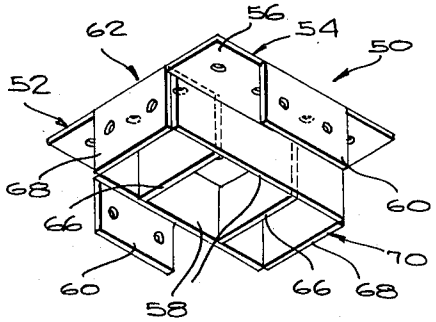


FIG. 7



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FIG. 9

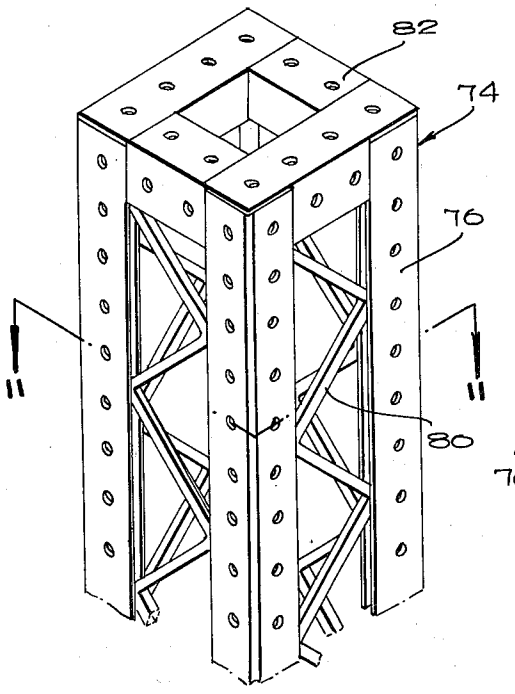


FIG. 10

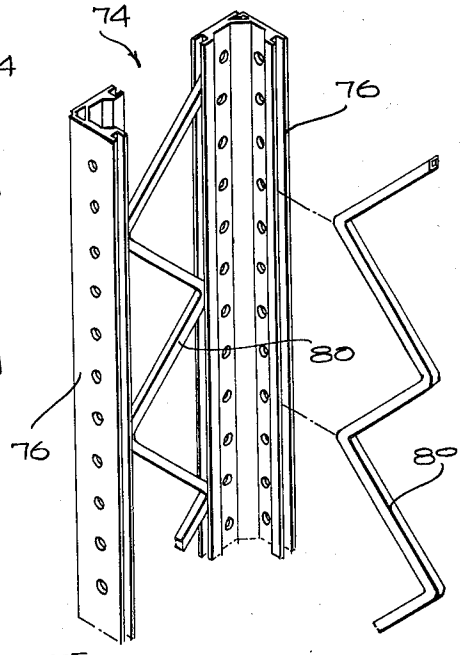
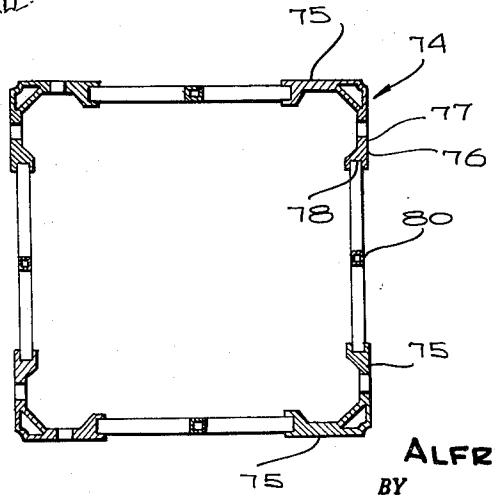


FIG. 11



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FIG. 12

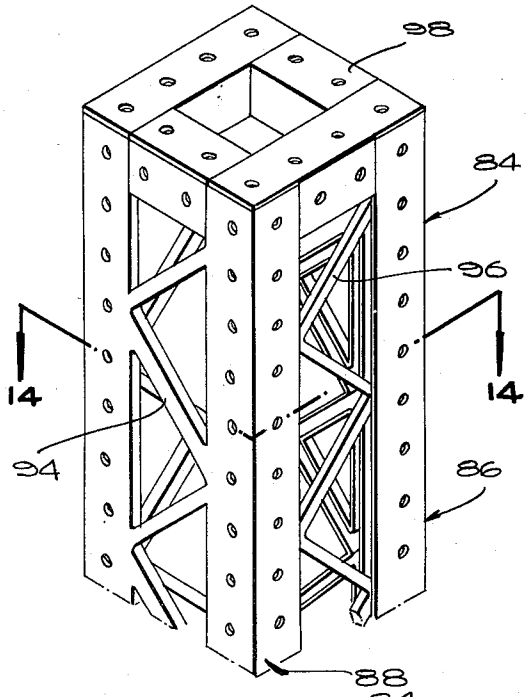


FIG. 13

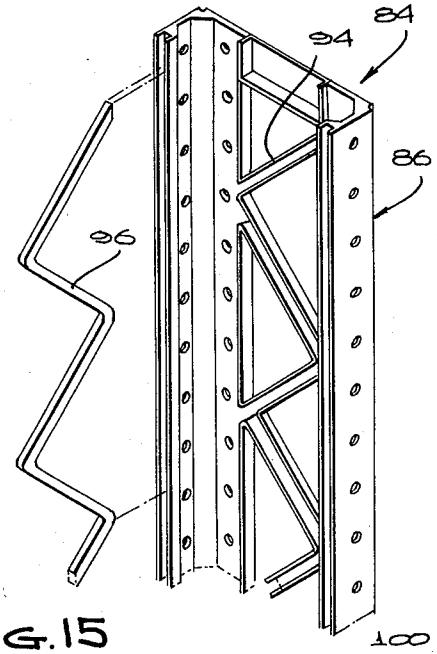


FIG. 14

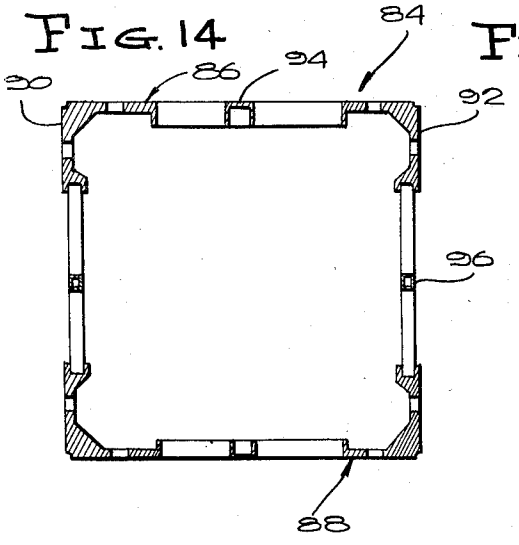
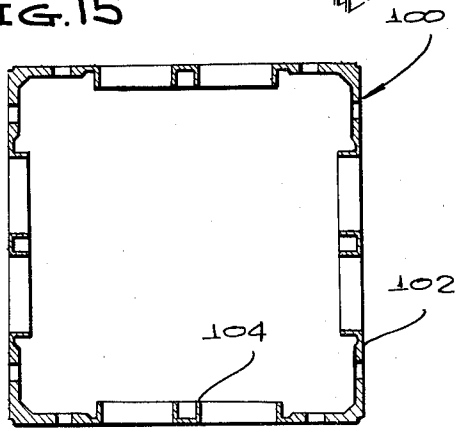


FIG. 15



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United States Patent Office 2,936,051 Patented May 10, 1960

2,936,051

METAL STRUCTURAL UNIT

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Application October 18, 1957, Serial No. 691,001

1 Claim. (Cl. 189—39)

The present invention relates to a metal structural unit for use in forming supporting columns in a skeleton building structure or as a girder connecting said supporting columns together.

An object of the present invention is to provide a metal structural unit which lends itself to rapid and efficient construction of supporting columns in a skeleton building, and one which may be used as a girder in such skeleton building, and one quickly and easily erected and dismantled.

Another object of the present invention is to provide a metal structural unit having maximum strength and minimum weight, one which lends itself to fabrication in modular units universally interchangeable, and one which is economically feasible.

These and other objects and advantages of the present invention will be fully apparent from the following description when taken in connection with the annexed drawings, in which:

Figure 1 is an isometric view, with portions broken away, of a skeleton building structure employing the metal structural unit constructed according to the present invention;

Figure 2 is a sectional view, on an enlarged scale, taken on the line 2—2 of Figure 1;

Figure 3 is a sectional view taken on the line 3—3 of Figure 2;

Figure 4 is a sectional view taken on the line 4—4 of Figure 2;

Figure 5 is a plan view of a section of the tie means in partially unformed condition, the dotted line showing indicating a portion bent for attachment to an adjacent leg of an angle member;

Figure 6 is an isometric view of one of the units of the present invention with the tie means of Figure 5 in formed condition and in condition for insertion within the unit;

Figure 7 is an isometric view of an end structure used with the unit of the present invention;

Figure 8 is an isometric exploded view of a portion of one of the units;

Figure 9 is an isometric view of a portion of a modified form of the unit of the present invention;

Figure 10 is an exploded view of part of the assembly shown in Figure 9;

Figure 11 is a sectional view taken on the line 11—11 of Figure 9;

Figure 12 is an isometric view of a portion of a still further modified form of the unit of the present invention;

Figure 13 is an exploded isometric view of part of the assembly shown in Figure 12;

Figure 14 is a sectional view taken on the line 14—14 of Figure 12; and

Figure 15 is a sectional view of yet another modified form of the metal structural unit of the present invention taken on a section similar to Figure 14.

Referring in greater detail to the drawings in which like numerals indicate like parts throughout the several views, the metal structural unit according to the present invention comprises an open-ended hollow beam 20 including a first pair of angle members 22 and 24 arranged so that leg 26 of the angle member 22 is in spaced alignment with one leg 28 of the angle member 24. The other leg 30 of the angle member 22 is in parallel spaced relation with respect to the other leg 32 of the angle member 24. This structure is best seen with reference to Figures 3 and 6. A second pair of angle members 34 and 36 are arranged so that one leg 38 of the angle member 34 is in spaced alignment with one leg 40 of the angle member 36. The other leg 42 of the angle member 34 is in parallel spaced relation with the other leg 44 of the angle member 36. The aligned legs 38 and 40 of the second pair of angle members 34 and 36 are positioned in parallel relation with respect to the aligned legs 26 and 28 of the angle members 22 and 24, respectively. The parallel legs 30 and 32 of the angle members 22 and 24, respectively, are in alignment with the parallel legs 42 and 44 of the angle members 34 and 36, respectively.

Tie means is provided by the present invention securing the adjacent and aligned legs of the first and second-named pairs of angle members 22 and 24, and 34 and 36, together. Specifically, this tie means embodies a zigzag shaped tie element 46 extending along and between and secured at the angle points of the element 46 to each of the aligned one legs 26 and 28 of the angle members 22 and 24, to each of the aligned legs 38 and 40 of the angle members 34 and 36, to the parallel legs 42 and 44 of the angle members 34 and 36 with parallel other legs 30 and 32 of the angle members 22 and 24, respectively. This tie element 46 is shown in Figure 5 and is a channel-shaped member having notches 48 cut therein at spaced intervals therealong. Each notch 48 extends in from alternating flanges of the tie element 46, across the width thereof, and to a point adjacent the opposite flange of the element 46. The dotted lines in Figure 5 show how the flange opposite the notch 48 is bent to permit the element 46 to assume a zigzag shape from one end to the other end for insertion between and securement to by welding or other suitable means, as shown in Figures 2 and 3, each of the aligned legs 32 and 44, 40 and 38, 42 and 30, and 26 and 28, as noted in the clockwise direction in Figure 3.

An end structure 50 is carried by each of the open ends of the beam 20, each end structure 50 embodying, as shown in Figures 7 and 8, a pair of channel members 52 and 54 each including a web 56 and a pair of flanges 58 and 60 projecting perpendicularly from the side edges of the web 56. The members 52 and 54 are disposed so that the webs 56 lie in the same plane and the flanges 58 and 60 of one channel member 52 are co-planar with and parallel to the flanges 58 and 60 of the other channel member 54.

The outer flanges 60 of the pair of channel members 52 and 54 are of a size conformably to fit between the aligned legs 26 and 28 of the angle members 22 and 24 and between the aligned legs 38 and 40 of the angle members 34 and 36.

A connecting member 62 including a web 64 and a pair of flanges 66 and 68 projecting perpendicularly from the side edges of the web 64 is positioned between the channel members 52 and 54 adjacent one of the ends of the latter with the web 64 lying in the same plane as the webs 56 of the channel members 52 and 54 and with the flange 68 flush with the adjacent ends of the channel members 52 and 54 and with the other flange 66 between and abutting the inner flanges 58 of the pair of channel members 52 and 54.

Another connecting member 70, also having a web 64 and flanges 66 and 68, is similarly positioned with respect to the other adjacent ends of the channel members 52 and 54.

It is to be noted that each end structure 50 with the connecting channel members 62 and 70 constitutes an end cap piece which is mounted within and carried by each of the open ends of the beam 20 and has a plurality of flanges 58, 60, 66 and 68 with a flange received between adjacent legs of two pairs of angle members 22 and 24 and 34 and 36.

Each end structure 50 is disposed with respect to the beam 20 so that the other flange 60 of the channel member 52 of the pair of channel members 52 and 54 is received between the aligned one legs 26 and 28 of the angle members 22 and 24, respectively, and the inner flange 58 of the channel member 52 is received between and abuts the other legs 30 and 32 of the angle members 22 and 24, respectively, and the web 56 of the channel member 52 engages the free edges of the angle members 22 and 24. The outer flange 60 of the other channel member 54 is similarly received between the aligned legs 38 and 40 of the angle members 34 and 36, respectively, and the inner flange 58 of the channel member 54 is received between and abuts the legs 40 and 42 of the angle members 34 and 36, respectively. The web 56 of the channel member 54 engages the free edges of the angle members 34 and 36.

The connecting members 62 and 70 are received respectively between the parallel other legs 30 and 32 of the angle members 22 and 24 and the parallel legs 42 and 44 of the angle members 34 and 36.

The beams 20 may be used to form the legs of such a structure as is shown in Figure 1 with a beam 20' serving as a cross girder extending between the legs intermediate the ends thereof and with another beam 20", of increased width, serving as a top girder extending between the upper ends of the legs of the structure. Each of the beams 20, 20' and 20" are formed as above described and are connected together by bolt and nut assemblies 72, as shown in Figure 2.

In Figures 9 to 11, a modified form of the beam is shown and is designated generally by the reference numeral 74. The beam 74 is formed of a plurality of angle members 76, each having legs 75 and 77 with a channel 78 extending along the free end of each of the legs 75 and 77. Each channel 78 receives the angle point of the zigzag shaped tie element 80 extending along the channel 78 formed on each of the aligned legs 75 and 77 of the adjacent angle member 76 and along the channels 78 of the parallel legs 75 and 77.

An end structure 82 is secured to each of the open ends of the beam 74 and is identical in construction and assembly to the previously described end structure 50.

In Figures 12 to 14, a further modified form of the beam of the present invention is shown in which the beam is designated generally by the reference numeral 84 and consists in two sections 86 and 88, each having angle members 90 and 92 and a connecting tie element 94 extending between the angle members 90 and 92 and formed integrally therewith by casting or molding. A tie element 96, identical in structure with the tie element 80, extends between the adjacent angle members 90 and 92 of the sections 86 and 88 and connects the aligned flanges thereof together. An end structure 98 extends over the open end of the beam 84 and is identical in structure with the end structure 50 and end structure 82 previously described.

In Figure 15 a still further modified form of the beam is shown and is designated by the numeral 100 and in which all of the angle members 102 and the tie elements 104 are connected together and formed integrally by a process of molding, casting, or rolling, or other process well known in the art.

It is to be understood that the beam 74, 84, or 100, may be substituted for the beam 20 in forming the skeleton building structure shown in Figure 1 or any other building structure as desired.

It will be seen, therefore, that the metal structure unit of the present invention in each of the embodiments above described may be formed in such sizes as is desired and preferably in modular units interchangeable for rapid and efficient erection of skeleton building structures in which the units may be used as columns or girders.

While only preferred embodiments of the present invention have been shown and described, other embodiments are contemplated and numerous changes and modifications may be made therein without departing from the spirit of the invention as set forth in the appended claim.

What is claimed is:

A metal structure unit for use in forming supporting columns in a skeleton building structure or as a girder connecting said supporting columns together, said unit comprising an open ended hollow beam including a first pair of angle members arranged so that one of the legs of one member is in spaced alignment with one of the legs of the other member with the other of the legs of both of said members in parallel spaced relation, a second pair of angle members arranged so that one of the legs of one member is in spaced alignment with one of the legs of the other member with other of the legs of both of said second pair of members in parallel relation, the aligned one legs of said second pair of members being positioned in parallel relation with respect to the aligned one legs of said first pair of members with the parallel other legs of said second pair of members in alignment with the parallel other legs of said first pair of members, tie means securing the legs of said first and second-named pairs of angle members together, and an end structure carried by each of the open ends of said beam, each of said end structures embodying a pair of channel members each including a web and a pair of flanges projecting perpendicularly from the side edges of said web disposed so that the webs lie in the same plane and the flanges of one of the channel members are parallel to and co-planar with the flanges of the other of the channel members, the outer ones of the flanges of said pair of channel members being of a size to conformably fit between the aligned one legs of said first pair of angle members and said second pair of angle members, a connecting member including a web and a pair of flanges projecting perpendicularly from the side edges of said web positioned between said pair of channel members adjacent each of the adjacent ends of said pair of channel members so that the web lies in the plane of the webs of the pair of channel members with one of the flanges flush with the adjacent ends of said pair of channel members and the other of the flanges between and abutting the inner ones of the flanges of said pair of channel members, said end structure being disposed so that the outer one of the flanges of one of said pair of channel members is received between the aligned one legs of said first pair of angle members and the inner one of the flanges of said one of said pair of channel members is received between and abuts the other of the legs in parallel spaced relation of said first pair of angle members with the web engaging the free edges of said first pair of angle members, the outer one of the flanges of the other of said pair of channel members is received between the aligned one legs of said second pair of angle members, and the inner one of the flanges of said other of said pair of channel members is received between and abuts the other of the legs in parallel spaced relation of said second pair of angle members with the web engaging the free edges of said second pair of angle members, and the connecting members are received respectively between said parallel other legs of said second pair of angle members aligned with

the parallel other legs of said first pair of angle members.

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