Dec. 6, 1938. H. H. KELLER 2,138,927

BUILDING CONSTRUCTION

Filed Nov. 25, 1935 5 Sheets-Sheet 1

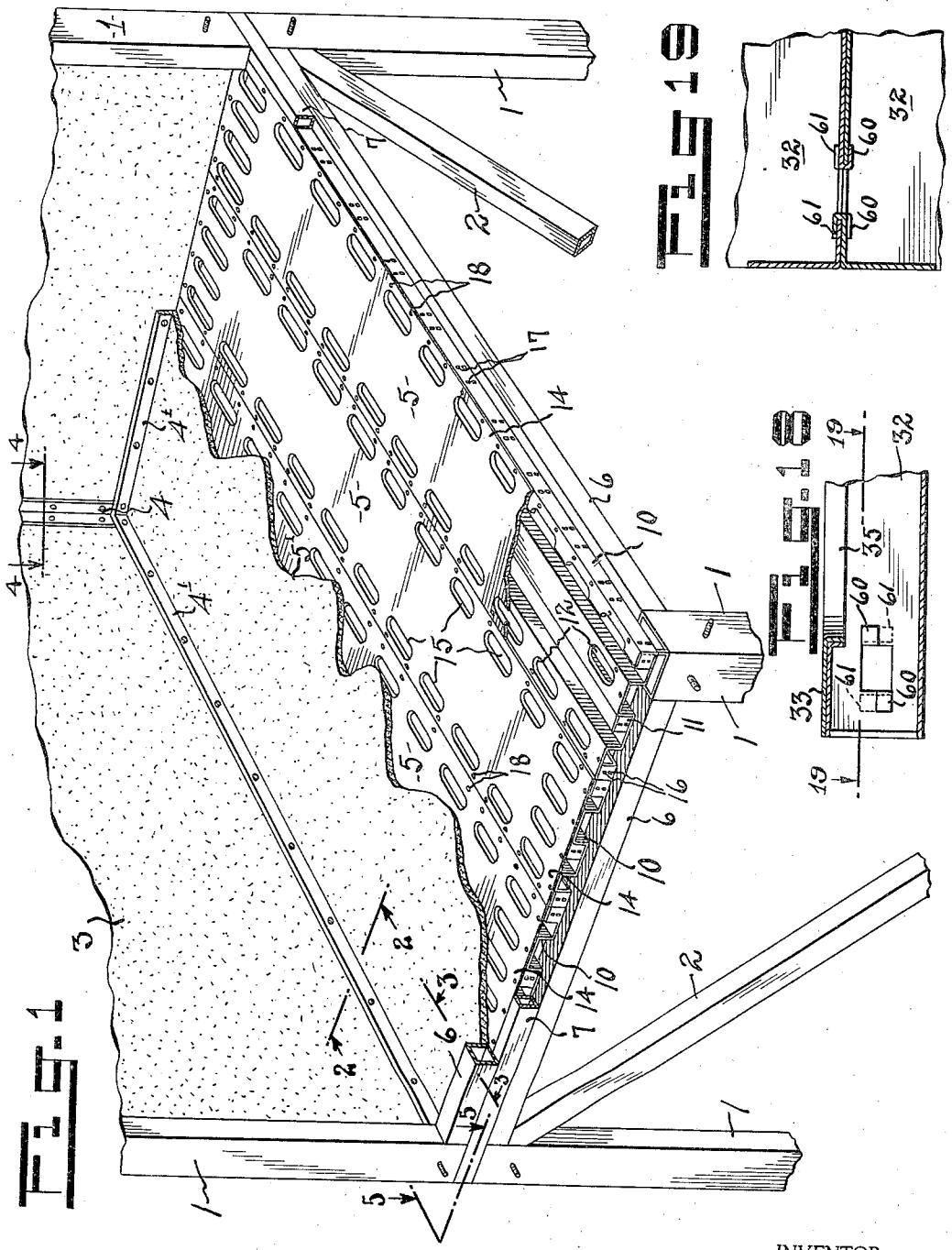


Fig. 1



Fig. 2



Fig. 3

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Fig. 4

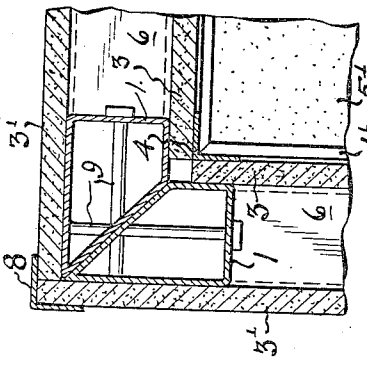


Fig. 5

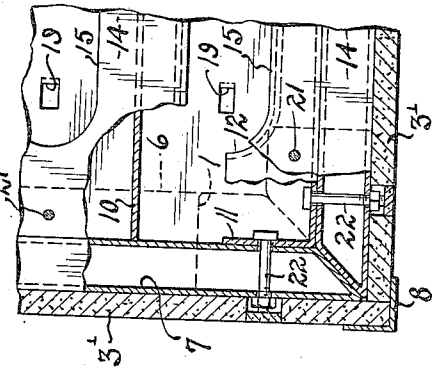


Fig. 3

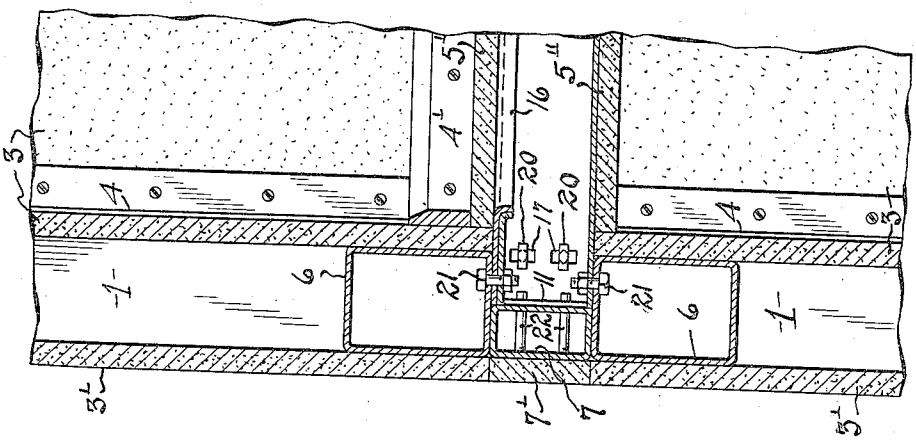
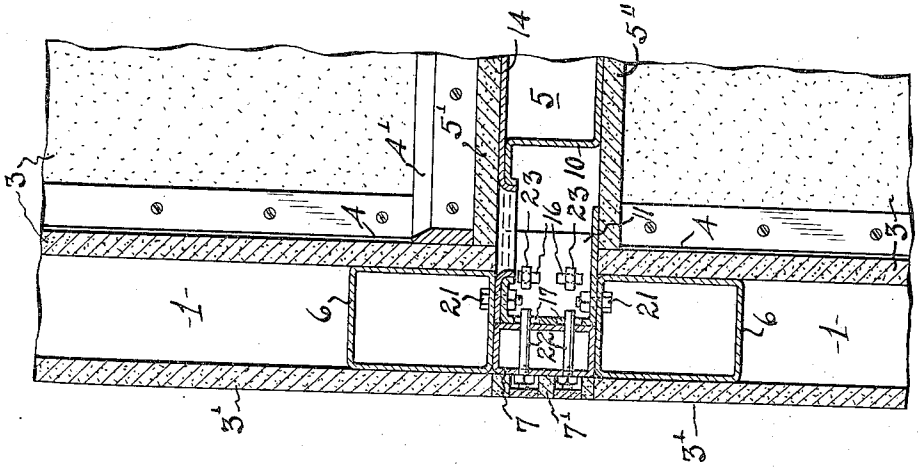


Fig. 2



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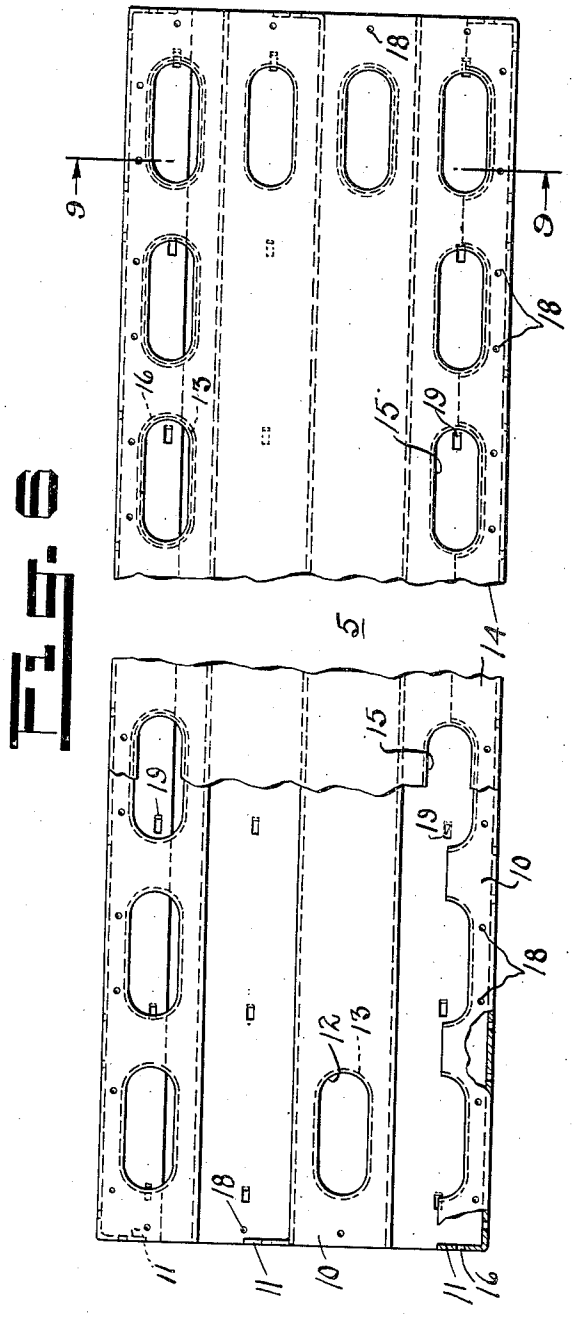


Fig. 6

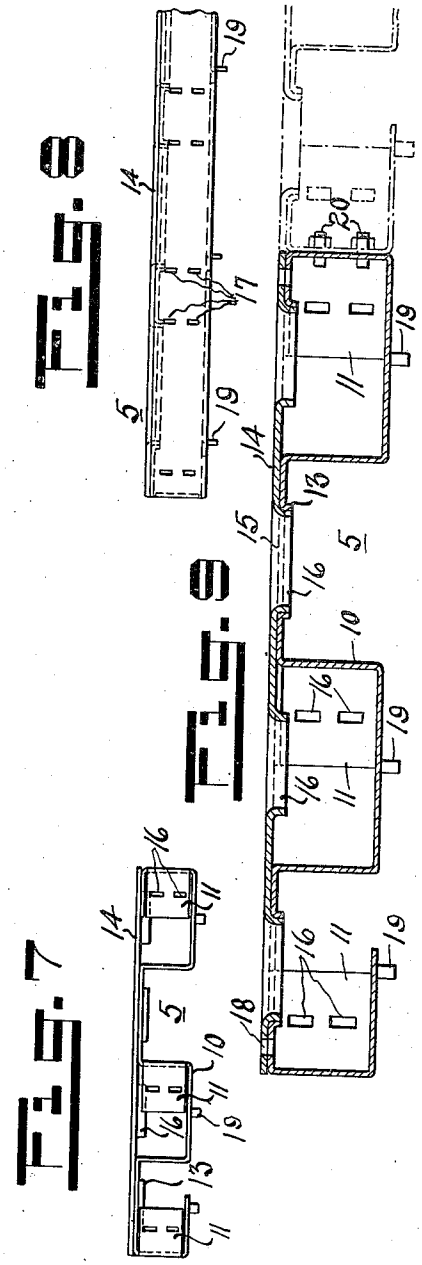


Fig. 8



Fig. 9



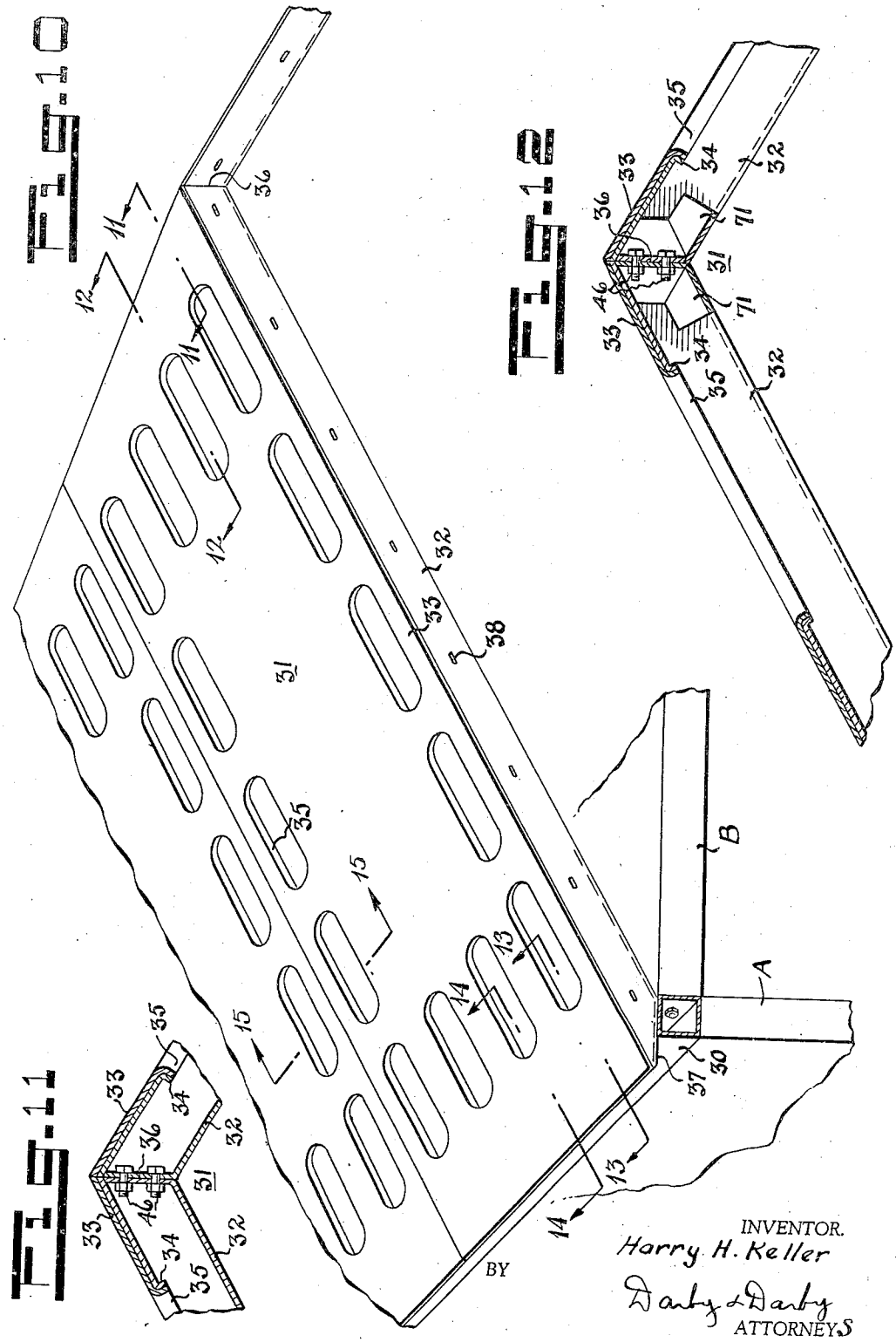
Fig. 7

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BUILDING CONSTRUCTION

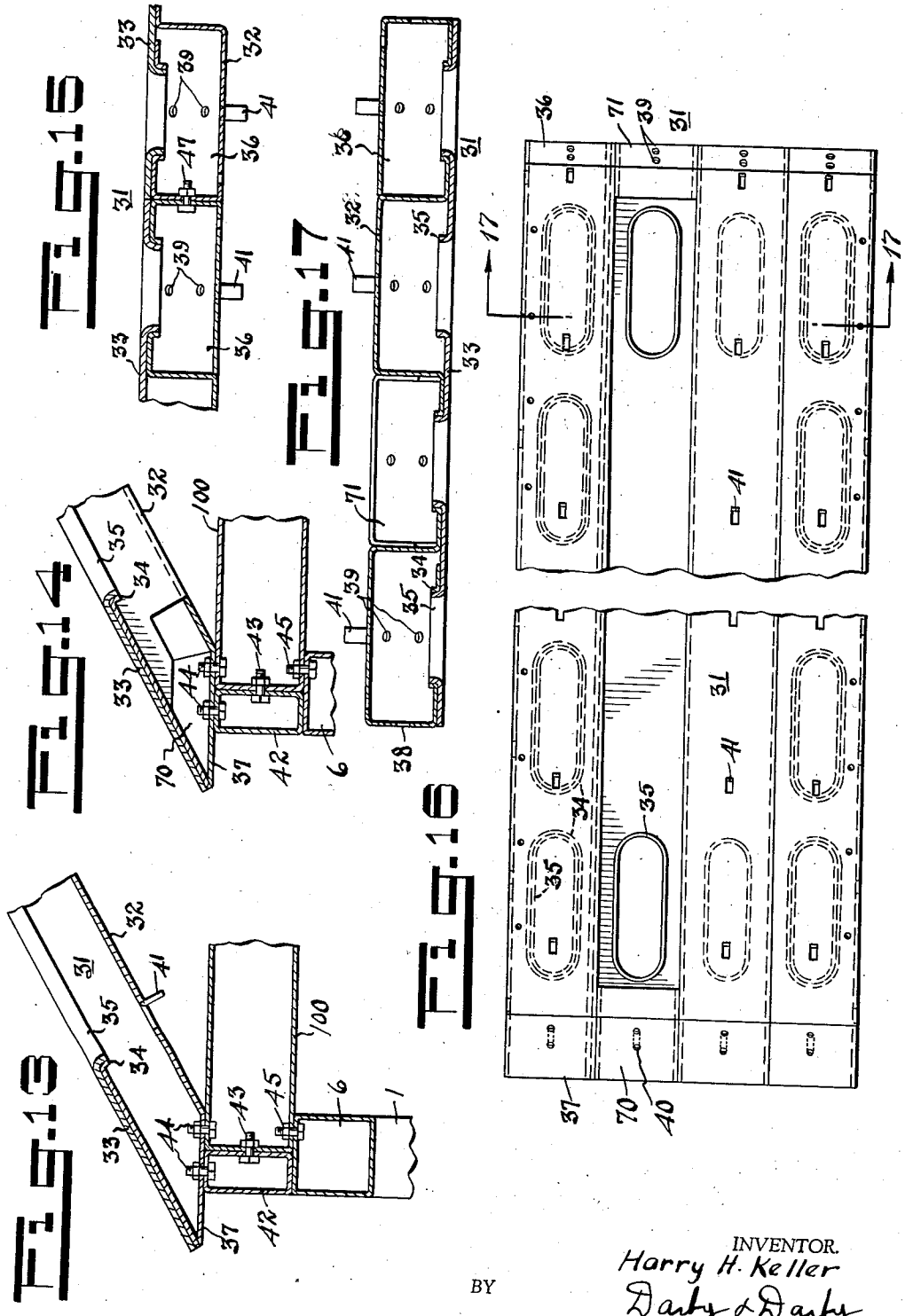
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BUILDING CONSTRUCTION

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Patented Dec. 6, 1938

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# UNITED STATES PATENT OFFICE

2,138,927

## BUILDING CONSTRUCTION

Harry H. Keller, Ventnor, N. J., assignor to Bitting Incorporated, New York, N. Y., a corporation of Delaware

Application November 25, 1935, Serial No. 51,494

12 Claims. (Cl. 189—34)

This invention relates to improvements in building construction with special relation to prefabricated floor and roof members.

The general object of this invention is to provide an improved form of floor and roof member which may be assembled side by side to form the floors and roofs of buildings and the like.

An important object of the invention is to provide members of this type which are exceedingly simple in construction, light in weight, and very strong in use.

A further object of this invention is to provide in combination with such floor and roof members means for attaching them to the side walls to form a sort of "drum head" construction, by means of which loads thereon are directly transmitted through the tensioned members to the side walls.

Other objects of the invention involve the details of construction of the members and the means for attaching them together and to the side walls.

These and many other objects, as will appear from the following disclosure are secured by means of this invention.

This invention resides substantially in the combination, construction, arrangement and relative location of parts, all as will be described in full detail in connection with the attached drawings, and defined in the appended claims.

Referring to the drawings,

Figure 1 is a perspective view of a room showing the side wall members and the floor members united together with some parts broken away;

Figure 2 is a cross sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a cross sectional view taken on the line 3—3 of Figure 1;

Figure 4 is a cross sectional view taken on the line 4—4 of Figure 1;

Figure 5 is a plan view at one corner with some parts broken away;

Figure 6 is a top plan view of one of the floor units with the cover plate partly broken away;

Figure 7 is an end elevational view of a floor unit;

Figure 8 is a side elevational view of one end of a floor unit;

Figure 9 is a cross sectional view taken on the line 9—9 of Figure 6;

Figure 10 is a perspective view of a portion of a roof structure in accordance with this invention;

Figure 11 is a cross sectional view taken on the line 11—11 of Figure 10;

Figure 12 is a cross sectional view taken on the line 12—12 of Figure 10;

Figure 13 is a cross sectional view taken on the line 13—13 of Figure 10;

Figure 14 is a cross sectional view taken on the line 14—14 of Figure 10;

Figure 15 is a cross sectional view taken on the line 15—15 of Figure 10;

Figure 16 is a bottom plan view of one of the roof units or members;

Figure 17 is a cross sectional view taken on the line 17—17 of Figure 16;

Figure 18 is a vertical, cross sectional view through either a floor or roof member showing a modified means for attaching two adjacent members together; and

Figure 19 is a cross sectional view taken on the line 19—19 of Figure 18.

This application is a continuation in part of my copending application Serial No. 663,284, filed March 29, 1933, for Building structures.

The prime object of this invention is to construct floor and roof members or units which may be employed side by side to form complete floors or roofs from very light gauge metal such as sheet steel. In order to employ the lightest possible gauges within the required safe loading limits it is necessary to employ a number of novel features of construction in combination with cross sectional formation of the members.

It is a basic object of this invention to so form up light gauge sheet steel into the strongest obtainable cross sectional form, when used in combination with proper interconnecting or fastening means and means for attaching these members to the side walls, that a maximum of strength will result.

This object is further attained by means of this invention by attaching the members or units to the side walls so that the resulting floors or roofs will act in a manner analogous to or approaching the action of a "drum head", which is securely fastened at its periphery upon a strong framework, and hence is able to stand considerable loading, the tension set up playing a considerable part in absorbing it.

In Figure 1 the side walls are generally illustrated along the lines of the disclosure in my above mentioned copending application. The side walls comprise open frames made up of side members 1, and the top and bottom members 6, each of which in turn is formed up into a column from light gauge sheet steel. These members are welded or otherwise fastened together to form a

rigid open framework which may be cross braced as indicated at 2, when desired.

As is clear from Figures 1 and 4, the vertical members 1 at the corners have inclined faces which, as indicated, preferably lie at an angle of 45 degrees to the plane of the wall units or panels. The floor units are generally indicated by the reference numeral 5 and rest, as is clear from Figures 2 and 3, by overlapping the top edges of the wall units. The inner surfaces of the wall panels are covered with a suitable surfacing material such as indicated at 3, which may be any suitable material. In a similar way the outer faces are covered with a surfacing material 3'. The corners of the room may be trimmed with angle irons 4 and the baseboards 4'. The flooring which covers the floor members or units is indicated at 5'.

The space between the ends of the floor units and the outer face of the wall panels is filled in by means of a filler piece 7 which may be an open hollow or tubular member likewise formed from light gauge steel. The outer faces of the filler members are covered with surfacing material 7'.

As indicated in Figure 5 these filler pieces likewise meet at the ends on an inclined face. The outer corners of the structure may be protected by the angle irons, as is clear from Figure 4.

The floor members are shown in detail in Figures 6 to 9 inclusive. A light gauge sheet of metal 10 of the desired length is bent up into a plurality of right angled open side panels alternately open at opposite sides, as is clear from Figure 7. One side wall of each channel is provided with an integral inturned flap or flange 11, which may also be fastened on. These flaps or flanges are provided with rectangular openings 16 which will be referred to later. The two outer side walls are provided with rectangular openings 17 which will be referred to later. One face of this formed member has applied thereto a light gauge sheet of metal 14 which may be attached by welding, bolting, or otherwise. The cover plate and formed member are provided with a plurality of holes 18 at the top and bottom along the edges, to be referred to later. The bases of the channels on the cover plate side are provided with openings 12, the edges of which are turned inwardly to form the flange 13. The cover plate is provided with aligned openings 15 which align with the openings 12 and they likewise have inturned flanges 16 which nest with the flanges 13. The bases of the channels on the other side may be provided with struck-out tabs 19 by means of which a suitable ceiling material may be attached thereto.

In addition bolts or rivets may be employed at the openings formed by the struck-out tabs for further attaching the ceiling material.

As indicated in Figure 9, adjacent units or members are secured together by means of the bolts 20 which pass through the openings 17. These bolts may be of the type which have rectangular heads, as is clear from Figure 3, which when inserted through the rectangular openings 17 are turned to an angle of 90 degrees to hold them in place. It is apparent that the adjacent members may be riveted, welded or cleated together if desired.

The ends of the floor members are bolted to the side panels by means of the bolts 21 and the filler pieces are attached across the ends thereof by means of bolts 22 which pass through the openings 16 in the flanges or flaps 11. As shown the rectangular headed bolts may be employed, or the parts may be riveted, welded or cleated together Thus the floor members are anchored to the side or wall panels to form a rigid transversely strong structure in which the loads on the floor are transmitted to the side walls through the adjacent panels, and the floor members under load are placed in tension, approximating a sort of "drum head" construction. If desired, the floor surfacing material may be attached to the cover plate 14 by means of struck-out tabs, or may be cemented or otherwise attached thereto.

It may here be noted that the wall surfacing materials on the inner and outer faces of the side wall panels may likewise be cemented, bolted or otherwise attached thereto. Reference is made, as indicated in Figure 4, to the manner in which the side panels are connected at the corner of the building. This is accomplished by means of bolts 9 which extend through the contacting inclined faces, as is clear from this figure.

At this point it may be noted that an alternative method of attaching adjacent floor members together is shown in Figures 18 and 19. The outer side walls of each member are provided with a plurality of pairs of tabs 60 and 61, which are so struck-out that they may be bent through the opening of the adjacent members, as is clear from Figure 19, and folded over to lock the members together. This is a simple, inexpensive arrangement which may be used to attach the adjacent members together more quickly than in the case of bolts, or even welding.

The object of flanging the openings 12 and 15 is to give a more finished appearance to the arrangement, to aid in interlocking the preformed member with the cover plates, and to further strengthen the entire unit. They may, of course, be omitted when desired. The openings 12 may be in alignment or may be staggered to afford greater stiffness.

A somewhat similar construction is employed in the roof members or units with modifications to adapt them for use in the roof.

In Figure 10 the side wall has been diagrammatically illustrated at A and the top floor ceiling at B. As illustrated in Figure 10, a roof bearing member 30, somewhat similar to the filler pieces 7 is employed. The roof is indicated as comprising a number of units generally indicated by the reference numeral 31. Each unit, as is clear from Figures 16 and 17, is as before formed up from a light gauge sheet of metal 32 into a plurality of open rectangular channels oppositely facing. In this case, however, the sheet is cut at the ends so that when it is formed up the end faces 36 and 37 lie at suitable angles to the plane of the unit.

Those skilled in the fabrication of metal will readily understand from the drawings the form of the blank sheet to provide such an end structure. As before, the rectangular member is provided with openings having flanged edges 34 and the cover plate is provided with aligned openings having the flanged edges 35. The outer side faces of each unit are provided with rectangular holes 38 by means of which adjacent sections may be secured together by bolts 47 (Figure 15). They may also be secured by welding or by means of tabs, as indicated in Figures 18 and 19. The end faces 36 and 37 are provided with a series of holes 39 and 40 for attachment as will be shown later. The inner face of the unit may be provided with struck-out tabs 41 for attaching the ceiling material, and the cover plate may be provided with similar tabs for attaching the roof surface if de-

sired. As before, the roof surface may be cemented, bolted, or otherwise secured in place.

Figures 13 and 14 show in more detail how the parts may be joined together. The side wall units will be as previously described, and the top floor ceiling unit, which is diagrammatically illustrated at **100**, may be of any suitable construction, or like the construction of the floor units previously described. A filler piece **42** is secured to the end thereof by means of the bolts **43** and the ceiling units are secured to the side walls by means of the bolts **45**. The face **37** of the roof unit engages the ceiling and filler members as shown, and is bolted thereto by means of the bolts **44**. Here again rivets, welding, or tabs may be employed to secure these various members together.

It may be noted that the bolts **44** lie in the holes **40** of the face **37**. The units abut at the ridge along the inclined faces **36**, and are bolted together by means of the bolts **46** (see Figures 11 and 12) which pass through the holes **39**. Here again rivets, welding, or tabs may be employed.

At each end of the roof members or units there are attached the members **70** and **71** which are really filler pieces for opposite ends of one of the channels of the member. In forming a single sheet into the cross sectional form illustrated it is more economical to provide the separate filler pieces **70** and **71** to close the one channel, as illustrated than it is to cut the sheet from a sufficiently large sheet so that these pieces would be integral.

In the particular formation of the sheet as illustrated in Figure 17 it so happens that the first channel from the left, which opens upwardly, cannot readily be provided with material integral with the sheet to close the ends thereof. For this reason separate pieces are formed up as indicated at **71** in Figure 12, and **70** in Figure 14. These short channel-shaped members are slipped into the ends of the channels and welded or otherwise secured in place so that the inclined ends **36** and **37** of the roof members are smooth and continuous, as is clear from Figure 16. The members **70** and **71** are preferably secured to the cover plate as well as to the channel member.

The large openings in the floor and ceiling units are provided to lighten the weight of the units. The metal which is removed, as indicated in the drawings, is removed from those parts of the units shown, and a minimum of loss of strength will result. Experience has demonstrated that the metal extending from the side walls of the channels is only of real importance for a distance equal to about fifty times the thickness of the sheet employed. For this reason the large openings may safely be provided without materially reducing the strength of the members, and yet considerably reducing their weight. By way of example, metal sheets of as light as 22 gauge may be employed in floor and roof units because of the novel features of construction and association of parts as herein described. The edges of these openings being turned down to eliminate free edges on the sheets, and forming a flange likewise adding considerably to the stiffness of the material.

From the above description it will be apparent that this invention resides in certain principles of construction which may be embodied in other physical forms without departure from the scope thereof.

I do not, therefore, desire to be strictly limited to the disclosure as given for purposes of illustration, but rather to the scope of the appended claims.

What I seek to secure by United States Letters Patent is:

1. A building unit as described comprising a sheet of metal formed into relatively deep parallel channels, integral flanges formed on the ends of said channels having apertures therein, and a metal cover plate for one side of the unit secured thereto and having a plurality of large openings therein.

2. A building unit comprising a box-like member, comprising oppositely opening U-channels, integral flanges formed on the ends of said channels having apertures therein, and a cover plate for one side thereof and secured thereto.

3. A building unit comprising a box-like member, comprising oppositely opening U-channels, integral flanges formed on the ends of said channels having apertures therein, a cover plate for one side thereof and secured thereto, and a surface covering attached to the other face thereof.

4. A unitary roof section as described comprising a multiple integral channeled member having inclined flanges at the end and a cover plate secured thereto and to the flanges to provide one edge of the unit with an oblique face.

5. A structural unit comprising a sheet of metal formed into a plurality of oppositely opening channels having flanges at the ends of alternate channels along one edge, said flanges lying at an oblique angle to the plane of the unit, and a cover plate secured to one face of the unit and attached to the free edges of the flanges to provide an oblique face for one edge of the unit.

6. A structural unit comprising a sheet of metal formed into a plurality of oppositely opening channels having flanges at the ends of alternate channels along one edge, said flanges lying at an oblique angle to the plane of the unit, a cover plate secured to one face of the unit and attached to the free edges of the flanges to provide an oblique face for one edge of the unit, and means on the cover plate for securing a surfacing material thereto.

7. A structural unit comprising a sheet of metal formed into a plurality of oppositely opening channels having flanges at the ends of alternate channels along one edge, said flanges lying at an oblique angle to the plane of the unit, a cover plate secured to one face of the unit and attached to the free edges of the flanges to provide an oblique face for one edge of the unit, and tabs struck out from the material of the unit along the face opposite to the cover plate to provide securing means for the unit.

8. A roof member as described composed of a single sheet of metal bent into a plurality of oppositely facing channels and a cover plate attached to one face of the member, the ends of the member having walls lying at an oblique angle to the plane of the member.

9. A building floor unit comprising a single sheet of metal formed up into connected oppositely facing channels, said channels having openings in the bases thereof with flanged edges, at least one face of the unit having a cover plate secured thereto with flanged openings in alignment with the first mentioned openings.

10. A structural unit comprising a sheet of light gauge metal formed into a plurality of oppositely facing channels and a cover plate secured to one side thereof so as to contact the bases of alternate channels, said cover plate and channel

bases having aligned openings, the edges of each opening being flanged.

11. In a building construction the combination comprising side walls, a floor or roof for the side walls resting around the edge thereof on the side walls, rigidly secured thereto and comprising a plurality of separate sections abutting at the sides and firmly secured together thereat whereby the roof or floor under load is in tension, each unit comprising a multi-channel portion and a cover plate therefor, and members secured to the outer side edges of the floor or roof to form an enclosing frame therefor.

12. A floor or roof member formed from a single sheet of metal by a plurality of right angle reverse bends to form a substantially rectangular cross section divided into a plurality of oppositely facing channels, a coextensive cover plate secured to one face of the member and attachment plates extending across the ends of the channels.

HARRY H. KELLER.