Jan. 9, 1940. W. VON HOEFEN 2,186,310

METAL BUILDING CONSTRUCTION

Filed July 12, 1937 4 Sheets-Sheet 1

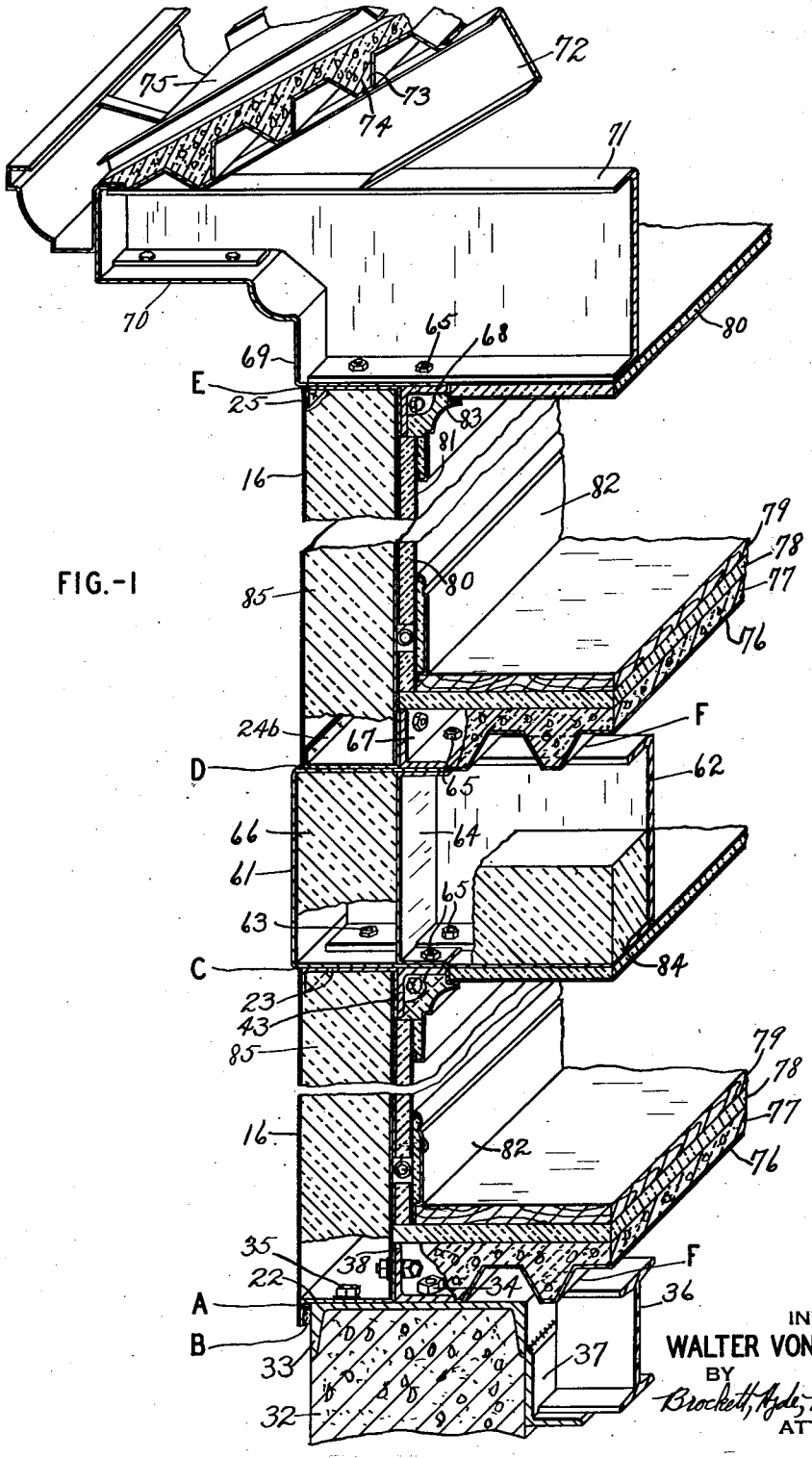


FIG.-1

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METAL BUILDING CONSTRUCTION

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FIG.-2

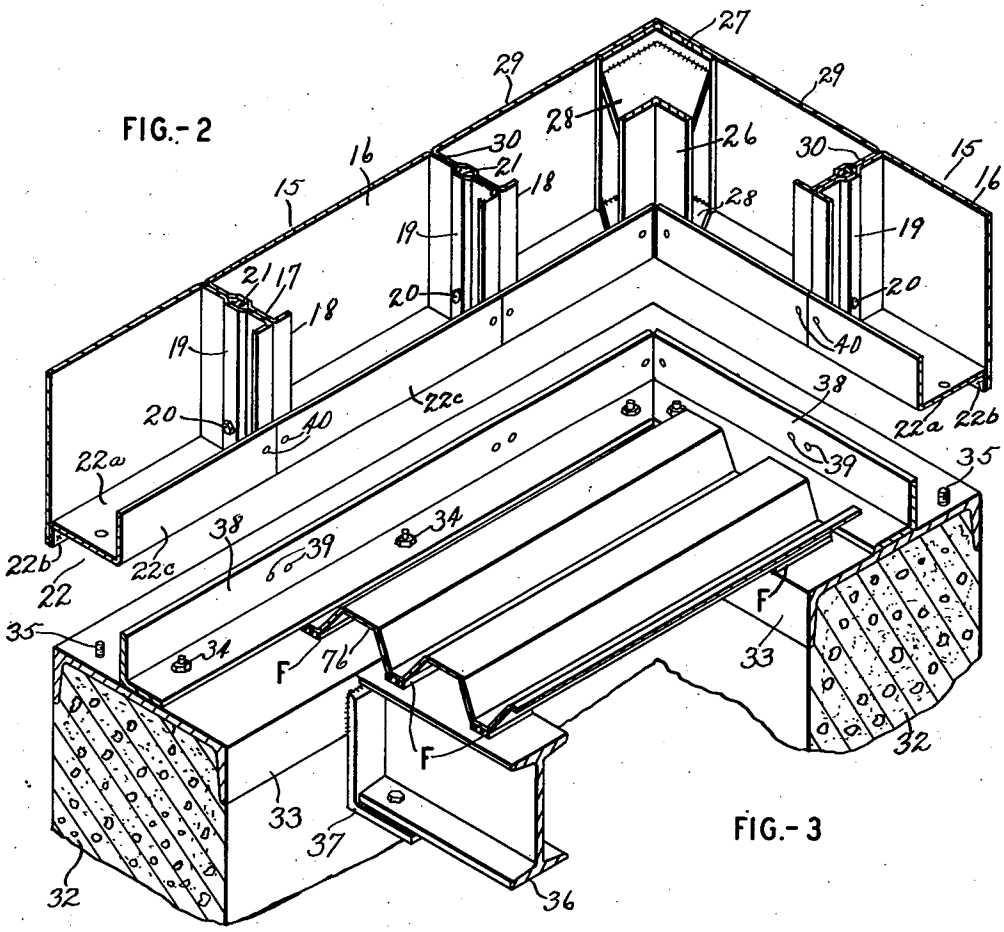


FIG.-3

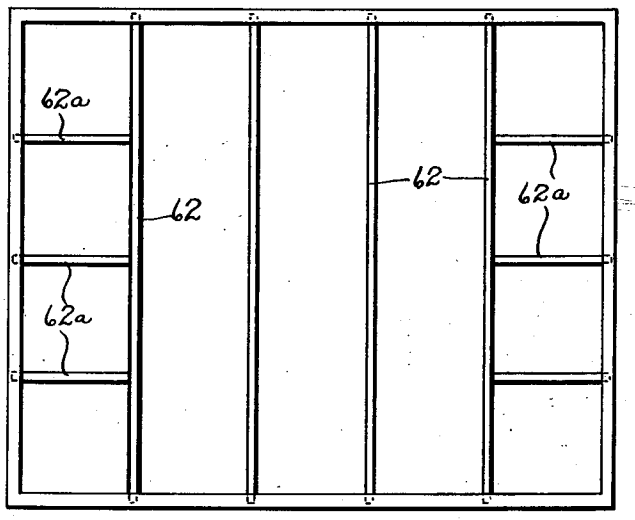


FIG.-12

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METAL BUILDING CONSTRUCTION

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FIG.-4

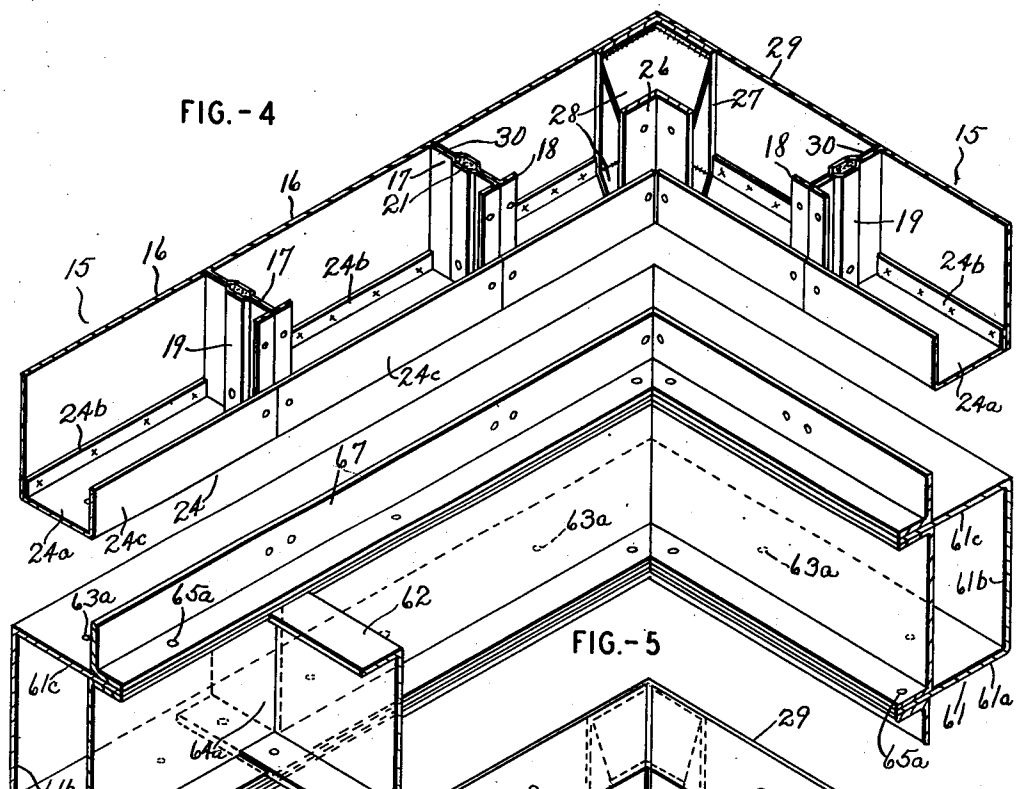


FIG.-5

FIG.-6

FIG.-7

FIG.-8

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METAL BUILDING CONSTRUCTION

Filed July 12, 1937 4 Sheets-Sheet 4

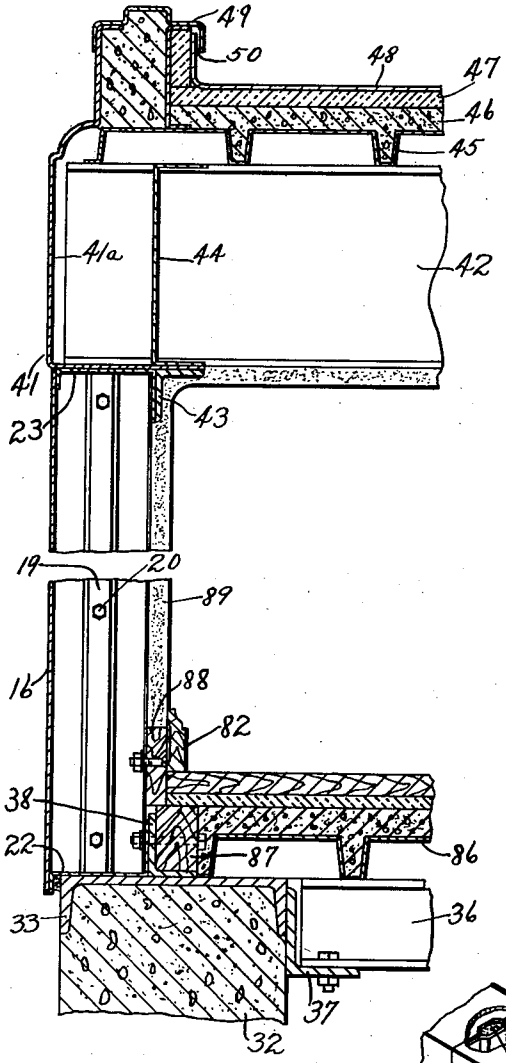


FIG.- 9

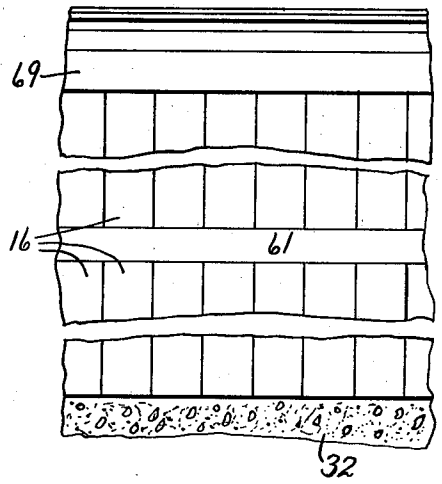


FIG.-11

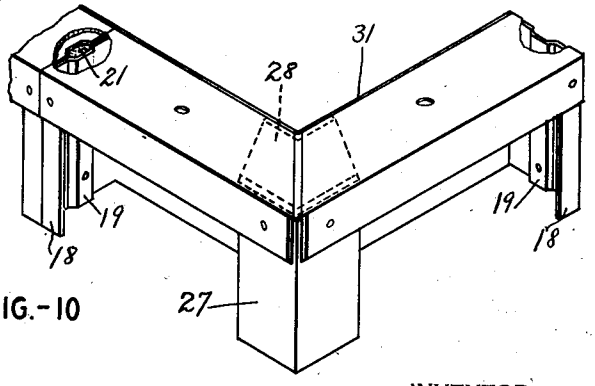


FIG.-10

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Patented Jan. 9, 1940 2,186,310

UNITED STATES PATENT OFFICE

2,186,310

METAL BUILDING CONSTRUCTION

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Application July 12, 1937, Serial No. 153,104

8 Claims. (Cl. 189—1)

This invention relates to improvements in metal building construction.

One of the objects of the present invention is to provide in a metal building, wall and floor construction requiring a minimum number of parts while at the same time providing a very strong structure.

Another object of the present invention is to provide prefabricated wall panels of novel form adapted to be assembled in place in the building with a minimum number of operations and fastenings and with a maximum strength in the finished structure.

My invention also provides a novel construction between floors whereby the joists for the upper floor are supported upon the walls of the lower floor in a novel manner and the structure which houses the joist ends also supports the wall for the upper floor. In this connection a novel box beam structure is provided of the same depth as the joists which forms a very strong support for the upper story wall and at the same time forms a novel container for insulation.

My invention also provides novel wall corner members which are adapted also to combine with the above mentioned panels so that when the corner members and panels are placed side by side they form a vertical wall structure extending completely around a building having any usual wall conformation.

My invention also provides novel roof structures adapted to be combined with the wall and floor structure mentioned above. My invention also comprises novel forms of structural members entering into the structures outlined in the preceding paragraphs and novel means for assembling and securing the same in place all as will more clearly appear in the accompanying drawings and specifications and the essential features of which will be set forth in the claims.

In the drawings,

Fig. 1 is a sectional elevation in perspective showing portions of the foundation, walls and floors of a multiple story building surmounted by a gabled roof structure;

Fig. 2 is a perspective view of the lower portion of a vertical wall adapted to rest upon a building foundation;

Fig. 3 is a view of a foundation suitable to support the wall of Fig. 2;

Fig. 4 is a view similar to Fig. 2 and shows the lower portion of the wall of an upper story;

Fig. 5 is a perspective view showing a between-floors construction;

Fig. 6 is a perspective view of the upper portion of the vertical wall of a lower floor, the parts of Figs. 4, 5 and 6 being adapted to fit together although not necessarily assembled in the form shown;

Fig. 7 is a perspective view of one of the members of Fig. 5;

Fig. 8 is similar to a corner portion of Fig. 6 showing an alternative form of construction;

Fig. 9 is a sectional elevation of a single story building showing certain modifications in the wall, ceiling and roof structure;

Fig. 10 shows a form of corner construction for an interior building corner;

Fig. 11 is an outer side elevation of a two story building formed of my novel building units; while

Fig. 12 shows a suitable arrangement of joist structure between floors.

One of the novel features of my building structure is the novel panels which form the vertical walls. These panels are adapted to be preformed so that the major portion of the formation of the vertical walls may be performed in the shop and the units assembled on the job. These panels are preferably channel shape in horizontal section and preferably bent from a single sheet of metal. The preferred form is best seen in Figs. 1, 2, 4 and 6. Each panel 15 has a web 16 and flanges 17 at right angles thereto. These panels are assembled in the building with their webs alined along the outer wall surface and their flanges in contact and secured together. The interior wall is then secured to the free edges of the flanges. Preferably the free edges of the flanges are bent back parallel to the web 15 as shown at 18 so as to provide additional strength in the panel and to give a better means for securing the tie members, cap members and interior wall to the panels.

Extending longitudinally of the central portion of each flange 17 is a rib-like deformation 19 extending inwardly from the outer face of the flange. When the panels are placed in juxtaposition the deformations 19 of adjacent flanges register forming a pocket between them. Before assembling the panels these deformations are filled with a metal cement. A suitable cement for this purpose where the panels are formed of steel, is a commercial cement known as "Hy-tempite.". When the panels are assembled as shown in Figs. 1 and 4, they are held together by bolts 20 but very quickly the cement in the pockets 21 between the rib-like deformations hardens and forms a continuous bond extending the entire length of the flanges of each panel,

at the same time forming a weatherproof joint at this point. It will be noted that the panels are formed of a length corresponding to the height of a single story of a building to be constructed and that the ends of the panels are substantially sealed by the cap members 22 and 23 in the case of a lower story and 24 and 25 in the case of an upper story. The member 22 at the bottom of a lower story panel is of substantially Z-shape having a web 22*a* closing the bottom of the panel, an outer flange 22*b* spot welded to the web 16 of its associated panel, and an inner flange 22*c* either spot welded or secured by bolts to the flange portions 18 of the associated panel. The members 23 and 25 are alike and the member 24 is similar except that it is turned in the opposite direction. These members have outer flanges having the suffix *b*, spot welded to the web of the associated panel and inner flanges having the suffix *c* secured to the panel flange portions 18 either by welding or by bolts. In the form shown in Figs. 2, 4 and 6, the panel flanges 17 are cut away at the ends for the thickness of a sheet of metal permitting the webs (having the suffix *a*) of the cap members to abut thus effectively sealing the ends of the panels. In the form shown in Fig. 8, the cap member web 23*a* ends at the rib 19 which substantially seals the ends of the panels but leaves a slight opening in this form of construction.

The corner column construction as shown in Figs. 2, 4 and 6 comprises an inner angle section 26 and an outer angle section 27 spaced apart with their legs alined respectively along the inner and outer walls of the building. These angle sections are preferably of the height of one story and are rigidly tied together either by the plate members 28 welded in place as illustrated at spaced points along the column or by strap members or the like in similar locations. This corner column is united with a corner plate 29 to form a wall corner member adapted to combine with the previously described panels to form a complete wall. The plate member 29 has flange portions 30 in all respects similar to the flange portions 17 of the panels. While the corner columns are shown in position for an exterior corner of the building, the same structure serves for the interior corner by simply securing a plate 31 to the angle 26 instead of to the angle 27. This form of corner member is shown in Fig. 10.

I prefer to assemble each panel with its end or cap members in the shop and likewise each corner member as I have described it. These members after assembly may be dipped in a ground coating, then sprayed with enamel and baked to provide any desired finish and to make them rust-proof. I do not limit myself to this method of finishing, however, as it will occur to those skilled in this art that many other types of finish may be applied to the structure here shown.

In forming a building upon a proper site, the foundation wall 32 of any suitable form is built and means provided on the top of the wall to secure my novel panels and corner members thereto. In the form shown, upon a concrete foundation I have secured a channel 33 with the flanges turned downwardly and punched to accommodate suitable bolts such as 34 and 35 by which the wall structure may be secured to the foundation. Joists 36 for supporting the first floor are suitably supported in the foundation as for instance by the chairs 37 formed of angle sections welded to the channel 33. The panels and corner members are then assembled in side by side relationship forming the vertical side walls of the building, each having a rib 19 filled with cement as previously described before being placed in position and then being secured to the channel 33 by the bolts 35. Preferably at the joint A a white rubber latex is applied for weatherproofing purposes and a caulking cement may be applied at the point B as illustrated in Fig. 1 for a similar purpose. A tie member 38 fastened by bolts in the bolt holes 39, as shown, securely and rigidly fastens together the lower ends of all of the panels and corner members. These tie members may be mitered at the corners as shown in Figs. 3 and 5. If desired, the bolts in the openings 39 may also pass through the openings 40 of the cap members 22 so as to secure those in place.

Where the building is of one story as illustrated in Fig. 9, a suitable roof structure may be superimposed upon the side walls as shown and described. In such a case a bearing plate 41 extends across the tops of the assembled panels and corner members and upon this rest the joists 42 supporting the roof. A tie member 43 is secured to the tops of all of the panels and corner members and secured to the plate 41, thus rigidly tying the structure together. Preferably the plate 41 has a portion 41*a* bent upwardly to form an outer wall surface of the depth of the joist 42 and this plate may extend upwardly as shown to form a finishing cornice. Spaced from the plate 41*a* is a shallow channel 44 filling the space between the joists and the space between 41*a* and 44 may receive a loose insulating material. On the joists 42 any suitable roof is supplied, that illustrated comprising a bent metal plate 45 having strengthening ribs as shown which is filled preferably with an insulating concrete 46 on top of which is further insulating material 47 and a sealing cover 48. The cornice may be capped as shown at 49 and the joint caulked at 50.

Where a multiple story building is to be formed, I show a between-floor construction in Figs. 1 and 5. On top of the panels and corner members is a bearing plate 61*a* which is preferably the lower flange of a deep channel 61 which has a web 61*b* forming an outer wall surface and an upper flange 61*c*. This deep channel may extend entirely around the structure and forms both a sealing means and a tie plate for the wall below it and a bearing plate for the joists resting upon it. Suitable joists of channel form are shown at 62 of a depth adapted to fit snugly between the flanges 61*a* and 61*c* of the deep channel. These joists rest upon the flange 61*a* and are supported by the wall structure therebeneath. The flanges of the joists 62 are secured by suitable bolts 63 to the flanges 61*a* and 61*c* and to the cap members 23 and 24. Bolt holes 63*a* are provided for this purpose. Spaced from the web 61*b* are filler plates 64 extending between the joists and entirely around the building and preferably in the form of a shallow channel as shown. These are secured to the deep channel by bolts 65 through holes 65*a* so that with the deep channel 61 a box beam or girder is formed making a strong support for the superstructure above it. At the same time the deep channel 61 houses and finishes off the space otherwise required for the joists 62 and also gives a convenient space housing insulation 66 which may be any suitable

form of insulation. 64*a*, Figs. 5 and 7, shows the manner in which the member 64 may have the flanges cut away to permit the web to fit snugly within the joists 62.

An upper story wall may then be assembled resting upon the flange 61*c* of the deep channel and supported by the box beam structure just described. The walls of the upper story are formed in a manner entirely analogous to that of the lower story already described. Preferably a white rubber latex is applied at the points C, D and E for weatherproofing purposes. Tie members 67 and 68 are secured along the bottom and top respectively of the panels and corner members forming the upper wall. These tie members are also secured by bolts 65 to the box beam and joists.

A gable roof structure is illustrated in Fig. 1 wherein a bearing plate 69 extends along the top of the second story wall and this plate is bent outwardly at 70 as shown to form a cornice. Joists 71 resting on plate 69 and bolted to the plate and wall structure support the roof. This roof may be of any suitable form, that shown having rafters 72 and a bent plate purlin structure 73 filled with an insulating cement 74 and surmounted by the roof cover 75.

The interior floors, walls and ceilings may be of any desired type, several of which are shown. In Fig. 1 on the joists 36 and 62 is metallic flooring 76 filled with an insulating cement 77 upon which is mastic 78 in which is set a floor 79. At points F (Figs. 1 and 3) a latex sound insulating cushion is provided. The walls and ceiling are of a wall board 80 preferably having insulating properties and it may be metal clad as at 81. The flanges 18 may be drilled as at 18*a* for attachment of the interior finish wall. Suitable baseboards 82 and moldings 83 may be applied. If desired between floors insulation 84 may be applied between the ceiling of the first floor and the floor above it. As the panels are assembled as shown in Figs. 1, 2, 4 and 6, they are open toward the interior of the building and before the interior wall finish is applied insulation may be supplied at these points as indicated at 85. This insulation may be of any desired form, but web material which may be of the entire length of the panel and folded therein is suitable for this purpose. The floor structure shown in Fig. 9 shows a different form of metal flooring 86 and indicates wooden beams at 87 and 88 bolted to the metal structure and forming means for securing the floors and wall members in place. In this structure the interior wall is of the usual plaster finish 89.

An arrangement of joists suitable between floors is shown in Fig. 12 where the joists 62 nearest the parallel side walls have abutting them at right angles the joists 62*a* welded to the joists 62 at one end and entering the box beam structure 61—64 at their other ends.

It will be understood that my entire building may be built of metal of comparatively light gage. For instance, the panels may be formed of 16 gage steel, the deep channel 61 of 14 gage, and the joists 62 of 10 gage. With these comparatively light metal parts formed and assembled as shown an exceedingly strong building structure is provided.

While nothing has been said herein as to doors and windows, it will be understood that special panels are provided for this purpose which are merely modifications of the panels 15 here described.

What I claim is:

1. In metal house construction, wall corner members having spaced vertically extending 90° angle sections with their legs respectively parallel and substantially in alinement with the inner and outer faces of the wall, tie members rigidly connecting said angles, a plate forming the outer wall surface secured to the legs of said outer angle section, said plate extending along each outer wall from said corner and each end of said plate then being bent inwardly substantially at right angles to said outer wall, said bent portions continuing inwardly for substantially the thickness of said wall.

2. In metal house construction, a vertical side wall comprising corner members having spaced vertically extending 90° angle sections with their legs respectively parallel and substantially in alinement with the inner and outer faces of the wall, tie members rigidly connecting said angles, a plate forming the outer wall surface secured to the legs of said outer angle section, said plate extending along each outer wall from said corner and each end of said plate then being bent inwardly substantially at right angles to said outer wall, said bent portions continuing inwardly for substantially the thickness of said wall, panels channel shape in horizontal section, said panels and corner members being placed side by side to form a continuous wall with corners, said panels adjacent said corner members having their flanges contiguous with the bent plate portions of the corner members, other panels being placed flange to flange, and all of said panels and corner members being rigidly secured together.

3. Metal house construction as in claim 2, wherein all of said corner members and panels are of one story height, an interior wall extending between the inner angle legs of the corner members and the bent portions thereof and extending across said panels and secured to the inner edges of the flanges of said panels, and means substantially closing the open ends of said panels and corner members, top and bottom.

4. In a metal house, between-floors construction comprising a box beam resting upon a lower story vertical side wall, a plurality of joists of a depth equal to the interior vertical dimension of said beam, said joists entering said beam at spaced points and resting on the lower flange thereof and secured thereto, and an upper story vertical side wall resting upon said beam.

5. Insulated metal house construction comprising lower and upper story side walls each having a plurality of panels generally channel shape in horizontal section secured flange to flange with their webs alined along the outer wall surface, means substantially closing the tops and bottoms of said panels, interior walls secured to the free edges of said flanges and closing the inner sides of said panels, a deep channel with its web vertical and toward the outside and having its lower flange resting upon the top of said lower story wall and having the upper story wall resting upon its upper flange, joists entering said deep channel and fitting snugly between the flanges thereof and secured thereto, plate members parallel to said deep channel web and extending between said joists whereby to form with said deep channel substantially a box beam, and insulating material in said box beam and in said panels.

6. In metal building construction, a wall comprising a plurality of panels generally channel shape in section placed flange to flange, each panel having a rib-like deformation extending

inwardly from the outer face of each flange and extending longitudinally of the flange, said deformations on contiguous flanges being in register, and a metal bonding cement in said deformations adhesively securing said flanges together.

7. In metal building construction, a wall comprising a plurality of metal panels generally channel shape in section placed flange to flange, at least one of said panels having deformations extending inwardly from the outer face of its flange, and a metal bonding cement in said deformations adhesively securing contiguous flanges together.

8. In metal building construction, a wall comprising a plurality of metal panels generally channel shape in section placed flange to flange, at least one flange of each pair of contiguous flanges being inwardly deformed over substantially the full length of the panel, and a metal bonding cement held by said deformed flange and adhesively securing the contiguous flanges together.

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