

March 23, 1954

H. L. PIERCE

2,672,958

STRUCTURAL BUILDING ELEMENT

Filed Nov. 26, 1946

2 Sheets-Sheet 1

Fig. 1

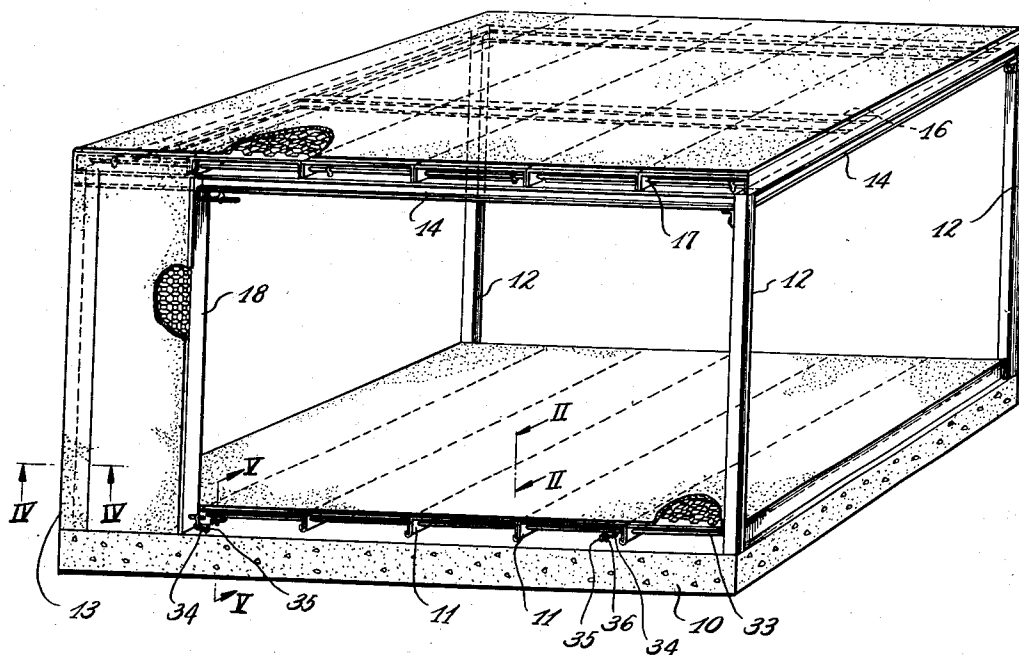
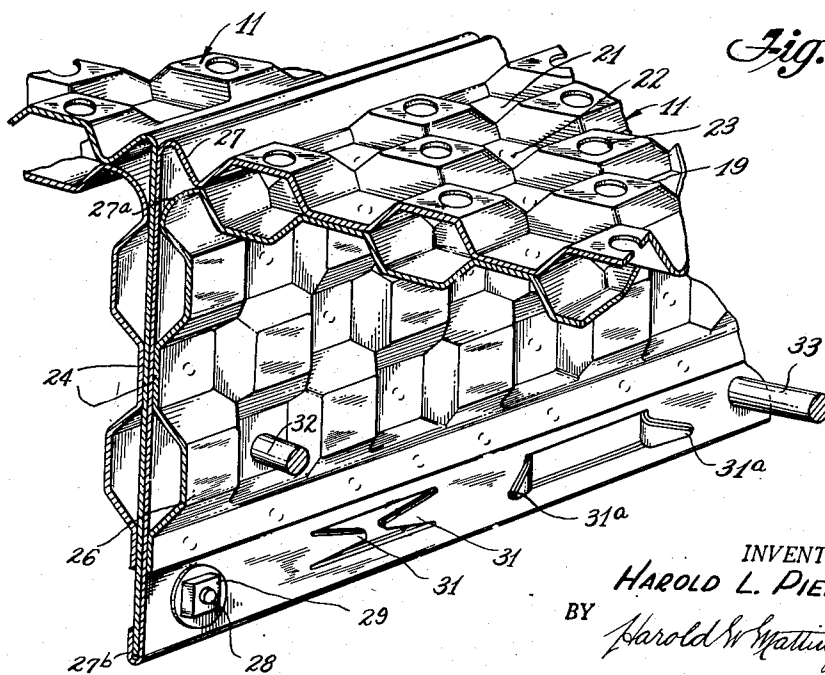


Fig. 2



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2 Sheets-Sheet 2

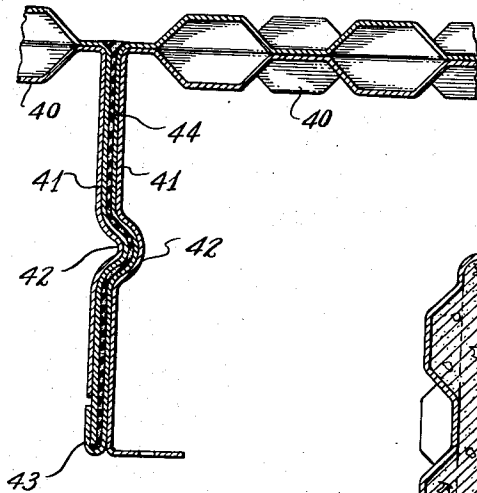


Fig. 3

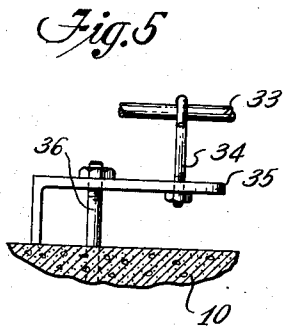


Fig. 5

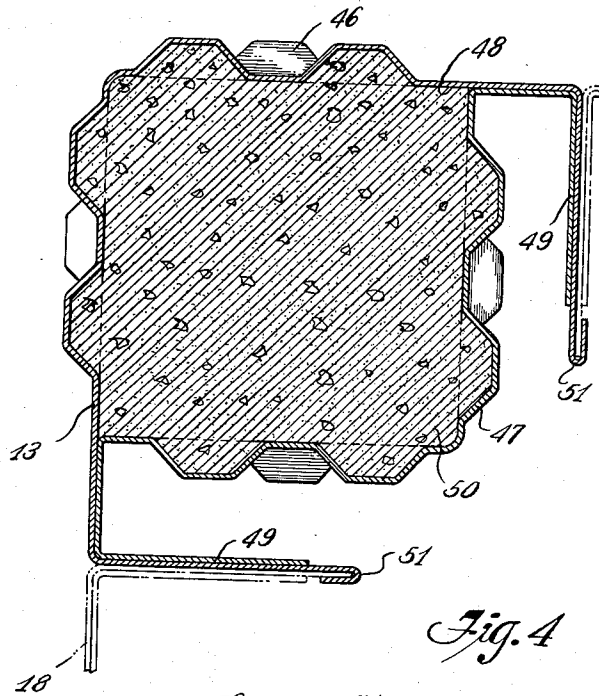


Fig. 4

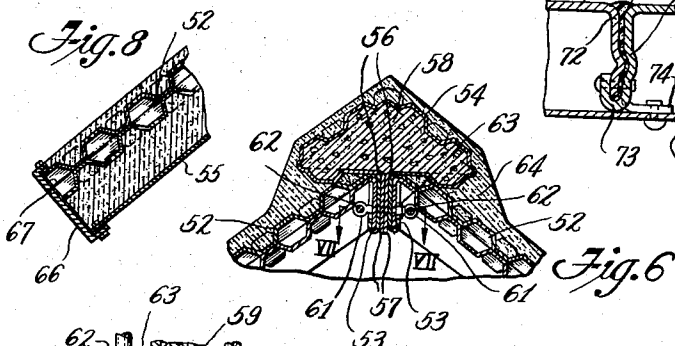


Fig. 6

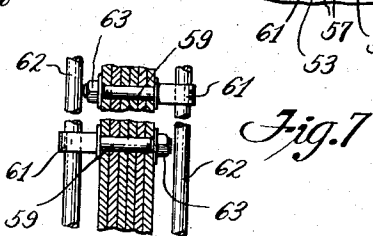


Fig. 7

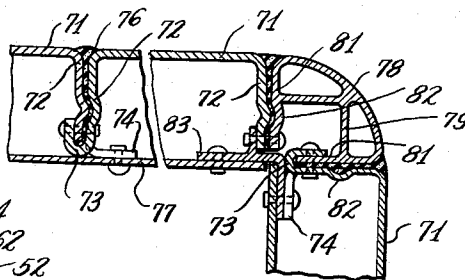


Fig. 9

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STRUCTURAL BUILDING ELEMENT

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3 Claims. (Cl. 189—34)

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My invention relates to structural panels, and has particular reference to a panel construction permitting interlocking of the panels to form a solid surface for use as a floor, ceiling, wall or other structural element.

While my invention has general utility, I will describe it with reference to its presently utilized embodiment; namely, as applied to double waffle-like panels formed of sheet metal. These waffle-like panels may be formed of two sheets of metal, each having a regular pattern of square projections formed thereon in a general "waffle" form. The two sheets may be placed back-to-back by disposing the flats of the waffle pattern of each sheet in contact with each other, and spot welds may be formed on the flats to secure the two sheets together.

Such waffle-like sheets are characterized by extremely high strength, together with lightness in weight. For example, when such a panel is made out of #26 sheet steel and each sheet is dished about one-half of an inch so that the overall thickness is about one inch, a panel a foot or two square will have sufficient strength to act as a floor member and at the same time will have a weight of approximately a pound and a half per square foot. Accordingly, therefore, these waffle-like panels are capable of use as any solid structural member of a building, such as floor, ceiling, roof, or side walls, or special forms may be employed as posts, columns, pilasters, etc. Plaster or cement may be applied to the panel, and in this connection various of the projections of the waffle-like form may be apertured so as to permit a grip by the plaster or cement thereon.

In general my invention embodies the formation of flanges on elongated panels, which flanges are disposed approximately at right angles to the plane of the panel. The edge of one flange of the panel may be bent back upon itself to form a general hook cross section, which hook structure may receive a straight-sided flange of an adjacent panel. My invention further embodies the use of fastening members to hold adjoining flanges either with or without the hook interlock. Also my invention makes possible the joining together of panels in unique and special forms so as to form new structural elements for buildings, which elements also form a part of my invention.

It is therefore an object of my invention to provide an improved locking or joining structure for panels.

Another object of my invention is to provide panels with flanges having hooked edges adapted

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to receive straight wall flanges of adjacent panels.

Another object of my invention is to provide flanges for sheet metal waffle-like panels, which flanges may be used as joists or other framing equivalents for a building.

Another object of my invention is to provide a fastening structure for structural panels used as roof members, which structure incorporates a waterproofing element.

Still another object of my invention is to provide a method and means of joining thin structural members together to define columns, posts, ridges or other framing elements of high strength, particularly when the space defined by the elements is filled with concrete or other high strength material.

These and other objects and advantages of my invention will be apparent in the following description and claims, considered together with the accompanying drawings forming an integral part of this specification, and in which

Fig. 1 is an isometric view of a corner of a building structure formed of panels and other structural elements embodying my invention;

Fig. 2 is a perspective view of an embodiment of my invention as applied to a joint between two adjacent panels such as might be used in the structural building of Fig. 1 as viewed along the line II—II of Fig. 1;

Fig. 3 is an elevation sectional view of a joint between two panels used for roof members and incorporating a waterproofing strip or element;

Fig. 4 is a second modification of my invention as applied to thin structural members that define a shaft that may be filled with concrete or other material to form a high-strength post or column as viewed along the line IV—IV of Fig. 1;

Fig. 5 is an elevation view of one form of fastening device that may be employed to retain the panels of my invention against a concrete sub-floor or other solid surface as viewed along the line V—V of Fig. 1;

Fig. 6 is still another modification of my invention showing its employment for use with structures that define a ridge or equivalent element for a roof structure;

Fig. 7 is a detail sectional view of the panel fastening of the roof structure of Fig. 6 taken along the line VII—VII of Fig. 6;

Fig. 8 is a sectional view along the eaves portion of a roof structure showing a cap construction for defining the eave; and

Fig. 9 is a sectional view through a double wall

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structure including panels secured together in accordance with the invention, as well as a rounded corner-piece, for example, as used in a refrigerator.

There is illustrated in Fig. 1 a plurality of uses to which the panels may be put that embody my invention. For example, a structure may include a subfloor 10 formed of concrete or other material upon which may be disposed a plurality of elongated panels 11 joined at their edges in accordance with the invention. The structure may also include a plurality of posts 12 which may be formed of the usual structural steel, wood or other material, or the posts may be formed particularly in accordance with the invention as in the case of the post 13. Girders 14 may interconnect the four posts 12 and 13, and an intermediate bracing girder 16 may be utilized as an intermediate framing member. Panels 17 may rest upon these framing girders and these panels may be used either as a floor for a second story of the building, or as a roof surface. Panels incorporating my invention may also be used as external wall members as illustrated by an upright elongated panel member 18. Accordingly, therefore, Fig. 1 discloses various uses of panels which may incorporate my invention, and this illustrative showing is primarily for the purpose of indicating that my invention may be employed in a great variety of places and locations in the entire structural building industry.

There is illustrated in Fig. 2 a representative type of waffle-like panel structure that embodies my invention. For example, the panels 11 of Fig. 1 may be represented by the disclosure of Fig. 2 wherein it will be noted that the panels employ a plurality of projections 19 joined together by flats 21 and that the flats of two oppositely disposed sheet metal sections may be spot welded together as at 22. Various of the projections 19 may be apertured as at 23 for the reception of plaster or concrete or other covering material so as to obtain a good bond or adherence of the covering material to the panels 11. Each panel 11 may be provided with a downwardly projecting flange 24 made particularly in accordance with the invention and which flange may be provided with a waffle-like structure 26 on at least one surface thereof. In this connection it should be noted that the angular bend to form the flange is constructed of spaced sheet metal portions 27 and 27a to maintain the strength of the joint approximately the same as the overall strength of the waffle-like paneling.

The bottom edge of one of the flanges 24 may be formed into a general hook shape 27b, and the bottom edge of the other panel may be straight and fitted in the hook portion. In this connection it should be noted that on any one panel only one flange generally has a hook formed thereon, the other flange being straight so that the edges of two adjoining panels may be joined by the hook and straight portions thereof. The lower edges of the panels thus joined may be of a single thickness of metal, or where desired may be of double thickness, but in this event it is preferable to stop the waffle-like form a short distance from the bottom thereof. The two flanges may be secured together in a variety of fashions, such as by a plurality of bolts 28 with nuts 29 threaded thereto. Alternatively, the panels may be secured together in addition to the joint structure 27 by means of bendable ear portions 31 formed in the bottom

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of each flange 24 so that the ears will be disposed opposite to each other. These ears may be bent together as shown at 31a to crimp the two panel members together.

The bottom edge or hook 27 of the two joined panels may bear against the supporting surface such as a concrete sub-floor as shown in Fig. 1. If desired, however, the entire panel structure may be spaced from the floor or other main support by means of rods 32 that may pass through the reinforced or waffle-like portions of the flanges 24, the rods in turn being supported above the sub-floor 10 in any suitable manner (not shown) such as by means of supporting beams, supporting posts or the like which may be disposed on sub-floor 10.

The panel structures may be secured against movement upwardly by means of rods 33 that may pass through the lower portions of the flanges 24, and in this connection it will be noted that the rods 33 also aid in tying together the panels. Hooks 34 may be passed around the rods 33 as shown in Figs. 1 and 5, and may in turn be tied down to suitable members such as angle irons 35 which in turn may be held to the sub-floor 10 by bolts 36 embedded in concrete.

It will be noted with respect to Fig. 2 that the major part of the flanges 24 may contain the waffle-like formation, thus giving them great strength with respect to bending and crumpling. Accordingly the flanges 24, particularly when joined together, form a very strong and solid structural member that is akin to a joist for supporting floor structure. Panels constructed in accordance with my invention therefore may serve as a complete flooring structure, including joists and planar spacing material between the joists.

A modified form of my invention is illustrated in Fig. 3, wherein the flange hook structure is aided in locking the panels together by a circular depression running lengthwise of the panel flange. This type of joint may be used with roof panels, and in this event a waterproofing element may be disposed between the flanges. Accordingly two roof panels 40 formed of waffle-like or other high-strength sheet metal may have flanges 41 formed thereon, each of which may be formed with a longitudinally extending rib or circular depression 42. The alternate flanges 41 of the panel members 40 may be formed with a hook portion 43 into which the straight flange of the adjoining panel 40 may fit. The mating ribs 42 of the two flanges secure the panels from slipping out of their hook joint. This joint may also be used to receive mastic or other pliable material 44 which may be disposed as a strip against one of the flanges 41 before the flanges are assembled. This material is adapted to maintain its flexibility and adhesive characteristic for a number of years, thus more or less permanently sealing the crack between the two flanges 41. This effectively seals the joined roof panels, particularly when a covering coating of cement, plaster or asphalt is laid upon the tops of the panels 40 and also the joint between them.

Shown in Fig. 4 is a modified form of my invention as applied to an integral column structure adapted to be filled with concrete or other stiffening material to form the column 13 (Fig. 1). Accordingly a waffle-like member 45 bent in general right angle form may be secured as by welding or otherwise to a complementary waffle-like portion 47 bent at an opposite right angle so that the two define a generally square chamber

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48. The two members 46 and 47 may have considerable height and thus define an elongated shaft 48 which may be filled with concrete 50 to form a structural column. Flanges 49 may be formed on the edges of the two joined elements 46 and 47, and may have hook portions 51 formed thereon adapted to receive the side panels 18 or other structural panels. Accordingly, therefore, an entire story of a building may be enclosed and defined by panels connected together in accordance with the invention and the corner members thereof may be in hollow columnar form, which hollow column may be filled with concrete, either reinforced or plain.

Shown in Fig. 6 is an application of my invention to a ridge-board structure for a roof. Roof panels 52 may have their edges bent into flanges 53, the angle of the flanges with respect to the panels depending upon the slope of the roof. A generally triangular element 54, made of waffle-like or otherwise, may have its two edges 56 brought together and elongated on their outer ends as at 57. The entire triangular element 54 may be filled with concrete 58, thereby making an extremely rigid ridge-board for the roof. The fastening of the panel flanges 53 to the edges 56 may be accomplished by means of through-bolts 59 having an eye 61 formed on the head end thereof. Rods 62 may be passed through the aligned eyes of the various bolts to keep them from rotating when nuts 63 are tightened on the opposite ends of the bolts. This joint structure of the flanges to the ridge-board member 54 may be more rigid if the edges of the panel flanges 53 are rolled, as shown in Fig. 6.

The entire roof panel structure 52 and the ridge-board 54 may be covered with a suitable weather-resisting material, such as cement or composition material 64. Since the waffle-like panels 52 are generally formed of steel because of cost considerations, it is accordingly imperative that the edges of the panels 52 be encased with a non-corrosive eave structure. Accordingly, as shown in Fig. 8, a generally channel-shaped eave member 66 may be riveted or otherwise secured to the outer edge of the roof panels 52, and preferably a strip of mastic 67 is placed on the inner side of the channel-shaped member 66. The undersurface of the roof panel 52 may be covered with a spaced sheet of metal 55 and the space between the two members may be filled with insulation or cement, as desired. The undersheet 55 and the eave cap 66 are preferably formed of a non-corrosive material, such as aluminum.

Illustrated in Fig. 9 is a modification of my invention which is suitable for double wall structures such as refrigerator cabinets. Accordingly panels 71 of any suitable construction may be formed with flanges 72, the opposite flanges being formed with hook members 73. Also alternate flanges 72 may be formed with ears 74 that are parallel to the main body of the panel 71. The various panels 71 may be joined together as generally described with respect to Fig. 3, and may also include a strip 76 of mastic or insulating material where waterproofing characteristics or insulation are of importance. An inner wall 77 may be secured to the ears 74, and the space between the inner wall 77 and the panel 71 may be filled with insulation if this is desired. A corner construction also made in accordance with the invention may be employed on cabinet structures, and may include a generally arcuate surface 78 which may be reinforced if desired by a generally angular internal structure 79. The 75

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corner structure may include flange members 81 having bulges 82 formed therein. One flange 81 may slide within the hook element 73 of a panel 71 on one corner, and the other flange 81 may abut against an unhooked flange 72 of another panel member 71. If desired, a corner bracket 83 may secure the corner assembly together and screws may be used to secure all flanges together. The corner member 78 may be extruded or fabricated as desired, and may be of metal, plastic, or other easily worked material.

From the foregoing it will be evident that my invention provides a fastening construction for panels and corner members that is simply made and at the same time rugged in construction. Also the fasteners are easily assembled, making possible the use of unskilled labor in assembling buildings made of panels with my fastening devices. It is obvious that various types of materials may be used in my invention, and while I prefer metals, it is apparent that plastic or other material could be used. Accordingly I do not care to limit myself to the specific embodiments and materials illustrated and described, nor otherwise, except by the terms of the following claims.

I claim:

1. A building panel structure including a pair of building elements, each of which comprises a flat panel formed of two sheets of metal having a waffle-like structure formed thereon which are secured together, and a flanged edge on each of said panels directed generally at right angles to the flat portion of said panel and including portions of both of said two sheets of metal, the flange portion of one sheet being flat and facing generally outwardly away from said panel, and the flange portion of the other sheet being of waffle-like construction and facing generally inwardly toward said panel, said pair of building elements being secured together with their respective said flat flange portions disposed adjacent to each other so that said flanged edges of said panels form a joist.

2. A building panel structure including a pair of building elements, each of which comprises a flat panel formed of two sheets of metal having a waffle-like structure formed thereon which are secured together, a flanged edge on each of said panels directed generally at right angles to the flat portion of said panel and including portions of both of said two sheets of metal, the flange portion of one sheet being flat and facing generally outwardly away from said panel, and the flange portion of the other sheet being of waffle-like construction and facing generally inwardly toward said panel, said pair of building elements being secured together with their respective said flat flange portions disposed adjacent to each other so that said flanged edges of said panels form a joist, and a plurality of rods passing through said flanged edges of said panels supporting the panels and holding them in aligned relationship.

3. A building panel structure including a pair of building elements, each of which comprises a generally horizontally disposed, flat panel formed of two sheets of metal having a waffle-like structure formed thereon which are secured together, a flanged edge on each of said panels directed generally downwardly and at right angles to the flat portion of said panel and including portions of both of said two sheets of metal, the flange portion of one sheet being flat and facing generally outwardly away from said panel, and the

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flange portion of the other sheet being of waffle-like construction and facing generally inwardly toward said panel, said pair of building elements being secured together with their respective said flat flange portions disposed adjacent to each other so that said flanged edges of said panels form a joist, and an upwardly directed hook structure formed on the bottom portion of one of said downwardly flanged edges gripping the other of said downwardly flanged edges.

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