April 6, 1954 D. K. MACLEOD 2,674,354

HEAT-INSULATING WALL AND ROOF FOR METAL BUILDINGS

Filed July 15, 1948

3 Sheets-Sheet 1

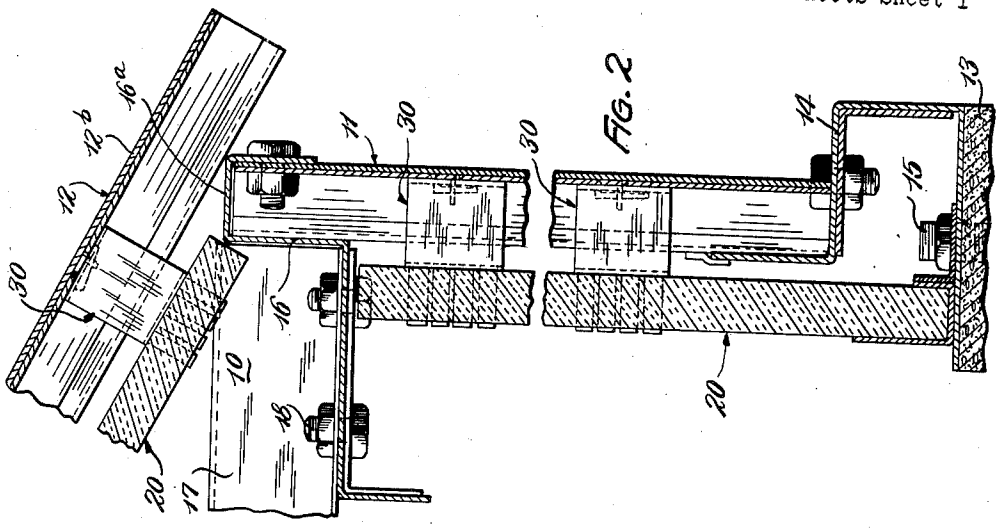


FIG. 2

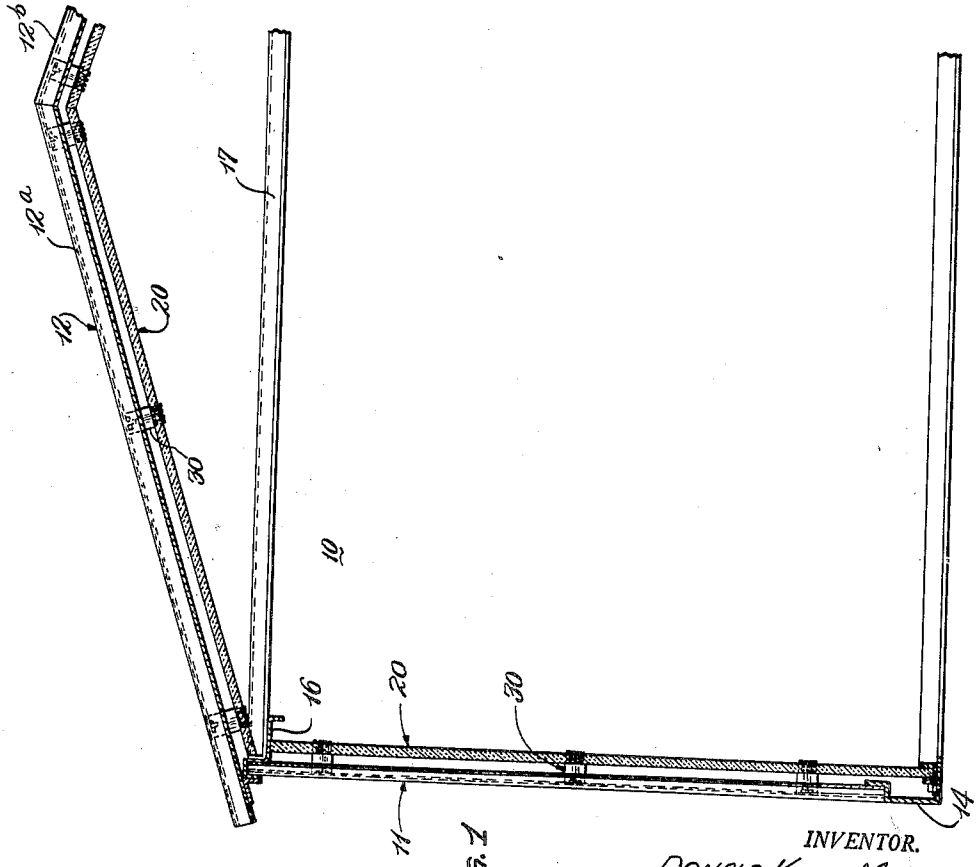


FIG. 1

INVENTOR.
DONALD KEITH MACLEOD
BY Hudson, Boughton, Williams, David & Hoffmann.
ATTORNEYS

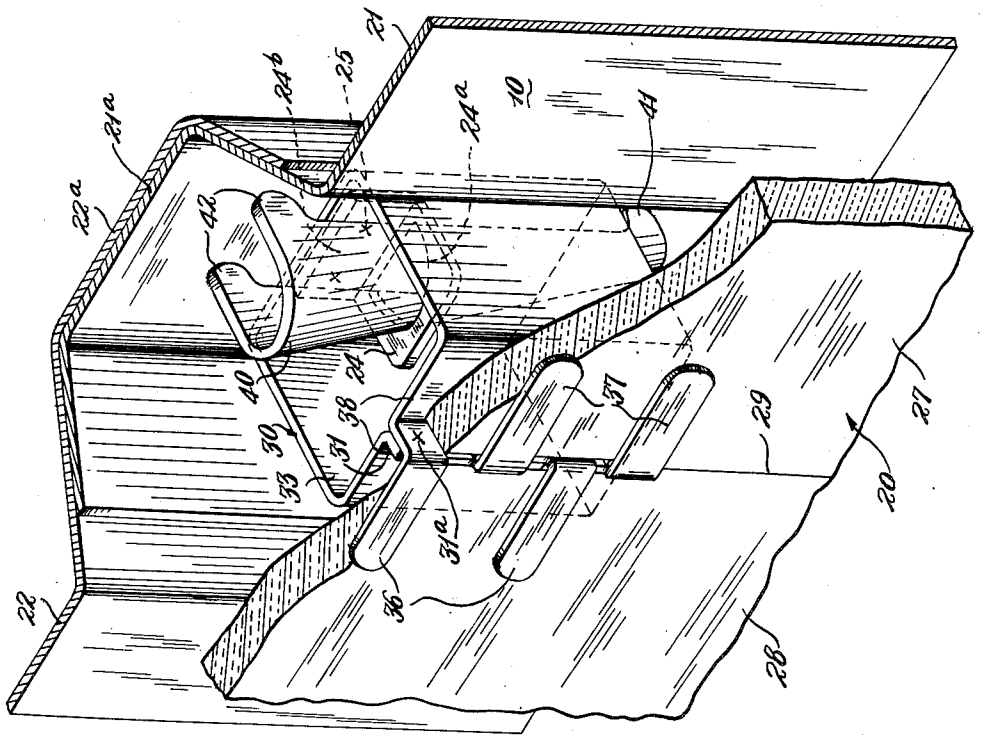
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3 Sheets-Sheet 2

FIG. 3



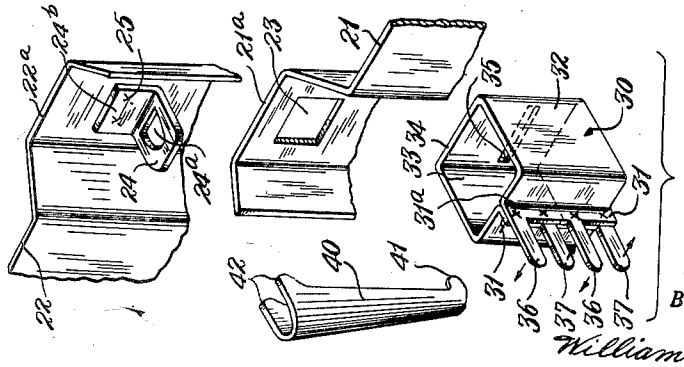


FIG. 4

INVENTOR.
DONALD KEITH MACLEOD
BY Hudson, Boughton, Williams, David & Hoffmann.
ATTORNEYS

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3 Sheets-Sheet 3

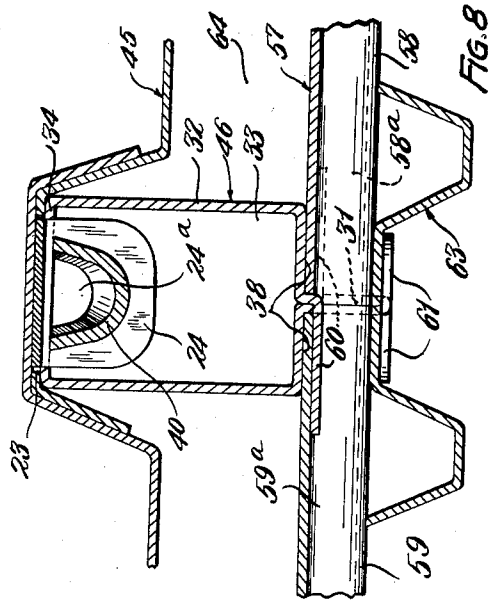


FIG. 8

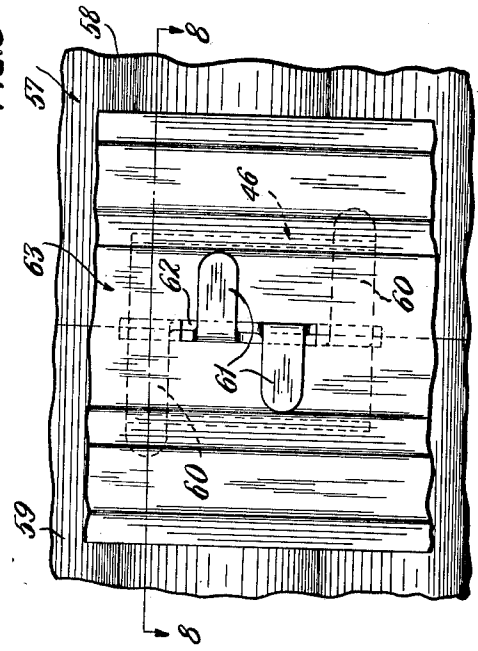


FIG. 7

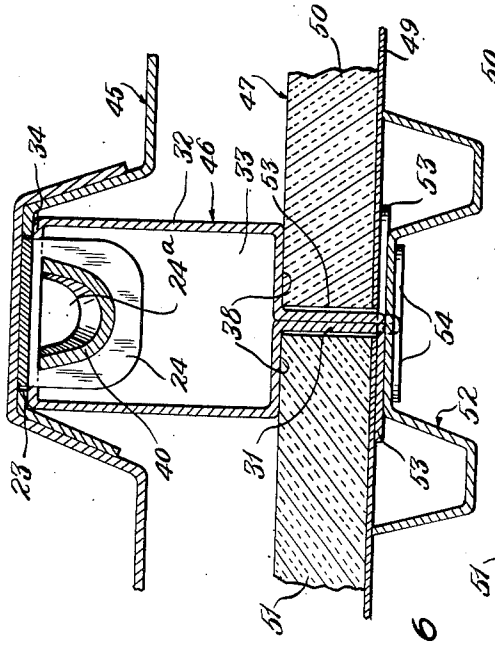


FIG. 6

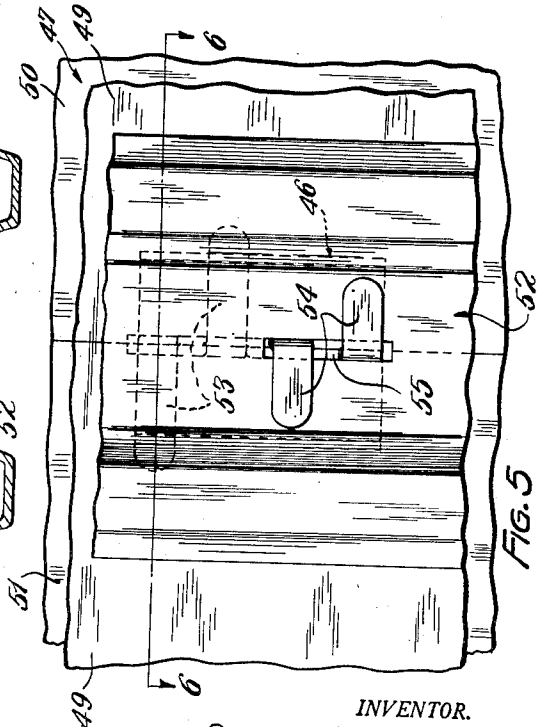


FIG. 5

INVENTOR.
DONALD KEITH MACLEOD
BY Hudson, Boughton, Williams, David & Hoffmann.
ATTORNEYS

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HEAT-INSULATING WALL AND ROOF FOR METAL BUILDINGS

Donald Keith Macleod, Wooster, Ohio, assignor to United Steel Fabricators, Inc., Wooster, Ohio, a corporation of Ohio

Application July 15, 1948, Serial No. 38,794

8 Claims. (Cl. 189—34)

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This invention relates to buildings and particularly to buildings of the type having their outer walls and roof made of metal, and provides an improved construction for buildings of this type in which a heat-insulating wall is located inwardly of the metal wall or roof.

In buildings having their external side walls and/or roof made of metal the relatively high thermal conductivity of the metal usually permits such a rapid transfer of heat from or to the interior of the building as to materially affect the usefulness of the building. For example, when the outside temperature drops as at night, or through seasonal changes, the rapid loss of heat through the metal walls or roof will make it difficult and uneconomical to maintain a desired temperature condition inside the building. The temperature drop occuring in the building will usually also result in the condensation of moisture on the inner surfaces of the metal walls and roof, which is objectionable and frequently produces a drip which is damaging to articles or materials located in the building. On the other hand, during the summer season a hot sun shining on the building may, through the high thermal conductivity of the metal, result in an objectionably high temperature inside the building.

A heat-insulating inner wall located inwardly of the outer metal wall or roof eliminates or materially improves these objectionable conditions but, so far as this applicant is aware, no form of building construction has been provided heretofore by which such a heat-insulating inner wall can be obtained in a metal building in an inexpensive, practical and satisfactory manner. In the case of metal buildings of the kind often referred to as "frameless" buildings, such as utility buildings assembled from prefabricated metal wall and roof plates or panels, the problem of providing a heat-insulating inner wall has been especially troublesome because of the lack of a frame structure to which the insulating inner wall could be satisfactorily attached. To provide such a building with a frame structure merely to afford a support or attachment for the insulating inner wall is usually prohibitive because of the cost increase which would result therefrom.

The present invention overcomes these disadvantages and, as one of its objects, provides an improved construction for metal buildings in which a heat-insulating inner wall located inwardly of the external metal walls or roof is attached thereto by novel means which eliminates

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the need for any kind of a frame structure for anchoring or supporting such inner wall.

Another object of this invention is to provide an improved construction for metal buildings of the type having external walls and a roof formed by prefabricated metal plates or panels and also having a heat-insulating inner wall located inwardly of such walls or roof, and in which the connecting means for the prefabricated panels also serves as a holding and attaching means for the inner wall.

A further object is to provide an improved metal building construction of the character mentioned in which sheet metal bracket members are employed at spaced points and form a connecting means between an external metal wall or roof and a heat-insulating inner wall.

Yet another object is to provide an improved metal building construction of the character referred to in which the sheet metal bracket members have shoulder means engageable with the back of the heat-insulating inner wall and bendable holding elements extending forwardly or inwardly through such heat-insulating wall.

As another of its objects this invention provides an improved metal building construction of the kind mentioned in which the sheet metal bracket members have a body portion which is connected with the outer wall or roof by cooperating clip and tapered pin elements.

Still another object is to provide an improved construction for metal buildings of the type having its walls and roof formed by prefabricated metal panels connected together by cooperating clip and tapered pin elements and in which a heat-insulating inner wall is connected to such outer wall or roof by a novel form of sheet metal bracket having holding elements engageable with such inner wall and a body portion adapted for connection with such outer wall or roof by such clip and pin elements.

As a further object this invention provides a novel connecting bracket for use in a metal building between a heat-insulating inner wall and a metal outer wall or roof formed of prefabricated metal panels connected by clip and tapered pin elements, such bracket having portions adapted to cooperate respectively with such inner wall and with such clip and tapered pin connection.

The invention can be further briefly summarized as consisting in certain novel combinations and arrangements of parts hereinafter described and particularly set out in the claims hereof.

In the accompanying sheets of drawings,

Fig. 1 is a partial vertical section taken

through a side wall and roof of a metal building embodying the present invention;

Fig. 2 is a similar partial vertical section taken through the same building but on a larger scale;

Fig. 3 is a perspective sectional view further illustrating the improved building construction, the view being taken to show the connecting bracket used between the outer metal wall and the heat-insulating inner wall;

Fig. 4 is an exploded view further illustrating the connecting bracket and also showing the clip and tapered pin elements with which it is used and the adjacent portions of a pair of wall or roof panels;

Fig. 5 is a partial face view looking toward the heat-insulating inner wall of a metal building embodying the present invention, the inner wall itself being of a somewhat different construction than the inner wall shown in Figs. 1 to 3 inclusive;

Fig. 6 is a partial transverse section taken through the building construction of Fig. 5 as indicated by section line 6—6 thereof;

Fig. 7 is a face view similar to Fig. 5 but showing another specific form of heat-insulating inner wall; and

Fig. 8 is a partial transverse section taken through the building construction of Fig. 7 as indicated by section line 8—8 thereof.

As one embodiment of the present invention Figs. 1, 2 and 3 show a metal building 10 which, by way of example, can be a utility building, such as a garage or storage building, of any desired size or shape. The building 10 is provided with upright side walls 11 and a roof 12, the latter being of the gable type and formed by oppositely sloping roof sections 12*a* and 12*b*. The side walls 11 can be supported on, and suitably connected with, a masonry foundation 13 by means of a fabricated metal sill 14, the latter being connected to the foundation by the anchor bolts 15.

The side walls 11 are provided at the top thereof with suitably formed cornice members 16 which also provide sill or plate portions 16*a* extending longitudinally of the side walls for supporting the roof 12. The side walls 11 can also be suitably connected together and reinforced by tie beams 17 which have their ends connected to the cornice members 16 by the bolts 18 and which are also adapted to serve as supports for a ceiling (not shown) when a ceiling is to be provided in the building.

The novel building construction provided by the present invention is especially useful in buildings of the prefabricated so-called "frameless" type and for that reason is hereinafter described in connection with a building of this kind, although it should be understood that the invention is not necessarily limited to use only in this particular kind of building. The building 10 is shown as being of the frameless type having its side walls 11 and its roof 12 formed by connected panels or plates preferably made of corrugated sheet metal. The panels constituting the side walls 11 and the roof 12 have the corrugations thereof extending longitudinally of the panels and the corrugations are preferably, though not necessarily, of a box-like cross-sectional shape as shown in Fig. 3. In the case of the wall panels constituting the side walls 11, these corrugations extend vertically and in the case of the roof panels constituting the roof 12, the corrugations extend along the slope of the roof. As shown in Figs. 1 and 2, the wall panels have their lower edges resting on the sill 14 and have their upper edges maintained in proper alignment by the cornice member 16.

In accordance with the present invention, a heat-insulating inner wall 20 is provided in the metal building 10 and is located inwardly of the upright side walls 11 and the roof 12. As indicated above, such a heat-insulating inner wall decreases the thermal conductivity of the metal exterior walls and roof so that a desired or satisfactory temperature condition can be more readily maintained inside the building, and also eliminates or minimizes the condensation of moisture on the inner surface of the side walls and roof. The application of the heat-insulating inner wall 20 to the side walls and roof of the building 10 is hereinafter described with reference to a pair of adjacent panels 21 and 22 which can be a pair of panels embodied either in the side wall 11 or in the roof 12. Since the construction used in the side walls 11 and in the roof 12 is essentially a wall construction and is identical or nearly identical for both the side walls and the roof, the panels 21 and 22 are hereinafter referred to merely as panels or wall panels and it should be understood that the term "wall" as used throughout the specification and claims is used in its broader sense in which it means either a side wall or a roof.

As shown in Figs. 3 and 4, the corrugated panels 21 and 22 have their adjacent edges disposed in overlapping relation with the edge corrugations thereof in interfitting engagement. The inner plate portion 21*a* of the panel 21 is provided with an opening 23 and the outer plate portion 22*a* of the panel 22 carries a clip 24 adapted to project inwardly through the opening 23 and the clip itself having an opening 24*a* therein. The clip 24 can be of any desired form or shape and in this instance has a base 24*b* which is attached to the panel 22 as by means of the spot welds 25.

The heat-insulating inner wall 20 is formed by suitable heat-insulating material which is in slab or sheet form so that when held in a fixed spaced relation to the outer wall it will provide a smooth flat inner wall of low thermal conductivity. The heat-insulating material used for the inner wall 20 can be a fibrous, porous or cellular sheet or slab made of any conventional heat-insulating material and having a desired stiffness or rigidity rendering it suitable for use in a wall. As shown in this instance, the heat-insulating wall 20 is preferably formed by slabs or panels 27 and 28 which are made of heat-insulating material and disposed so as to lie in the same plane with their adjacent edges in contiguous or abutting relation. The joint 29 formed by the adjacent edges of a pair of contiguous panels lies in front of the joint formed by the overlapping panel portions 21*a* and 22*a* of the outer wall.

An important feature of the present invention resides in the use of bracket members 30 at spaced points between the heat-insulating inner wall 20 and the outer wall formed by the corrugated metal panels 21 and 22. The bracket members 30 constitute a holding means by which the heat-insulating inner wall 20 is connected to the outer wall and maintained in a fixed spaced relation to the latter.

Each of the bracket members 30 is a one-piece member formed from a single piece or strip of sheet metal. The sheet metal strip has its end portions connected together in face-to-face rela-

tion as by means of the spot welds 31*a* and has its intermediate portion bent or otherwise formed into a polygonal hollow body portion 32 having a passage or opening 33 extending therethrough. The connected end portions of the strip form a forwardly extending front flange 31 on the hollow body portion 32. The body portion 32 also has a substantially flat rear wall 34 forming one of the sides of the polygonal shape and provided with a slot 35, the purpose of which slot will be presently explained. The bracket 30 is provided at the front thereof with bendable holding portions, preferably in the form of pairs of lugs or fingers 36 and 37 carried by the connected ends of the sheet metal strip and constituting integral extensions of such ends. The front wall of the hollow body portion 32 provides a pair of flat surfaces or abutment shoulders 38 located on opposite sides of the front flange 31.

As shown in Fig. 3, the bracket 30 is disposed between the metal outer wall and the heat-insulating inner wall 20 so that the flat front portions 38 of the bracket are engaged by the backs of the panels 27 and 28 adjacent the joint 29. The flat rear wall 34 of the bracket 30 lies against the flat face of the inner panel portion 21*a* with the clip 24 extending through the slot 35 into the passage 33 of the bracket. The pairs of bendable lugs 36 and 37 extend inwardly through the heat-insulating inner wall 20, preferably through the joint 29 thereof, and are bent laterally in opposite directions away from each other, as shown in Fig. 3 so as to lie in holding engagement against the front face of the heat-insulating inner wall.

The bracket 30 is held in connected relation with the outer wall by means of a tapered pin 40 which extends through the opening 24*a* of the clip 24. The pin 40 is here shown as being a longitudinally tapered, transversely curved sheet metal member which exerts a wedging action on the clip 24 tending to draw the inner and outer plate portions 21*a* and 22*a* tightly together for holding the outer wall panels 21 and 22 in connected relation. The tapered pin 40 is disposed in the passage 33 of the bracket 30 and is preferably of a length such that its ends extend outside the bracket. These projecting ends are provided with pairs of rounded lugs 41 and 42 which bear against the inner plate portion 21*a* when the pin has been securely driven into the opening of the clip 24. The pin 40 thus, in addition to holding the wall panels 21 and 22 in connected relation, also connects the bracket 30 to the outer wall, thus enabling the bracket to serve as a holding means for the heat-insulating inner wall 20.

When the bracket 30 has been constructed and assembled in the manner above described, it will now be understood that the bracket is connected to the outer wall by the clip and pin elements 24 and 40 and that the heat-insulating inner wall 20 will be held in a fixed spaced relation to the outer wall by reason of the fact that portions of the inner wall are embraced between the shoulders 38 and the pairs of bent retaining lugs 36 and 37. It will also be understood, of course, that the connecting brackets 30 are used in suitable number and at appropriately spaced points between the outer and inner walls, as shown in Figs. 1 and 2.

Figs. 5 and 6 show a building construction of the kind described above in which the outer metal wall 45 and the connecting bracket 46 are substantially identical with the outer wall and

connecting bracket 30 described above, but in which the heat-insulating inner wall 47 differs from the heat-insulating wall 20 in that the wall 47 has a moisture barrier on the inner surface thereof. This moisture barrier may comprise a metal sheet 49 such as a metal foil, and extends over the inner surface of the heat-insulating slabs or panels 50 and 51. The metal sheet 49 constituting the moisture barrier can be attached to the panels 50 and 51 by cement or any other suitable attaching means.

The building construction of Figs. 5 and 6 preferably also includes a molding 52 in the form of a sheet metal strip constituting a cover for the joint 53 formed by the adjacent edges of the contiguous panels 50 and 51. The connecting bracket 46 in this instance has one pair of its bendable elements 54 in engagement with the front faces of the panels 50 and 51 and a second pair of such elements 55 extending through a slot 56 of the molding strip 52 and engaging a flat front portion thereof. In other respects the bracket 46 is the same as the bracket 30 and is connected to the outer wall 45 in the same, and hence, the same reference characters have been used on corresponding parts.

Figs. 7 and 8 show another form of building construction which is similar to that illustrated in Figs. 5 and 6, but in which the heat-insulating inner wall 57 comprises adjacent panels 58 and 59 each of which consists of a corrugated metal sheet having heat-reflecting characteristics. The metal sheets 58 and 59 preferably have their corrugations extending at substantially right angles to the direction of the corrugations of the outer metal wall 45. The connecting bracket 46 is similar to the bracket shown in Figs. 5 and 6, but has one pair of its lugs 60 bent so as to lie in channels 58*a* and 59*a* of the corrugations of the panels 58 and 59 and another pair of its lugs 61 extending through a slot 62 of the molding strip 63 and engaging a flat front portion thereof. The heat-reflecting inner wall 57 also acts as a moisture barrier and the air space 64 between the inner and outer walls further increase the heat-insulating characteristic of the structure.

From the foregoing description and the accompanying drawings it will now be readily understood that this invention provides an improved construction for metal buildings by which a heat-insulating inner wall is connected in a novel manner to an external metal wall or roof so as to decrease the thermal conductivity and render the building less susceptible to temperature changes and to the dripping of water from the walls and roof as the result of moisture condensation thereon. It will also be seen that this invention provides a novel construction which is especially applicable to buildings of the frameless type having metal walls and roofs formed of connected panels made of corrugated sheet metal. Additionally, it will be seen that the present invention provides novel bracket means by which a heat-insulating inner wall can be connected to the outer metal wall of a building by utilizing for this purpose the same clip and tapered pin elements which are used as a connecting means for adjacent panels of the outer wall.

Although the improved building construction provided by this invention has been illustrated and described herein to a somewhat detailed extent, it will be understood, of course, that the invention is not to be regarded as being limited

correspondingly in scope, but includes all changes and modifications coming within the terms of the claim hereof.

Having thus described my invention, I claim:

1. In building construction, an outer supporting wall comprising wall units having their adjacent edge portions in overlapping relation and connected together by cooperating clip and tapered pin elements, said clip element having an opening therein and being connected with the outer one of said overlapping edge portions and extending through the inner one of said overlapping edge portions and said tapered pin element being engaged in the opening of said clip element, an inner wall spaced from and supported by said outer wall and comprising panels disposed in contiguous relation, and sheet metal brackets connecting said inner wall with said outer wall at spaced points, said sheet metal brackets each comprising one-piece hollow body portion of a substantially closed polygonal shape in transverse cross-section and having front and rear walls of which the rear wall has a slot therein through which one of said clip elements extends, said bracket being attached to said outer wall by said tapered pin elements being located in the hollow body portions and by the engagement of said pin elements in the openings of said clip elements, said front wall having shoulder means engaged by the backs of a pair of said panels and also having bendable elements extending forwardly between said pair of panels and bent into overlying relation to the front faces of said pair of panels and retaining the panels against said shoulder means.

2. In building construction, an outer supporting wall comprising wall units having their adjacent edge portions in overlapping relation and connected together by cooperating clip and tapered pin elements, said clip element extending through the inner one of said overlapping edge portions and having an opening therein, an inner wall spaced from and supported by said outer wall and comprising panels disposed in contiguous relation, and sheet metal brackets connecting said inner wall with said outer wall at spaced points, said brackets each comprising a hollow body forming a spacing member between said inner and outer walls and having a substantially flat rear wall provided with a slot through which one of the clip elements of said outer wall extends and also having bendable elements extending forwardly between a pair of said panels and bent into overlying relation to the front faces of said pair of panels and retaining the panels against said spacing member, said tapered pin element being disposed in said hollow body and having wedging engagement in the opening of said clip element.

3. In building construction, an outer supporting wall comprising wall units having their adjacent edge portions in overlapping relation and the inner one of said edge portions having an opening therein, a clip holding said wall units in connected relation and having a portion thereof extending inwardly through said opening and itself provided with an opening, an inner wall spaced from and supported by said outer wall and comprising heat-insulating panels disposed in contiguous relation and including a pair of panels whose adjacent edges form a joint lying substantially in front of said clip, a sheet metal bracket having a hollow body portion forming a spacing member between said inner and outer walls and also having bendable elements extending forwardly through said joint and bent into overlying relation to the front face of said inner wall and holding the same against said spacing member, said hollow body portion having a rear wall provided with a slot through which said clip extends, and a tapered pin disposed in said hollow body portion and having wedging engagement in the opening of said clip and connecting said bracket with said outer wall.

4. In building construction, an outer supporting wall comprising wall units having their adjacent edge portions in overlapping relation and the inner one of said edge portions having an opening therein, a clip holding said wall units in connected relation and having a portion thereof extending inwardly through said opening and itself provided with an opening, an inner wall spaced from and supported by said outer wall and comprising heat-insulating panels disposed in contiguous relation and including a pair of panels whose adjacent edges form a joint lying substantially in front of said clip, a sheet metal bracket having a hollow body portion forming a spacing member between said inner and outer walls and also having bendable elements extending forwardly through said joint and bent into overlying relation to the front face of said inner wall and holding the same against said spacing member, said hollow body portion having a rear wall provided with a slot through which said clip extends, and a tapered pin disposed in said hollow body and having wedging engagement in the opening of said clip, said bracket including said hollow body portion and said bendable elements being formed from a single metal sheet having intermediate and edge portions with the intermediate portion of the sheet forming said hollow body portion and edge portions of the sheet forming said bendable elements.

5. In building construction, an outer supporting wall, clips connected with said outer wall and projecting inwardly therefrom at spaced points and provided with openings, an inner wall spaced from and supported by said outer wall and comprising panels disposed in contiguous relation, a plurality of sheet metal brackets located at said spaced points and each comprising a hollow body forming a spacing member between said inner and outer walls and having a rear wall provided with an opening through which one of the clips of said outer wall extends, tapered pins located in the hollow bodies of said brackets and extending through the openings of said clips and connecting said brackets with said outer wall, and bendable lugs projecting forwardly from said brackets and extending through said inner wall, said lugs being bent into overlying relation to said inner wall and holding said panels against the hollow bodies of said brackets.

6. In building construction, an outer supporting wall, clips connected with said outer wall and projecting inwardly therefrom at spaced points and provided with openings, an inner wall spaced from and supported by said outer wall and comprising corrugated panels disposed in contiguous relation, a plurality of sheet metal brackets located at said spaced points and each comprising a hollow body forming a spacing member between said inner and outer walls and having a rear wall provided with an opening through which one of the clips of said outer wall extends, tapered pins located in the hollow bodies of said brackets and extending through the openings of said clips and connecting said brackets with said outer wall, and bendable lugs projecting forwardly from said

brackets and extending through said inner wall, said lugs being bent into overlying relation to said inner wall and holding said panels against the hollow bodies of said brackets with the bent portions of certain of said lugs lying against the tops of the corrugation of said inner wall and the bent portions of others of said lugs lying in the channels of the corrugations.

7. In building construction, an outer supporting wall, clips connected with said outer wall and projecting inwardly therefrom at spaced points and provided with openings, an inner wall spaced from and supported by said outer wall and comprising panels disposed in contiguous relation, a plurality of sheet metal brackets located at said spaced points and each comprising a hollow body forming a spacing member between said inner and outer walls and having a rear wall provided with an opening through which one of the clips of said outer wall extends, tapered pins located in the hollow bodies of said brackets and extending through the openings of said clips and connecting said brackets with said outer wall, said panels having adjacent edges thereof forming joints disposed in front of said hollow bodies, molding strips covering said joints and provided with openings overlying the joints, and bendable lugs projecting forwardly from said brackets through said joints and molding strip openings, said lugs being bent into overlying relation to said molding strips.

8. In building construction, an outer supporting wall, clips connected with said outer wall and projecting inwardly therefrom at spaced points and provided with openings, an inner wall spaced from and supported by said outer wall and comprising panels disposed in contiguous relation, a

plurality of sheet metal brackets located at said spaced points and each comprising a hollow body forming a spacing member between said inner and outer walls and having a rear wall provided with an opening through which one of the clips of said outer wall extends, tapered pins located in the hollow bodies of said brackets and extending through the openings of said clips and connecting said brackets with said outer wall, said panels having adjacent edges thereof forming joints disposed in front of said hollow bodies, molding strips covering said joints and provided with openings overlying the joints, and bendable lugs projecting forwardly from said brackets through said joints, certain of said lugs being bent into overlying relation to said panels for holding the same against said hollow bodies and others of said lugs extending also through the molding strip openings and being bent into overlying relation to the molding strips and holding the same in covering relation to said joints.

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