Feb. 28, 1939. T. H. COE, JR 2,148,436

WALL CONSTRUCTION FOR BUILDINGS

Filed Sept. 10, 1934 2 Sheets-Sheet 1

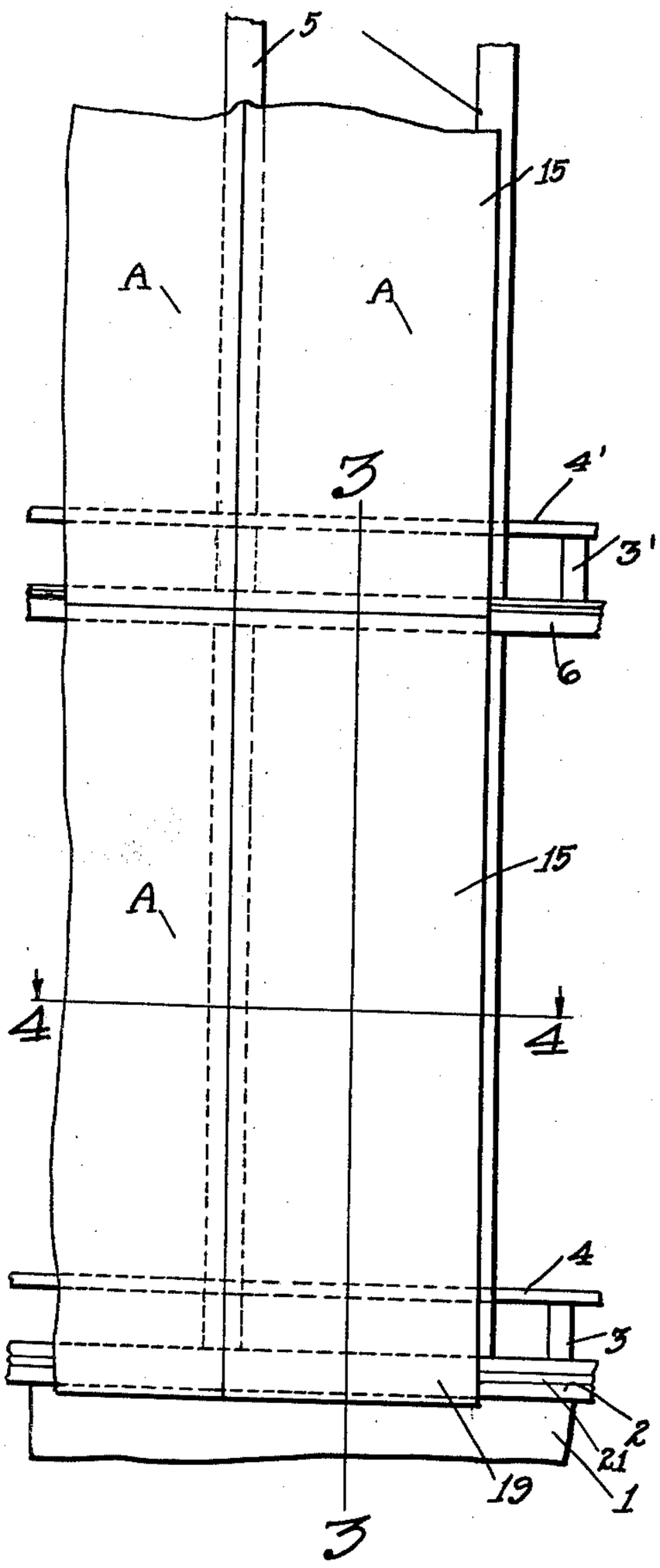

Fig. 1.

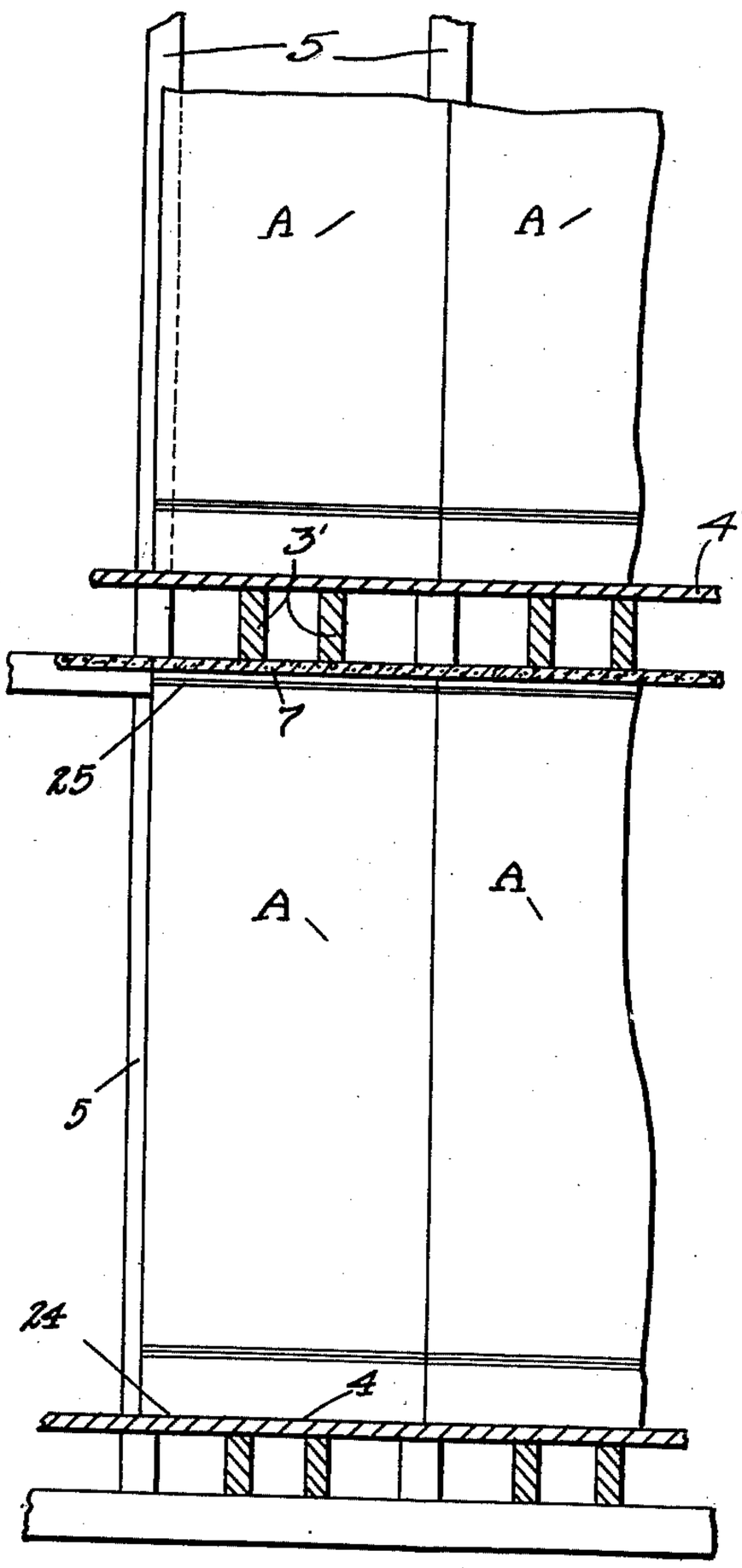

Fig. 2.

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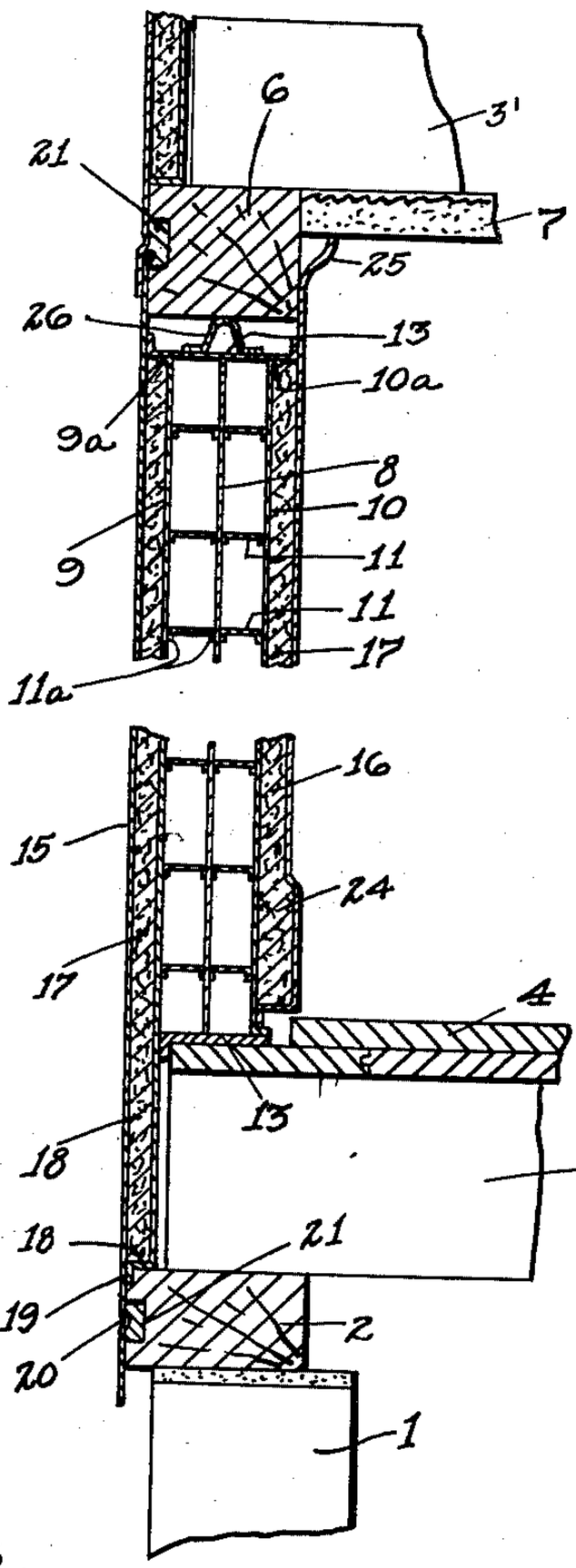

Fig. 3.

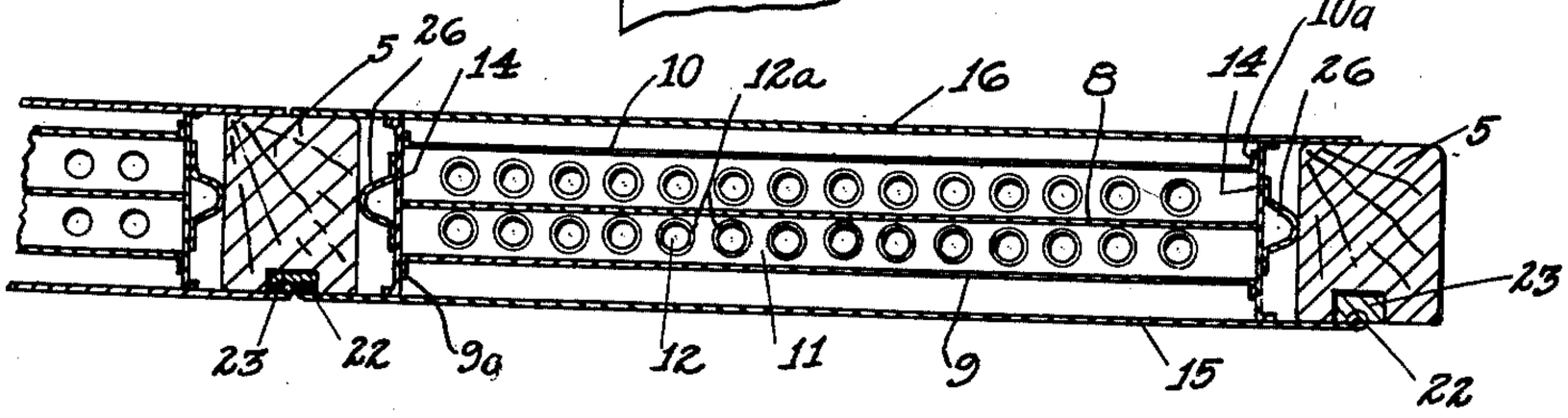

Fig. 4.

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Patented Feb. 28, 1939 2,148,436

UNITED STATES PATENT OFFICE

2,148,436

WALL CONSTRUCTION FOR BUILDINGS

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Application September 10, 1934, Serial No. 743,331

21 Claims. (Cl. 189—34)

The present invention relates to an improved wall construction for buildings, characterized by the provision of unitary factory-made, or assembled, wall panels or sections, each providing both exterior and interior surfaces of a building wall, said wall construction being applicable to the roof as well as the exterior and interior walls.

In a building having walls constructed in accordance with the present invention, each unitary panel or section generally corresponds in height to one story of the building and in width to the distance between adjacent uprights, or studs, of the building frame. In certain cases, two or more panels, one above the other, may be used to extend between adjacent floors of the building, thus reducing the panel size for easier handling. Furthermore, adjacent panels preferably overlie the supporting frame members of the building in abutting relation to provide smooth joints therebetween, so that an assembly of such panels may, if desired, completely enclose the frame members. In addition, the invention contemplates the construction of each panel in such a manner as to obtain a maximum degree of heat insulation, use being made of a material having high structural strength and relatively low thermal conductivity, as well as of bright interior surfaces resistant to the transmission of heat by radiation by virtue of the high reflectivity and low emissivity of such surfaces, so that the material of a panel gives off or transmits heat very slowly. The above and other advantageous features of the invention will hereinafter more fully appear from the following description with reference to the accompanying drawings, in which:

Fig. 1 is a side elevation of a portion of a building wall made up of panels embodying the invention, as viewed from the outside of the building.

Fig. 2 is a vertical section through a corresponding portion of the building shown in Fig. 1, as viewed from the inside.

Fig. 3 is a vertical sectional view along the line 3—3 of Fig. 1, on an enlarged scale.

Fig. 4 is a horizontal sectional view along the line 4—4 of Fig. 1.

Like reference characters refer to like parts in the different figures.

Referring first to Figs. 1 and 2, a portion of the foundation of a building is indicated at 1, on which is supported a sill 2 carrying floor joists 3 on which is laid the usual flooring 4. The customary upright exterior wooden or, if desired, other framing material frame members, or studs 5, are adapted to support a plate 6 that provides support for the joists 3' for the floor 4' of the second story of the building. The parts described thus far constitute the usual elements of the framing and floor structure of an ordinary building, and the invention contemplates the provision of unitary wall panels A for support by the frame, each panel providing both exterior and interior surfaces of the building wall. As best shown in Fig. 1, the panels A are applied to the frame of the building in such a manner as to constitute a continuous outside wall extending the width and height of the side of the building, while in Fig. 2, it is evident that, from the inside, the panels A constitute a continuous wall extending between the floor 4 and ceiling 7 of each story of the building.

Referring now to Figs. 3 and 4, each panel A is a unitary structure built up of a central plate 8 flanked on either side by vertically extending parallel plates 9 and 10, and the inner opposed surfaces of the plates 8, 9 and 10, which are preferably of metal, are bright or reflective, so that these surfaces will absorb and give off heat very slowly. The plates 8, 9 and 10 are united to each other at intervals and held in spaced relation by a series of horizontally disposed cross-plates 11 preferably provided with flanges 11*a*, whereby they may be secured to the respective plates 8, 9 and 10 in any suitable manner, as by welding. The cross-plates 11 are desirably made of metal having a relatively low heat conductivity, such as stainless steel or metal made from a nickel compound. The cross-plates 11 also provide apertures 12 extending therethrough, each aperture providing a lip or flange 12*a* which serves to greatly strengthen the plates 11 against flexure and thereby stiffen the assembled plates 8, 9, 10 and 11. The shape of each aperture is not necessarily circular, said apertures being of such size and shape and so located as to eliminate, to as great an extent as possible, and to control the convective air currents within the panel, the apertures being arranged in single rows between the plate 8 and each of the adjacent plates 9 and 19 so that up-going and down-going air currents are constrained to flow through the same apertures.

The assembled plates 8, 9 and 10, as held together by the cross-plates 11, are secured together around their outside edges by sealing plates 13 and 14 extending horizontally and vertically, attachment to the plates 13 and 14 being readily obtained by flanges 9*a* and 10*a* provided by the plates 9 and 10, respectively. The plates

13 and 14 are preferably of a material having high structural strength, relatively low thermal conductivity and high resistance to corrosion, such as stainless steel or a nickel alloy. The necessity for reflective inner or outer surfaces for these plates is less apparent, by reason of the location of these plates in planes parallel to the direction of heat transfer through the panel. The plates 13 and 14 are fastened to the main plates in such a manner as effectively to seal the inside of the panel from the atmosphere, thus protecting the reflective surfaces from corrosive agents. Ducts for electrical systems or heating systems or the like may also be located in the panel in any desired location.

Each panel A, consisting as it does of an interior sealed air chamber of low heat conductivity, further comprises outside wall surface plates 15 and 16, these plates extending parallel to and being spaced from the plates 9 and 10, respectively. The plate 15 constitutes a portion of the exterior wall surface of the building, and extends on all sides beyond the area of the central air space of the panel to overlap the sill 2, floor plate 6 and the vertical studs 5 which support the panel. The space between the plates 9 and 15 is filled by suitable sound insulating material 17 having a low cost, such as wood fiber, hair quilting or other sheet or granular material. The plate 9 also extends below the floor level at the base of the panel to provide a continuation of the space between the plates and thus provide an apron 18 which shields and closes in the space between the floor joists 3 and 3', as shown clearly in Fig. 3.

The exterior wall surface plate 15 is secured to the sealing plates 13 and 14 and to the plate 9 by suitable flanges secured in any desired manner, or by direct welds, so that the plate 15 forms an integral part of the panel. Furthermore, the plate 15 extends below that portion of the plate 9 which forms the apron 18 to provide an extension 19 that is turned inwardly at 20 to provide an expansion joint with an insert 21 of flexible material provided by the sill 2 or by the floor plate 6, as the case may be. The vertical edges of the exterior wall plate 15 which overlap the studs 5 are similarly provided with enlarged bulbous edges 22 which cooperate with insets 23 provided in the studs 5, the vertical seals between adjacent panels A, A being clearly indicated in Fig. 4.

The plate 16 which constitutes the interior building wall of each panel A is secured to the sealing plates 13 and 14 by flanges or welds, in substantially the same manner as is the exterior plate 15, and the space between the interior surface plate 16 and the plate 10 is also filled by sound insulating material 17 of the type previously described. The bottom of the plate may readily be shaped to provide the equivalent of a baseboard, as indicated at 24, which fits closely with the top flooring 4, while the top of the plate may be readily shaped to form a molding 25 fitting closely with the ceiling 7, as clearly indicated in Fig. 3.

From the foregoing, it is apparent that each panel A provides a building wall section ready made, assembled and finished throughout, so that a house wall can readily be erected from such panels in conjunction with the ordinary framing provided in any building. Each panel A provides an integral sealed air space in which the transmission of heat is reduced to a minimum by the use of bright or reflective interior surfaces enclosing this air space and the use of material of low heat conductivity extending across the space. Therefore, the walls of a building constructed of such panels will resist the transmission of heat in either direction, so that the building can be readily maintained at an even temperature throughout the year. The panel, as will be apparent, is applicable to the roofs of buildings as well as to interior and exterior vertical walls.

The preferred method of building a house utilizing my improved panels consists in laying the foundation 1, sill 2, floor joist 3 and a floor 4 in the usual manner. A stud 5 is then erected and the first panel is put in place with its bottom plate 13 resting on the subfloor and its side plates 15 and 16 overlying the opposite sides of the stud. Another stud is next put in place between the spaced side edges of plates 15 and 16 on the other edge of the panel, and successive panels and studs are erected in this manner to complete the wall.

In addition, provision is made for taking care of the expansion and contraction of the metal parts of the panel by the extension joints between abutting edges where they overlap the frame members of the building. In order to prevent expansion of a panel from setting up strains in the enclosing frame members of the building, expansion strips 26 extend both vertically and horizontally along the sides of each panel, these strips being preferably made of sheet metal possessing a considerable degree of inherent resiliency by reason of the cross-section of each strip, as indicated. Said strips 26 also prevent the passage of air, as will be apparent, by maintaining engagement at all times between the frame members and the edge of the panel.

While I have in this application specifically described one embodiment which my invention may assume in practice, it will be understood that the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

I claim:

1. In a wall construction for buildings, a unitary panel having sheet portions adapted to provide both the exterior and interior surfaces of the building wall, said panel also having enclosed within said portions and spaced therefrom an inner metal panel reenforcing envelope having sheet metal edge members rigidly connecting said exterior and interior panel portions, said edge members surrounding said envelope to form an internal, sealed air space adapted to reduce transmission of heat through said panel.

2. In a wall construction for buildings, a unitary panel having sheet portions adapted to provide both the exterior and interior surfaces of the building wall, said panel also having enclosed within said portions and spaced therefrom an inner metal envelope having sheet metal edge members rigidly connecting said exterior and interior panel portions, said edge members surrounding said envelope to form an internal sealed air space enclosed by bright inner reflecting surfaces adapted to reduce radiation of heat therefrom, and members of low heat conductivity connecting said surfaces and reenforcing said envelope.

3. In a wall construction for buildings, a unitary panel adapted to provide portions of both the exterior and interior surface of the building

wall, said panel comprising an internal air space formed by spaced members, exterior and interior wall forming members on opposite faces of said spaced members, and enclosing metal edge members rigidly connecting said spaced members and said wall forming members and enclosing said spaced members and said space therebetween.

4. In a wall construction for buildings, a unitary panel adapted to provide portions of both the exterior and interior surface of the building wall, said panel comprising an internal air space formed by spaced members, exterior and interior wall forming members on opposite faces of said spaced members, and peripheral edge enclosing members rigidly connected to said spaced members and enclosing the air space therebetween and connected to said exterior and interior wall forming members and disposed within the opposite edges thereof and providing channels along the vertical edges of said panel.

5. In combination, a building having vertical spaced frame elements, unitary panels adapted to be positioned between adjacent frame elements, each panel having edge portions adapted to be moved into positions overlying the frame elements on the exterior side thereof upon relative lateral movement of said panels and frame elements along the line of the building wall, and cooperating resilient and embedded sealing means between each frame element and the overlying edge portions of said panels operatively connectible upon such relative lateral movement.

6. In combination, a building having spaced frame elements, panels adapted to be positioned between adjacent frame elements and having adjacent edge portions overlying an intermediate frame element, a yielding sealing strip on the surface of said intermediate frame element at the junction of adjacent panels, and means on the edges of adjacent edge portions embedded in said yielding strip, said overlying portions being on the outside of the building and said panels also having internal edge portions also overlying the opposite faces of the frame elements.

7. In combination, a frame building having parallel spaced frame elements forming rectangular side wall openings, unitary panels adapted to be positioned in and forming a closure for said openings, each panel having spaced plate members forming exterior and interior wall surfaces, edge forming members secured to said plate members and forming a peripheral closure for the space between said plate members, means providing a peripheral seal between said panels and adjacent frame members comprising the panel opening, including resilient sealing strips carried by said frame members and resiliently engaging adjacent portions of said wall plate members, and means on said panels for maintaining said strips and said panel portions in pressure engagement.

8. A prefabricated wall forming panel unit comprising a rigid enclosing edge portion having rigidly connected thereto inner and outer spaced face portions and an enclosed portion therebetween sealed around its edges, and spacing means in said enclosed portion comprising a plurality of vertically apertured transversely disposed spacing members, said spacing members having between the lateral edges thereof a single row of apertures therein and dividing said enclosed portion into a series of parallel compartments communicating only through said apertures, and said apertures being so disposed as to create turbulence while passing therethrough convection air currents moving oppositely along opposite outer and inner walls of said enclosed portion.

9. In a wall construction for buildings, a unitary panel adapted to provide portions of both the exterior and interior surfaces of the building wall, said panel comprising an internal air space formed by spaced metal plates and having metallic enclosing edge members rigidly connecting said spaced plates, and exterior and interior wall forming members fixed to said plates and extending in substantially parallel relation to said plates and spaced from the latter, said wall forming members extending beyond said edge members and overlying frame members of the building.

10. In a wall construction for buildings, a unitary panel engageable at opposite edges with the frame of the building and adapted to provide sheet portions of both the exterior and interior surfaces of the building wall, said panel comprising an internal air space formed by spaced metal plates reenforced and held in spaced relation by connectors of low heat conductivity, exterior and interior wall forming sheets secured to said plates and extending in substantially parallel relation thereto and sheet metal edge members rigidly connecting said exterior and interior sheets, said wall forming sheets extending laterally beyond the edges of the air space to provide continuous wall surfaces when said panels are mounted in the building frame.

11. In a wall construction for buildings, a unitary panel adapted to provide portions of both the exterior and interior surfaces of the building wall, said panel comprising an internal air space, cooperating laminated portions on opposite sides thereof comprising spaced metal plates on opposite sides of said air space, exterior and interior wall forming members extending in substantially parallel relation to said spaced plates, and sheet insulation between said plates and said wall forming members and fixed thereto, and edge forming means connecting said spaced plates and said wall forming members and enclosing said air space.

12. In a wall construction for buildings having spaced frame members, a series of unitary panels adapted to be positioned between adjacent frame members, each panel comprising spaced metal plates, sheet metal edge members rigidly connecting said plates and forming therebetween an internal air space, and exterior and interior wall forming members secured to and spaced from said plates, said wall forming members extending laterally beyond the edges of the air space to overlie the frame members of the building thereby forming continuous interior and exterior wall surfaces.

13. In a wall construction for buildings having spaced frame members, a series of unitary panels adapted to be positioned between adjacent frame members, each panel comprising spaced metal plates and enclosing sheet metal edge members rigidly connecting said plates and forming therebetween an enclosed air space, and exterior and interior wall forming members secured to said plates and disposed outside the latter, at least one of said members of each of the panels extending laterally beyond the edges of the air space to overlie the frame members of the building, thereby forming a continuous wall surface.

14. In a wall construction for buildings hav-

ing spaced frame members, a series of unitary panels adapted to be positioned between adjacent frame members and between an upper plate and a lower sill, each panel comprising a rigid enclosing edge portion having rigidly connected thereto spaced metal plates forming therebetween an internal air space, exterior and interior wall forming members secured to said plates and disposed outside the latter, at least one of said wall forming members extending laterally beyond the edges of the air space to overlie the frame members and the sill and the plate, thereby forming a continuous wall surface and an apron over said sill, and means on said panels cooperating with said frame members for holding said wall forming members in the aforesaid position overlying said frame.

15. The combination with a building frame having parallel spaced frame elements, of panels adapted to be moved laterally into position between adjacent frame elements, each panel having parallel spaced sheet members forming interior and exterior wall surfaces overlying the inner and outer faces of intermediate frame elements, and resiliently mounted sealing means along the vertical edges of the outer wall surface of each panel projecting into the space between the sheet members thereof and gripping the outer face of the frame element therebetween as the panel is moved laterally relative thereto, the spacing between the inner wall surface and the sealing means of said panels being less than the distance from the inner to the outer faces of the frame elements received therebetween.

16. The combination with a building frame having spaced frame elements and a panel adapted to be positioned between adjacent elements by relative lateral movements of said panel and elements along the line of said building wall and having at least one wall forming surface overlying said frame elements, of cooperating resiliently engaging sealing means, one on the frame element and the other on the panel engageable upon such lateral movement, for making a disconnectible weather tight joint therebetween.

17. The combination with a building frame having parallel spaced frame elements, of panels adapted to be positioned between adjacent frame elements, each panel having rigid edge forming members carried on the panel between the body of the panel and the frame elements at opposite sides of the panel, and having a plurality of internal spaces enclosed by said members and formed by spaced parallel metal plates including exterior and interior wall forming plates fixed to said rigid edge members.

18. The combination with a building frame having parallel spaced frame elements, of panels adapted to be positioned between adjacent frame elements, each panel having rigid edge forming members carried on the panel between the body of the panel and the frame elements at opposite sides of the panel, and having a plurality of internal spaces enclosed by said members and formed by spaced metal plates including exterior and interior wall forming plates fixed to said rigid edge members and extending in substantially parallel relation thereto, and insulating members between certain of said space forming plates and said wall forming plates.

19. A hollow insulating panel comprising an enclosing edge portion having connected thereto spaced substantially parallel plates forming an enclosed air space, cross plates between said parallel plates dividing the hollow interior of said panel into compartments wherein air may circulate freely and providing a connection between said parallel plates, each of said cross plates having a single row of spaced apertures between said spaced parallel plates, with the apertures in the several cross plates providing conflicting air flow of convection currents between adjacent compartments.

20. A hollow insulating panel comprising a rigid enclosing edge portion having rigidly connected thereto spaced substantially parallel plates forming an air space substantially enclosed by bright inner reflecting surfaces adapted to reduce radiation of heat therefrom and transmission of heat through said plates, a cross plate between said parallel plates dividing the air space in said panel into compartments wherein air may circulate freely and providing a connection between said parallel plates, said cross plate having a single row of spaced apertures between said spaced parallel plates, with the apertures therein providing conflicting air flow of convection currents between adjacent compartments.

21. A hollow insulating panel comprising spaced substantially parallel plates formed from material resistant to heat absorption and emission, cross plates extending between said parallel plates dividing the hollow interior of said panel into compartments wherein air may circulate freely and providing a connection between said parallel plates, each of said cross plates having spaced apertures, said apertures being in double rows, and a dividing plate secured to said cross plates between said rows of apertures.

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