

Feb. 15, 1955

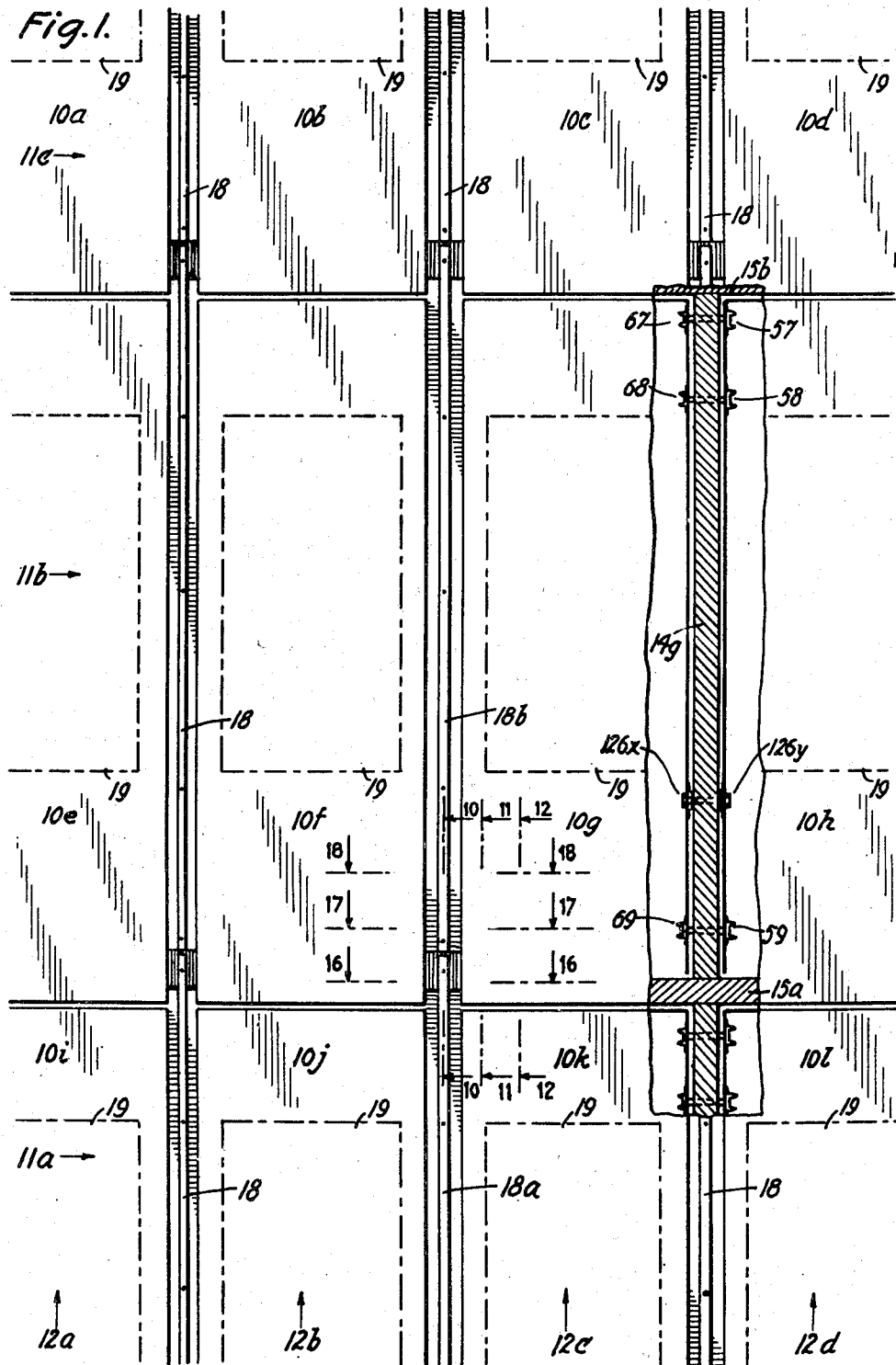
W. K. HARRISON ET AL

2,702,104

METAL PANEL BUILDING CONSTRUCTION

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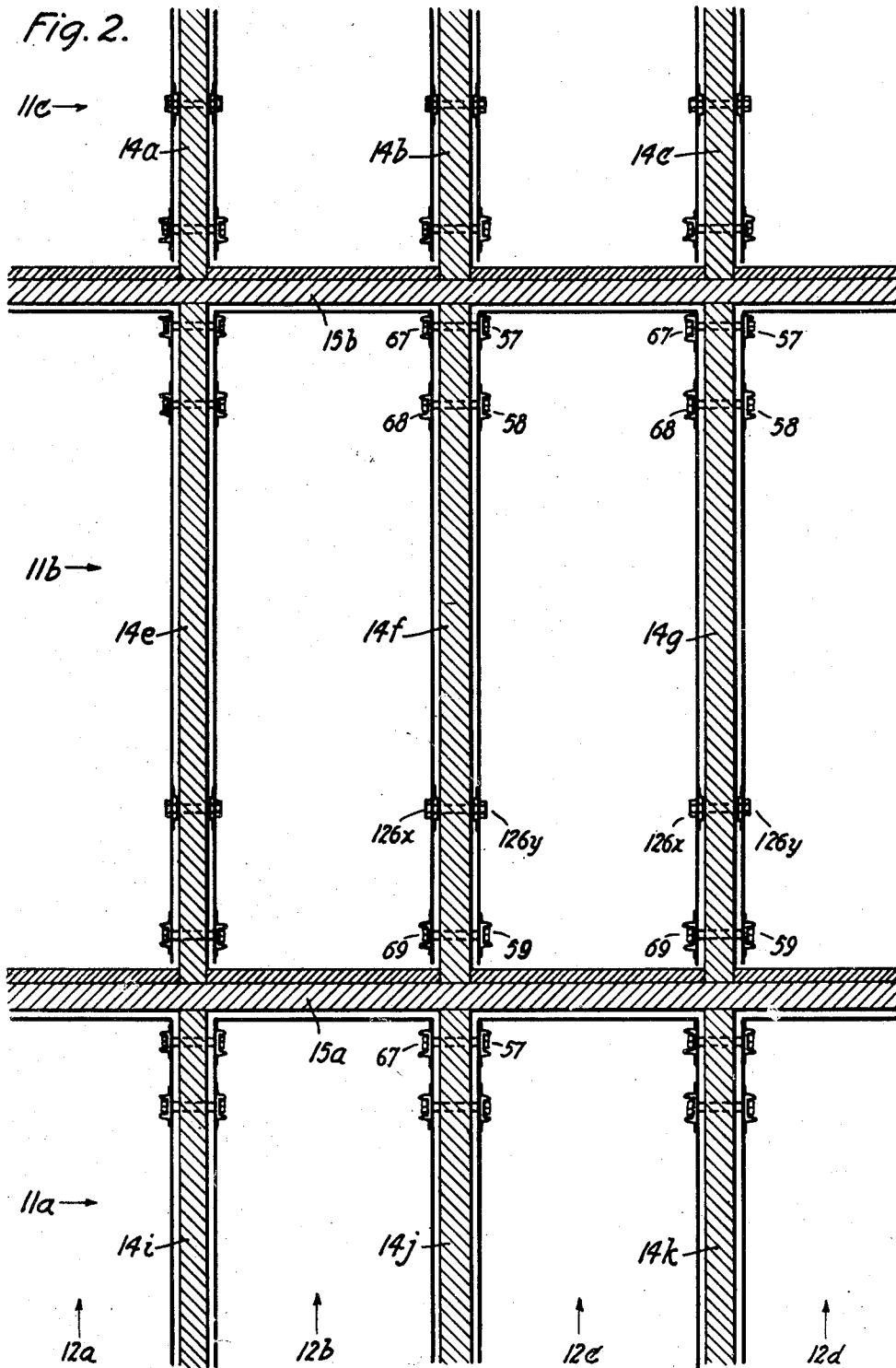
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Fig. 2.



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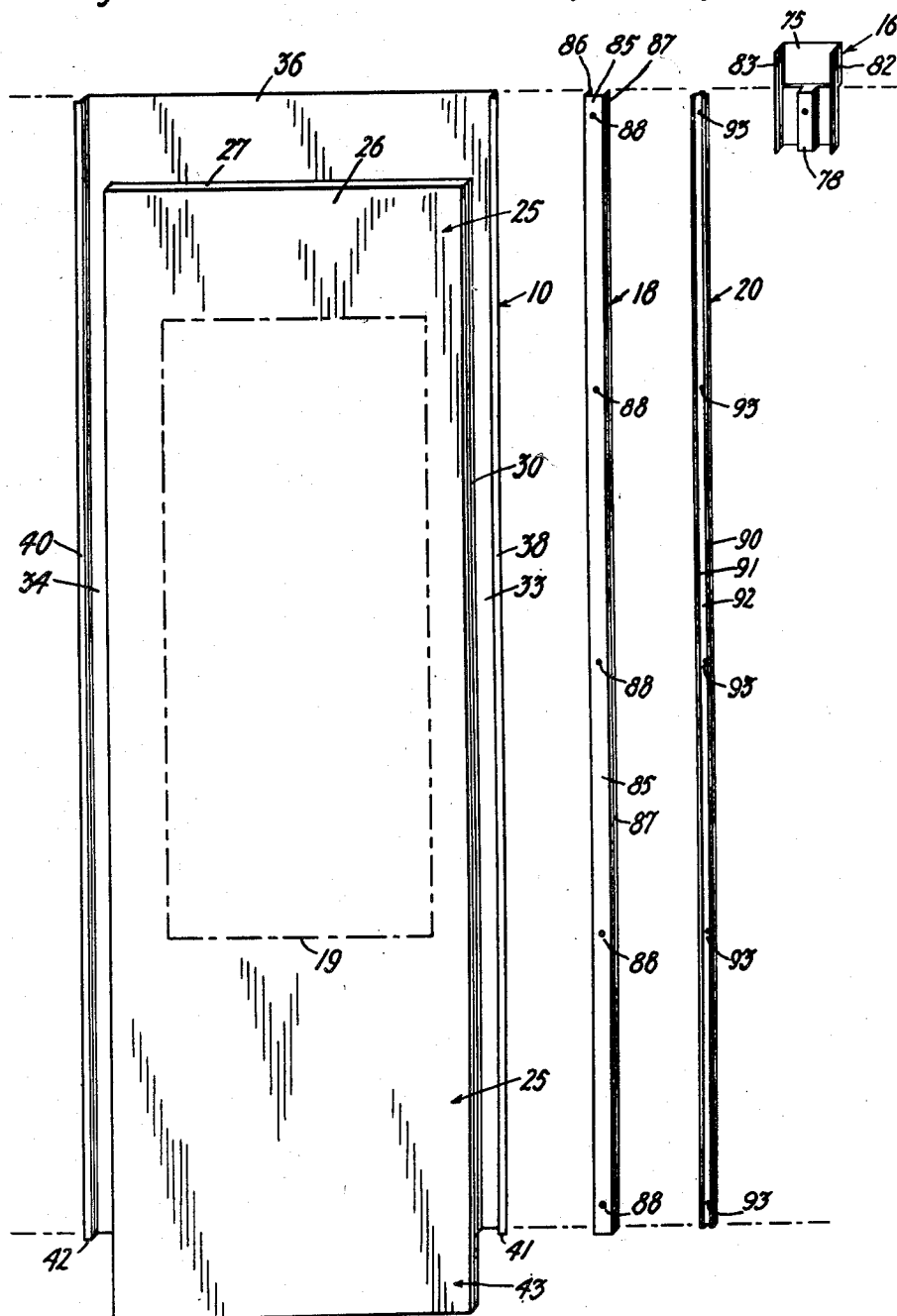
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Fig. 3.

Fig. 5. Fig. 6. Fig. 4.



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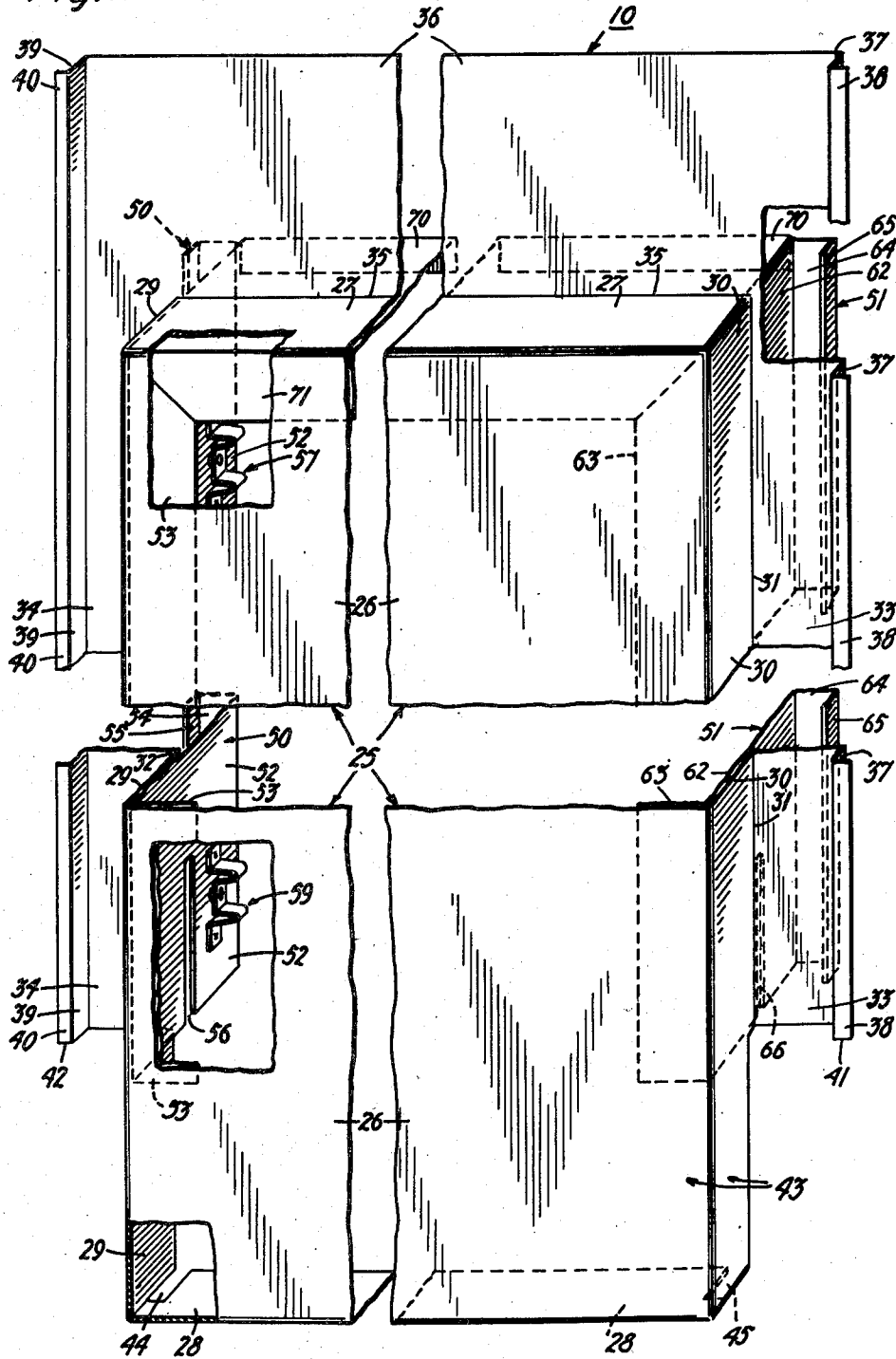
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Fig. 7.



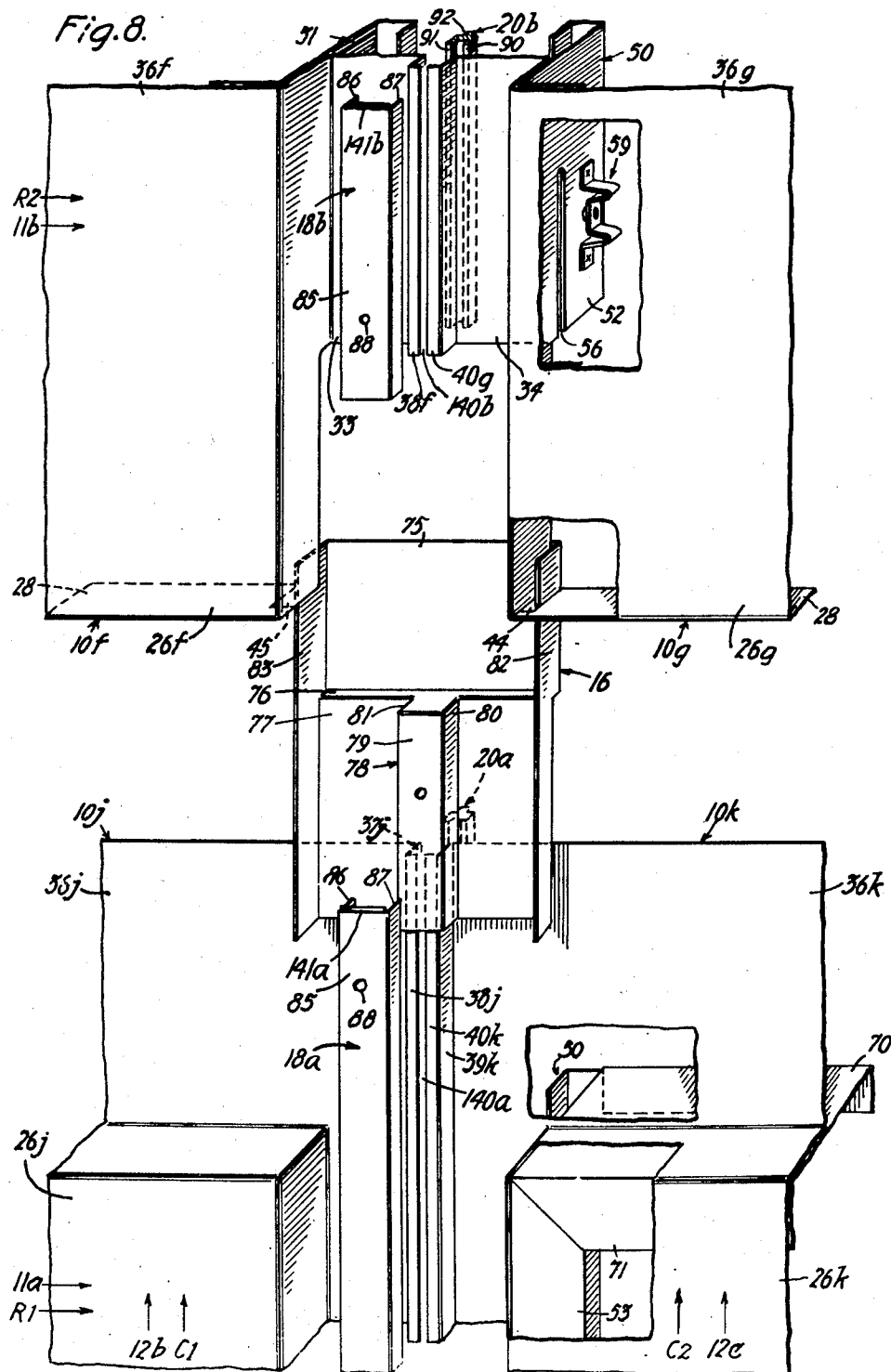
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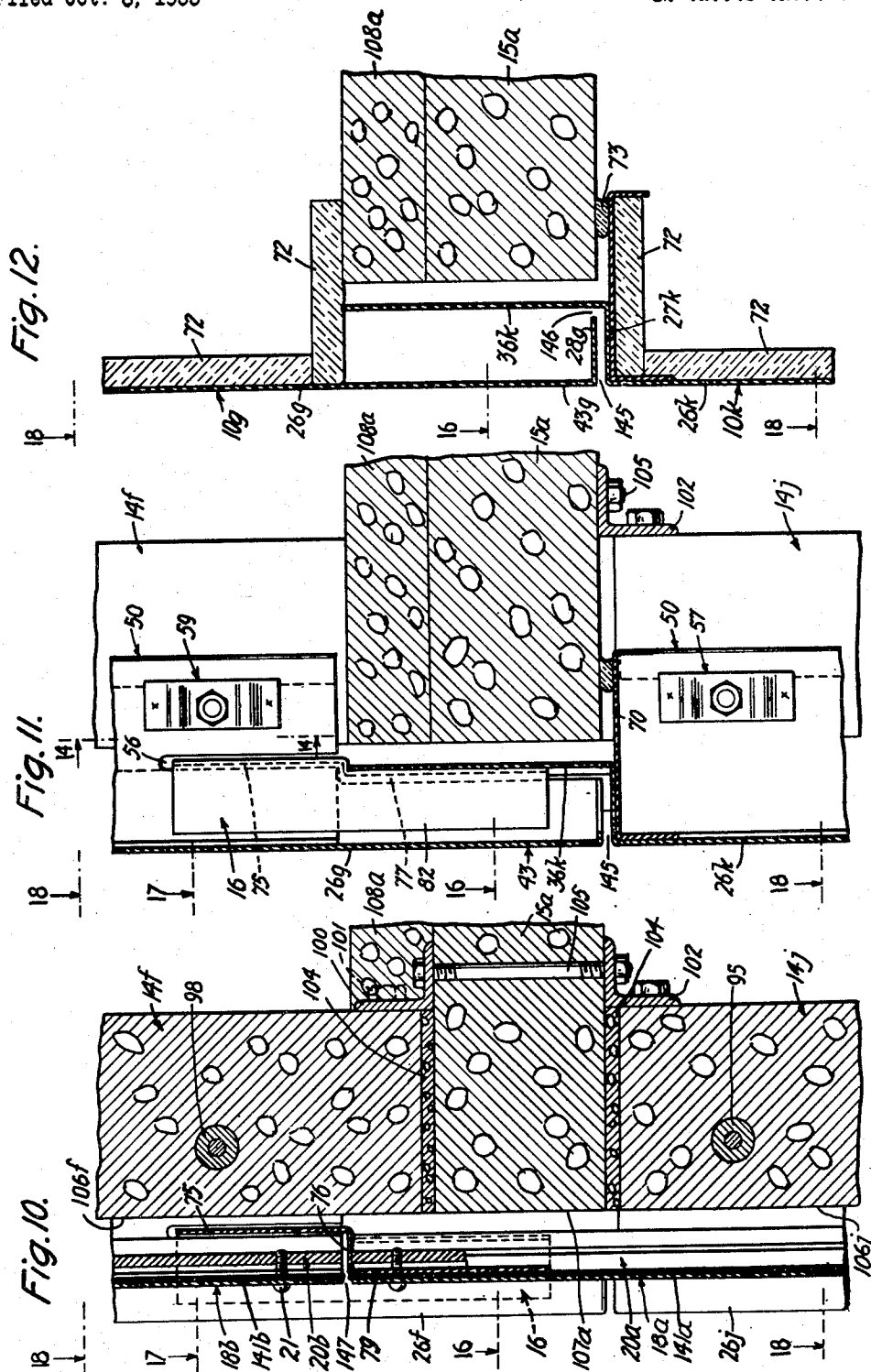
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Fig. 18.

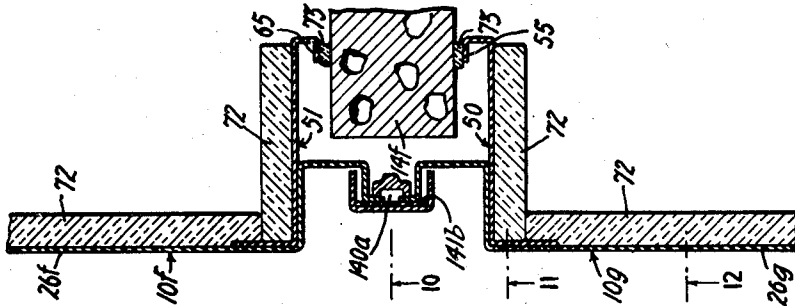


Fig. 17.

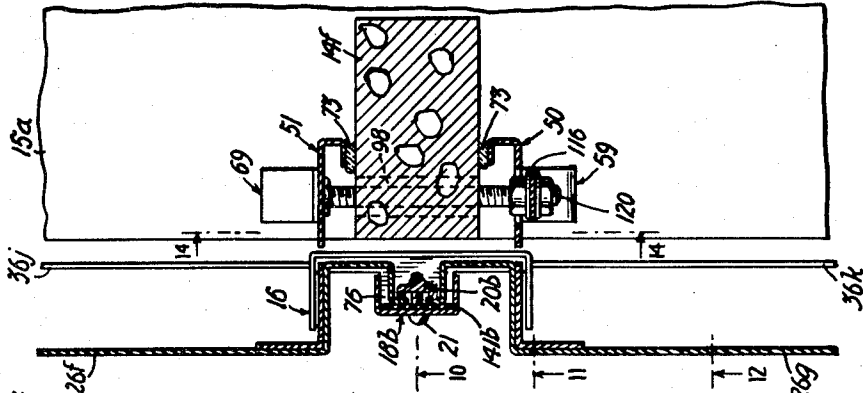


Fig. 16.

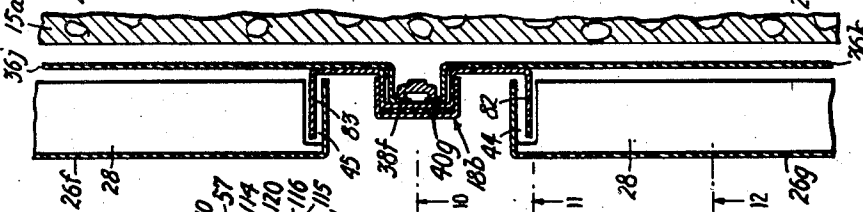


Fig. 14.

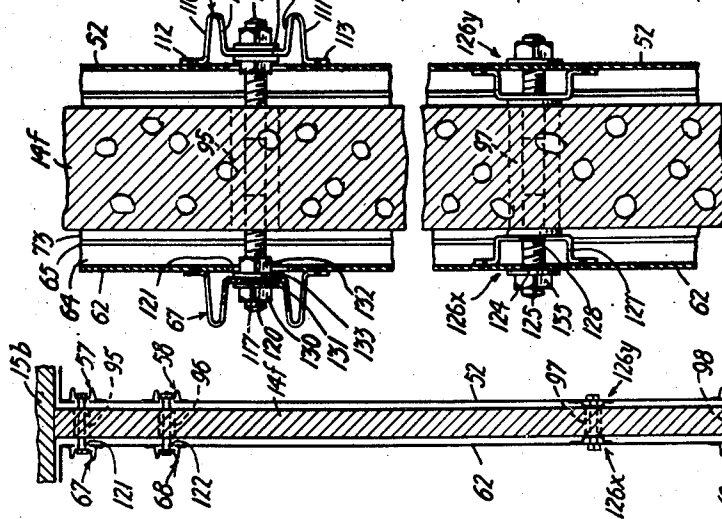


Fig. 13.

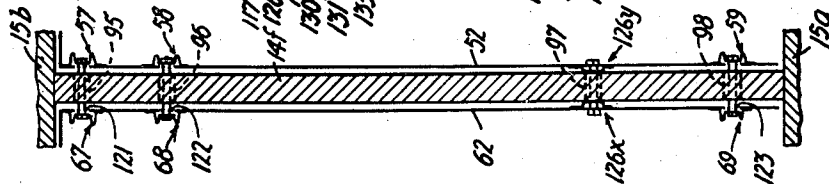
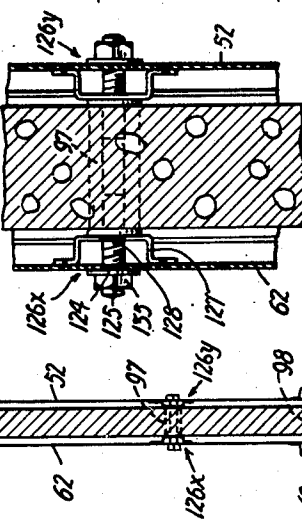


Fig. 15.



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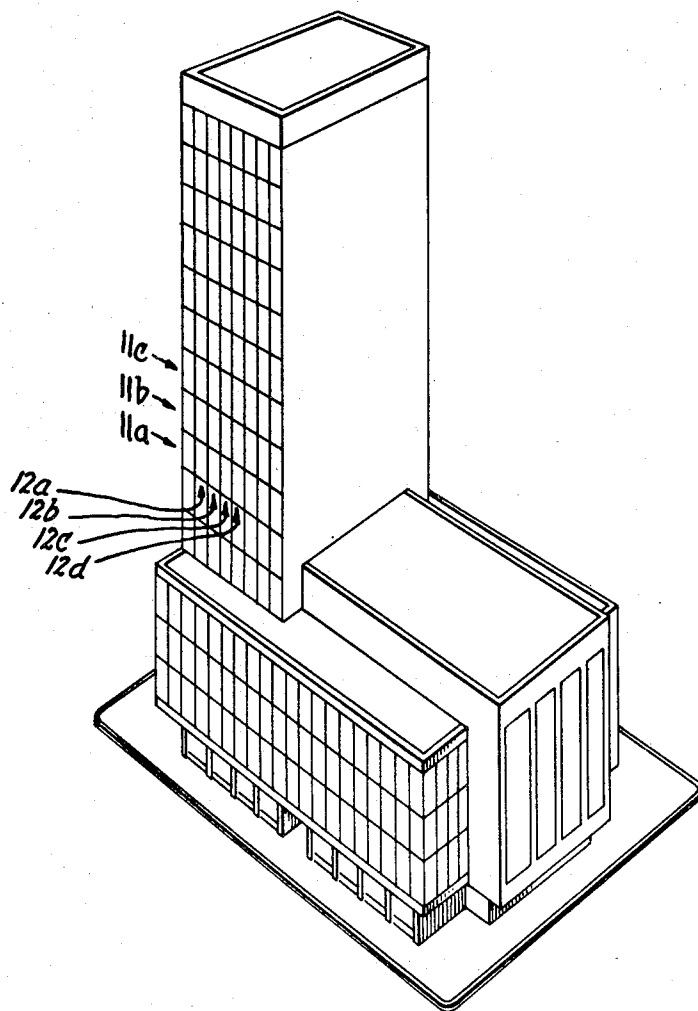
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Fig. 20.



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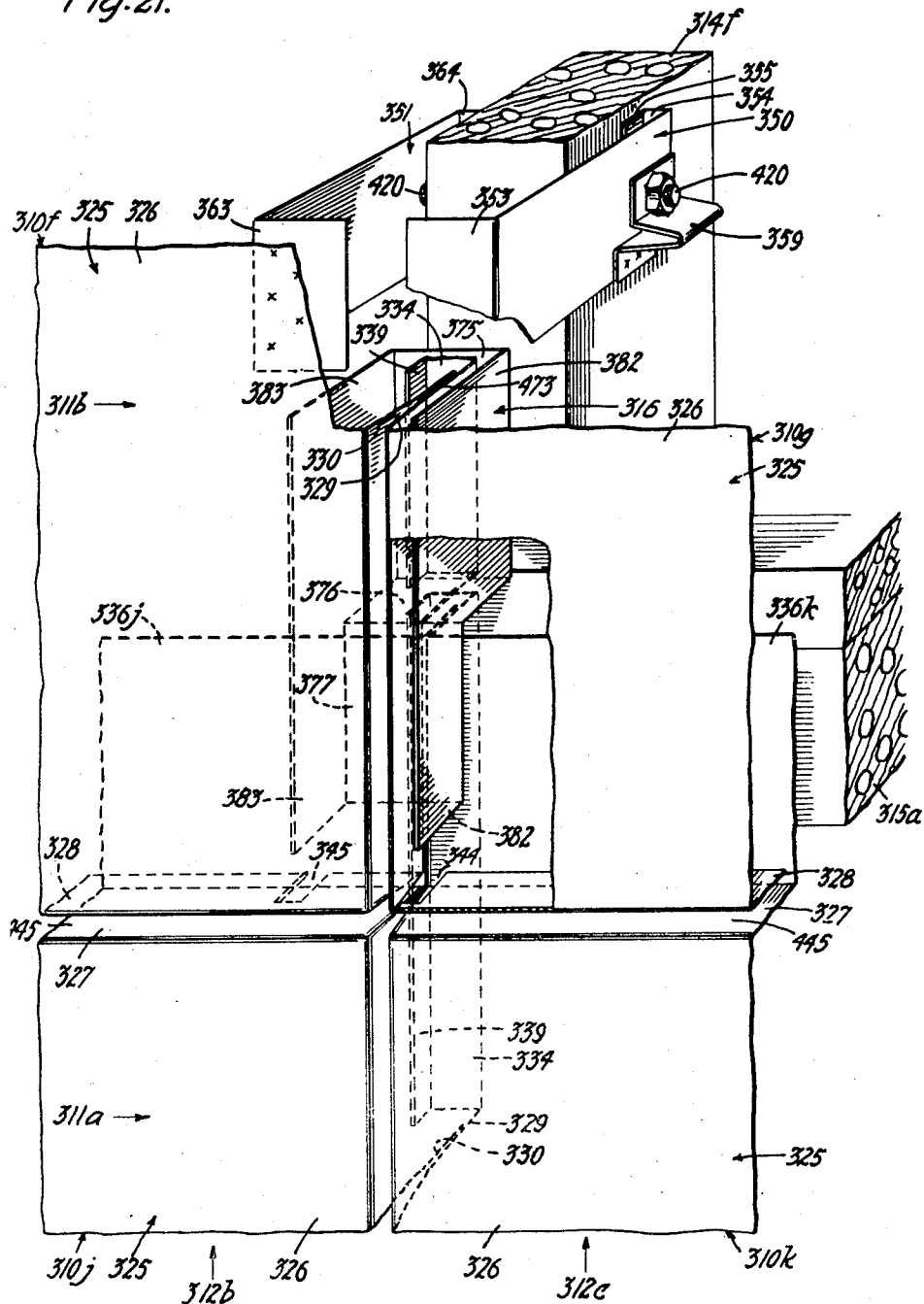
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Fig. 21.



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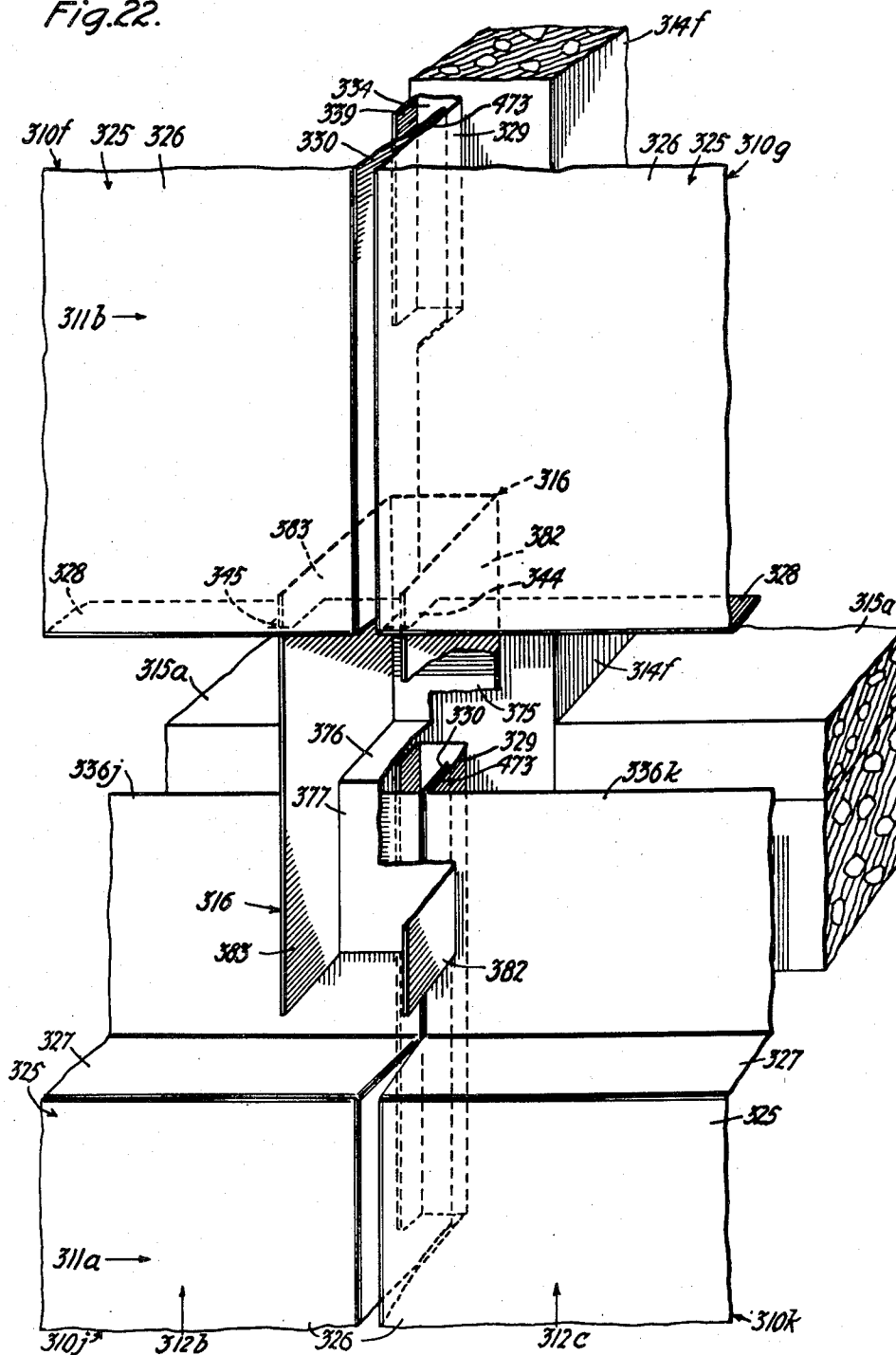
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Fig.22.



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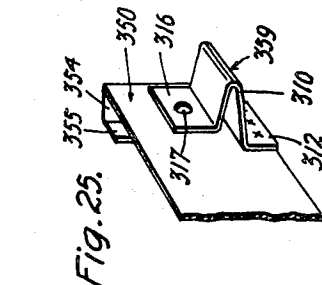
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METAL PANEL BUILDING CONSTRUCTION

Wallace K. Harrison and Max Abramovitz, New York,
and Oscar F. Wiggins, Glen Head, N. Y.

Application October 8, 1953, Serial No. 384,976

12 Claims. (Cl. 189—85)

This invention relates generally to building construction and more particularly to the wall structure and to the provision of metallic elements to be attached to the wall structural members to form a metallic sheath or "skin" for the outer wall of the building.

The trend in building construction, and particularly in large buildings of the so-called "skyscraper" type, is toward the utilization of metallic facing for the exterior walls, the metallic facing or "skin" being made up of sheet metal in the form of panels which are mounted in one way or another on the steel or reinforced concrete framework which, of course, rests upon a suitable foundation. It is desirable that the panels and other elements which are to provide the wall facing be prefabricated at the manufacturing plant to the end that as little work as possible remains to be done on the job where the erection is done. Erection of the wall from prefabricated panels and accessory parts results in uniformity and permanence of construction, savings in erection time, and other economies.

Although buildings have heretofore been constructed and faced with metallic sheathing made up of panels prefabricated from metal such as aluminum alloys, stainless steel and the like in sheet metal form, difficulties have presented themselves in making and maintaining the exterior walls weatherproof. Furthermore, by reason of the expansion and contraction of the metallic panels due to weather changes, prior constructions have failed to measure up to the requirements where it is desired to have a metallic surface facing which is not only weatherproof, particularly at the joints, but also one which is not subject to unwanted condensation of moisture or "sweating" at the interior surface of the wall.

According to this invention there is provided a metallic wall construction which may be made up from prefabricated uniform metal panels, drip plates, and other accessory parts. The panels are mounted in courses or rows on suitable vertically disposed frame members or mullions and provision is made for expansion and contraction of the individual metallic panels which result from temperature changes. The panels are constructed and arranged to provide weatherproof horizontal and vertical joints or seams, and special provision is made for weatherproofing the joint where the corners of four adjacent panels meet, by means of a flash plate member or drip plate which prevents rain water from passing through the four-corner joint to the interior surface of the walls and which constrains the rain water to flow outwardly and down, over the exterior surface of the wall. Also, the panels are so designed and mounted that "breathing" can take place to prevent unwanted condensation of moisture behind the panels. "Weatherproof" as used herein will be understood to mean that rain striking the exterior surface of the wall is prevented from passing through the joints or seams or working its way to the back of the wall but is constrained to run outwardly and downwardly over the exterior surface of the wall.

Although the novel features which are believed to be characteristic of the invention will be pointed out in the annexed claims, the invention itself as to its objects and advantages and the manner in which it may be carried out may be better understood by reference to the following description taken in connection with the accompanying drawings forming a part hereof, in which:

Fig. 1 is a front view of a portion of the wall of a

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building having the panels and other parts mounted in place to form the exterior wall of the building, said view being partly broken away to show the position of the frame members or mullions;

Fig. 2 is a view of the framing members or mullions behind the portion of the wall shown in Fig. 1;

Fig. 3 is a view in perspective of a typical panel;

Fig. 4 is a view in perspective of a drip plate to cover the joint where the corners of four panels meet;

Fig. 5 is a view in perspective of channel member to cover the vertical joint where two panels meet;

Fig. 6 is a view in perspective of a clamp member to which the channel member shown in Fig. 5 is secured;

Fig. 7 is a view broken away and to larger scale of a typical panel showing further details;

Fig. 8 is an exploded view of the corner portions of four adjacent panels, drip plate, channel member and channel member clamp, to illustrate the manner of assembly and the relation of the cooperating parts;

Fig. 9 is a view in perspective of a portion of the wall where the corners of four adjacent panels meet showing the elements (shown in Fig. 8) after erection is completed;

Figs. 10, 11, 12, 14, 15, 16, 17, and 18 are views on lines 10—10; 11—11; 12—12; 14—14; 15—15; 16—16; 17—17, and 18—18 respectively of Fig. 1; said reference lines also appearing in other views;

Fig. 13 is a view to illustrate the mounting of the panels on the mullions;

Fig. 19 is a more or less diagrammatic view to illustrate one manner of forming and mounting a corner panel for the corner of a building;

Fig. 20 is a view in perspective of a building of the skyscraper type having walls embodying the invention; Fig. 21 is a partial view in perspective and partly broken away to illustrate a modification;

Fig. 22 is a view corresponding to Fig. 21, partly exploded to further illustrate the embodiment shown in Fig. 21;

Fig. 23 is a vertical section view of the assembly shown in Fig. 21 and on line 23—23 of Fig. 24;

Fig. 24 is a horizontal section view of the assembly shown in Fig. 21 and on line 24—24 of Fig. 23, and

Fig. 25 is a view in perspective of one form of flexible hanging clip.

Referring now to the drawings, like numeral reference characters denote similar parts throughout the several views whereas a small letter added to the numeral reference character denotes a like part but designates also a particular main part such as a particular panel for a particular course or column of panels. The wall shown in Fig. 1 comprises a plurality of panels 10—(a to l) all alike, arranged in horizontal rows or courses 11—(a, b, c,) and vertical rows 12—(a, b, c, d). The vertical rows are herein, for convenience of description, designated as "columns" although it will be understood as the description proceeds that these columns of panels do not in the ordinary sense support the weight of the building, as the panels are mounted or suspended on vertical frame members 14—(a, b, c, e, f, g, i, j, k) which are herein called "mullions" (see Figs. 1 and 2). These mullions in the illustrative embodiment are not relied upon to carry the weight of the building but serve primarily as mounting supports for the panels as will be described in further detail hereinafter. It will be understood, however, that the mullions upon which the panels are supported can be designed as supporting frame members. The mullions 14 extend from floor to floor, the floors being designated 15—(a, b).

The joint where four corners of four adjacent panels meet (such as panels P1, P2, P3 and P4 identified in Fig. 9) is covered with a flash plate member 16 (see also Figs. 4 and 8). This flash plate member is herein referred to as a "drip plate." The vertical joints between adjacent vertical columns 12 of panels 10 are covered by channel members 18 and, as described hereinafter, the horizontal joints between horizontal rows or courses 11 of panels are overlap joints, made by overlapping the lower portions of the panels of the course of panels

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over the upper portions of the course immediately below it as described hereinafter.

The panels 10, drip plates 16 and the channel members 18 and clamping member 20 (see Figs. 3, 4, 5 and 6) are made of sheet metal or other suitable stock (such, for example, as aluminum alloy) which may be formed into shape by stamping, drawing, or other known ways. Each panel 10 may have a window (indicated in dot-dash lines 19) mounted therein, or, if desired, the panel may be formed wholly of sheet metal without making provision for a window. The method of mounting a window in a panel is known and a detailed description of the window and its mounting is deemed unnecessary to an understanding of the features which characterize the invention.

As has been indicated above, the entire wall structure may be made up of a few standard elements, the important elements being the panel 10, the drip plate 16, the channel member 18, and the clamp member 20. The member 20 serves as a clamping member for mounting the channels 18. All these parts may be prefabricated at the factory and shipped to the job ready to be erected without any further work being done on the job other than the erection of the parts on the building. A typical building having the wall structure embodying the invention is illustrated more or less diagrammatically in Fig. 20.

The particular shape and construction of the standard elements (panel, drip plate, channel member, and channel clamp member) are perhaps best shown in Figs. 3-9. The panel 10 has a pan shaped portion 25 comprising a face 26 of generally rectangular shape. As shown, the face 26 is smooth but it may have stamped or embossed therein such embellishment or design as may be desired for aesthetic appearance. Extending from each edge of the face 26 (see Fig. 7) is an intumed horizontally disposed web portion 27 at the top, a horizontally disposed flange portion 28 at the bottom end, a vertically disposed web portion 29 and a vertically disposed web portion 30 at the sides; these webs and flanges lying in planes substantially perpendicular to the plane of the face portion 26. Extending outwardly from the inner edges 31 and 32 of the pan 25 in a plane parallel to the pan face 26 are flat portions 33 and 34 and extending upwardly from the edge 35 is a flash flange portion 36, which, for convenience of description, may be called a "panel flash strip." The portion 33 is turned outwardly in a plane perpendicular to the plane of portion 36 to form web 37 and outwardly again to form edge flange 38 which lies in a plane substantially parallel to the face 26 and the web 33. The corresponding opposite side of the panel is formed to have a corresponding web 39 in a plane perpendicular to the portion 34 and parallel with web 29 and an edge flange 40 corresponding to the edge flange 38; it being noted that one side may be considered as righthand and the other as lefthand.

In the embodiment illustrated in Fig. 3, the overall width of the panel is of the order of $4\frac{1}{2}$ feet and the height of the pan is of the order of 11 feet, which represents the height from floor to floor. But it will be understood, of course, that these dimensions may be varied as the panel may be made in such size as may be desired, depending upon the placement of the frame members or mullions on which the panels are to be mounted. The upstanding flash strip 36 of the panel 10 is preferably of the order of 8 to 12 inches.

The vertical flange portions 33 and 34 do not extend to the bottom end 28 of the pan but terminate short of the bottom end a distance corresponding to the height of the flash strip 36. The portion of the pan 25 which lies below the lower ends 41 and 42 of the edge flanges 38 and 40, for convenience of description, is herein designated as an overlapping or overhang portion 43. The portion 43 will overhang or overlap the flash strip 36 of the adjacent panel in the next lower course of panels when the panels are erected as described hereinafter. It will be observed that the intumed flange 28 (see Fig. 7) at the bottom end of the pan 25 is provided with a slot 44 adjacent to and parallel with the intumed vertical flange or web 29, and a corresponding slot 45 adjacent to and parallel with the vertical web or flange 30, the slots being opened at their rear ends. The purpose of these slots is explained hereinafter.

The panel 10 is provided with two vertically disposed hanger members, one on each side (designated generally

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by reference characters 50 and 51); one of which may be considered as righthand and the other as lefthand. Hanger member 50 comprises a plate having a mounting web portion 52 lying against and secured to web 29 of the panel pan and an outwardly turned flange 53 at right angles to web 52 which is secured to the inner surface of pan face 26. The plate 50 extends rearwardly from the pan and has a web 54 at right angle to web 52 and the plate is again bent to form edge flange 55. At the bottom end of hanger plate 50 adjacent to and just back of the plane of the web 34 is a vertically disposed slot 56, the length of which corresponds to the height of the flash flange 75 of drip plate 16 described in further detail hereinafter. Mounted on the inside surface of hanger plate web portion 52 are flexible hanger clips 57, 58 and 59 (see Figs. 7, 13) underneath which are registering bolt holes as described later. The plate 51 is similar to plate 50 but is other-hand thereto, having a hanger web portion 62, face portion 63, flange 64, edge flange 65, slot 66 and flexible hanger clips 67, 68 and 69 (see Figs. 7, 13). The panel is further reinforced by horizontally disposed reinforcing plate 70 secured to the inner surface of the panel web 27 and having a right angle flange 71 which engages and is secured to the inner surface of pan face 26.

The drip plate 16 (see Figs. 4, 8) is for covering the joint where four corners of four adjacent panels meet and serve as a flash member. It comprises a vertically disposed flash flange portion 75, a horizontally disposed web portion 76, and an apron portion 77 depending from the edge of the web 76. The apron portion 77 has a channel portion 78 which is closed at its top end by the web portion 76 and is bounded by face portion 79 and side portions 80 and 81. The height of the drip plate 16, as shown, is of the order of 10 to 14 inches. Extending outwardly from the ends of flash flange 75 and apron portion 77 are vertically disposed flange portions 82 and 83. Thus it will be observed that flange portion 75 lies in a plane parallel to the plane of apron 77 but offset therefrom by the horizontal web 76, the width (measured horizontally from flange 75 to apron 77) being that which will permit the web to overlies and cover the upper edges of two adjacent panels in a course where they meet to form a vertical joint. The drip plate member 16 is so designed that it will provide a weatherproof joint where the corners of four adjacent panels meet.

The channel member 18 (see Figs. 5, 8) has a face web 85 and intumed flanges 86 and 87 on each side and, as shown, is of a length corresponding to the vertical length of the panel pan 25. The face 85 is provided with holes 88 to accommodate mounting bolt screws. The clamp plate member 20 (see Figs. 6, 8) is of generally U-shape having ridges 90 and 91 and the cross portion 92 is of substantial thickness so that it can be provided with tapped holes 93 registering with holes 88 in the channel member 16 to receive the mounting screws.

The preferred method of mounting the various parts to form an exterior wall of a building and various features of the construction provided by the invention will be better understood from the following more detailed description.

The frame members on which the panels 10 are mounted and supported are herein shown as vertically disposed mullions 14. In the illustrative embodiment the building is constructed of the usual steel structural members (not shown) and reinforced concrete floors 15. The mullions 14 are precast reinforced concrete and have a length to reach from floor to floor (see Fig. 2). Each mullion has cast in it when made a plurality of internally threaded metallic sleeves 95, 96, 97, 98 (see Figs. 10, 14, 15, 17) extending crosswise through the mullion. The means for mounting the mullions in place is shown perhaps best in Fig. 10 where it will be observed that the lower end of the mullion 14f engages the sub-floor 15a and is secured thereto by angle piece 100 fixed to the mullion by bolt 101 and grouting 104 is provided for a rigid footing. The upper end of the mullion 14f, on the next floor below mullion 14f and aligned with it, is secured to the undersurface of floor 15a by a similar angle piece 102 similarly bolted to the mullion, the grouting 104 being used to make a rigid construction. A bolt 105 through the sub-floor 15a secures the angles 100 and 102, and hence the mullions, firmly in place, it being noted that the faces 106f and 106i of the mullions lie flush with the edge 107a of the sub-floor 15a. Finally, the concrete is poured on the sub-floor 15a to provide a finished floor surface 108a.

All mullions may be mounted in similar fashion and the foregoing describes a typical mounting. The mullions are spaced apart a proper distance to accommodate a standard panel 10, as indicated in Figs. 1 and 2.

Panels 10 are mounted on and supported by the mullions 14. Taking a typical example for purpose of description, panel 10 is provided on each side with a plurality of hanging clips 57, 58, 59, 67, 68, 69 (see Fig. 13) which, as shown, are three in number on the righthand side of the panel and three in number on the lefthand side. A typical flexible hanging clip (see Fig. 14) is made from a strip of springy metal formed into a particular shape. It comprises two V-shaped portions 110 and 111, one terminating in a base flange 112 engaging and secured (as by welding) to the righthand hanger web 62 of the panel and the other terminating in a base flange 113 engaging and secured to the hanger web. The legs 114 and 115 of the clip are connected by a cross portion 116 lying parallel with the plane of the outwardly turned base flanges 112 and 113 but offset a slight distance to provide a space between the cross portion 116 and the hanger webs 62 of the panel. The cross portion 116 is provided with a bore 117 to accommodate a mounting bolt 120. The hanger web portion 62 of the panel is provided with an aperture 121 registering with the bore 117 of the clip but of larger diameter, to permit a substantial amount of play between the bolt 120 and the web 62 of the panel. The righthand hanger web 62 of a panel has, as shown, three flexible clips 67, 68, 69 which register with apertures 121, 122, 123 in the hanger web 62. These flexible clips are positioned in spaced relation, as shown in Fig. 13, there being two in the upper portion and one near the lower end. Between the flexible clips 68 and 69 there is a bore 124 to accommodate a mounting bolt 125 but without play between the bolt and web (see Figs. 13, 15). For convenience of description the three mounting connections 67, 68 and 69 are herein referred to as "elastic points" or floating connections inasmuch as they permit of relative movement between the rigid mullion 14 and the panel 10, such movement being brought about by expansion or contraction of the metal panels as a result of temperature changes. The connection 126x of the hanger web portion at the bore 124 provided by bolt 125 is herein referred to as a "fixed point" or rigid connection inasmuch as the hanger web portion 62 is tightened against a U-shaped shim 127 having a bore 128 to receive the bolt 125 and there is no play between the bolt and panel and therefore this mounting connection is rigid, as distinguished from the flexible or floating connections 67, 68, 69. The fixed point connection 126x is located on the hanger web portion of the panel at a point at or about the level of the sill of the window 19 (see Figs. 1 and 2) to prevent inward movement of the panel at the window sill level and to cause any movement of the panel resulting from expansion and contraction due to temperature changes to take place above and below window sill level, the flexible connections 67, 68 and 69 permitting such movement without any buckling or warping of the panel which might otherwise result if the panel were rigidly mounted at all connecting points.

It will be understood, as illustrated in Figs. 13, 14 and 15, that the lefthand hanger web portion 52 of the next panel to the right in a row of panels has similar flexible connections 57, 58 and 59 and rigid connection 126y on the opposite side of the mullion 14f but, of course, "at opposite hand" to those of the righthand side of the panel to its left.

Referring more particularly to a typical flexible mounting connection of a panel to a mullion and more particularly to Fig. 14, it will be seen that the mounting bolt 120 is provided with a nut 130 and washer 131 on one side of the cross member 116 of the clip 67 and a nut 132 and washer 133 on the opposite side of member 116 and also that the threaded bolt 120 is secured to the internally threaded metal sleeve 95 which, as stated above, was cast into the reinforced concrete mullion. Also, it is to be noted that the panel has freedom of movement at this place relatively to the fixed mullion by reason of the larger diameter aperture 121, the V-shaped portions 110 and 111 being such that they will flex upon movement of the panel. The same applies to all flexible clips. On the other hand, the rigid connection at 126x which is located at or just below window sill level does not permit relative movement at this point because (see Fig. 15) the bolt 125 fits snugly through aperture 124 of the hanger web and the

portion is secured into sleeve 97 so that the panel web 62 is held rigidly by nut 135 against U-shaped shim 127, in turn engaging a washer 136 which rests against the sleeve 97. The same applies to fixed connection 126y and all fixed connection points.

In erecting an exterior wall of the building, the first course of panels (say, 10a of Fig. 1) is erected by mounting them on the spaced mullions. Each panel 10 is mounted at its right and left sides as indicated in Fig. 13. Then the channel clamping members 20 are inserted back of the edge flanges 38 and 40 (see Figs. 8, 9). Then the drip plate members 16 are mounted over the vertical joints between each pair of adjoining panels in the first row, then the channel members 18 are mounted over the vertical joints between the panels. This is perhaps best illustrated in Figs. 8 and 9, Fig. 8 being an exploded view and Fig. 9 showing the construction as it appears after the parts are erected in place, these figures showing a typical four-corner connection, that is, the construction where the corners of four adjacent panels meet. The upper righthand corner of panel 10j is shown as meeting the upper lefthand corner of panel 10k, both in row 11a, and the lower righthand corner of panel 10f and the lefthand lower corner of panel 10g of course 11b are shown where they meet with panels 10j and 10k to form a four-corner joint. The lower course 11a having been erected and clamping members 20a put in place, it will be noted that the flash strips 36j and 36k lie in the same plane and parallel to the face of the mullions but located a slight distance therefrom (see also Figs. 16 and 17). The web 37j and the edge flange 38j and the web 39k and edge flange 40k form a channel which is interrupted by the space 140a where two edge flanges meet to form the vertical joint (see Fig. 8).

Next, the drip plate 16 is placed over the upper end of the vertical joint 140a so that the horizontal portion 76 rests upon the upper edges of the flash strips 36j and 36k. Then the cover channel 18a is placed over the outwardly protruding channel formed by the panel flanges. This cover channel is lined on the interior surface of its face 85 with a compressible layer of a plastic impregnated felt 141a (see also Fig. 16). The channel 18a is secured to the clamping member 20a by means of screws 21 which are secured into registering tapped holes 93 in the clamping member and when screwed tight the plastic felt 141a insures a watertight joint at the upper end of the face 85 of the channel. It will be observed also that the panels 10 may, if desired, be lined with a suitable insulating material such as fiber glass pads 72 (see Fig. 18). Also, it is desirable to calk the joint between flanges 55 and 65 and the mullions 14 with a suitable calking material 73; and also the joint between the horizontal plate 70 and the undersurface of the floor 15 (see Fig. 12).

The first course of panels having been erected and the drip plates 16 having been put in place to cover the upper edges of the flash strips 36 of the panels and the vertical joints between them, the next course of panels is installed by mounting them on the mullions in the next superjacent course. It will be noted that the lower or overhanging portion 43 of a panel pan will lie over the upstanding flash strip 36 of the panel immediately below it in that column of panels (see Figs. 11, 12) but will leave a space 145. Referring more particularly to Figs. 7, 8 and 9, it will be seen that the slot 45 in the intumed flange 28 registers with the outwardly turned flange 83 of the flash plate member 16 and the slot 66 in panel 10f registers with the upstanding flash flange 75. The corresponding slots 44 and 56 in the adjacent panel 10g register with the upwardly turned flange 82 and the upstanding flange 75 of the flash plate member 16. Consequently, the panels 10f and 10g may be lowered so that the lower ends of the pans of panels 10f and 10g lie adjacent to but not in engagement with the upper ends of the pans of the panels 10j and 10k (see Fig. 9). When the panels 10f and 10g are secured to their adjacent mullion 14, in a manner described above, the weight of the panels is carried on the mounting bolts so that the panels are free to expand and contract within limits because of the flexible mounting clips. In the meantime the clamping member 20b will have been placed behind the edge flanges 38f and 40g. Then after the flash plate member 16 is in place in position over the top edges of panels 10f and 10g, the channel 18b may then be installed in place over the vertical joint 140b and made

fast by screws 21. It will now be seen from the foregoing that the panels are erected course upon course around the building and ultimately form an exterior wall in which the panels form both horizontal and vertical rows, herein referred to as "courses" and "columns."

While the corners of the building may be treated in different ways, one manner of treating a corner is illustrated diagrammatically in Fig. 19. A standard panel 10 is in effect turned up on itself in a vertical line 150 which divides the panel into two like sections but one hand to the other so that the lefthand half 151 lies at right angle to the righthand half 152. The righthand section of the panel thus formed is mounted on mullion 14x and the lefthand section of the panel is mounted on mullion 14y as indicated in Fig. 19.

In the construction provided by the invention, it is significant to note that the joint at the meeting corners of four adjacent panels is weatherproof. Provision is made for the expansion of the metal panels by mounting the panels at a fixed point on each side and on flexible clips at each side above and below the fixed points; the panels may be insulated and at the same time provision is made for ventilation behind the panels to inhibit condensation of moisture behind the panels.

With regard to the weatherproof joints it will be noted, first with reference to the horizontal joints, that the overhanging portion 43 of a panel overlaps the flash strip of the next panel below. Referring to Fig. 12 it will be seen that flash strip 36k of the lower panel 10k will prevent rain from working its way behind the panels even though the rain is blown at high velocity by the wind. Also, overhanging portion 43g of the pan 25g where it overlaps the flash strip 36k permits of air circulating through the spaces 145 and 146 to the space behind the panel, thus permitting "breathing" which will prevent a dead air space. Consequently, condensation of moisture is prevented or if there is condensation or if rain should work its way through spaces 145 and 146, it can merely run down and out over the exterior of the wall for it cannot work its way up over the flash strip 36k.

It is particularly significant to note the construction where the corners of four adjacent panels meet forming both a vertical and a horizontal joint. It will be seen that rain cannot work its way behind the panels at this juncture of the four corners but will always run toward the outside and down the exterior surface of the wall. Should rain be blown in the space 147 below the vertical cover channels 18b and 18a (see Fig. 10) it cannot work its way upwardly and over the flash flange 75 of the drip plate member 16. It cannot work its way down between the adjoining edges through the vertical joint because of the horizontal web 76 and any water on the web 76 is constrained to run out over the exterior surface of the wall because of the flanges 82 and 83 (see Fig. 9) of the drip plate member 16, these flanges serving as side flashings to prevent water from working its way to the interior surface of the wall. In brief, the completed wall structure is such that rain striking the exterior surface is always constrained to run outwardly and down the exterior surface and cannot work its way to the interior of the wall through either the vertical or horizontal joints even where the horizontal and vertical joints meet. For convenience of description, the vertical joints where two adjacent panels meet are herein sometimes referred to as vertical "seams" and the horizontal joints where two adjacent panels meet are sometimes referred to as horizontal "seams."

The modification illustrated in Figs. 21-24 differs from the construction above described in that the completed wall presents a flush wall appearance, it being noted that there are no cover channels such as the cover channels 18. In this modification the cover channels 18 and the clamping members 20 are not used and the panels are so formed as to present horizontal joints substantially the same as in the previously described construction. However, the vertical flanges at the sides of the panel are so designed as to interconnect to form vertical joints, so that the finished wall has a "flush" surface appearance. In this illustrative embodiment the wall may be constructed of standard panels 310 and drip plates 316.

A typical panel of the "flush" type comprises a pan portion 325 having a face 326. Extending rearwardly from the lefthand vertical edge of the face 326 is a web 329 from which extends a web 334 at right angle thereto,

this web being bent outwardly to form edge flange 339. It will be noted that web 334 and flange 339 terminate short of the bottom wall 328 of the pan portion. The bottom wall 328 has a slot 344 adjacent the lefthand vertical side wall of the pan and also a slot 345 a slight distance from the righthand vertical side wall of the pan portion 325. Extending rearwardly from the face 326 at its upper edge is an inturned top wall 327 and extending upwardly from the rear edge of the top wall 327 is a flash strip 336. It will be noted that a panel 310 has an overhang portion 343 corresponding to the overhang portion 43 of a panel 10 of the previously described construction. The righthand vertical side of a panel 310 has an inturned flange portion or side wall 330 which registers with and extends into the channel formed by the webs 329, 334 and edge flange 339 along the lefthand side wall of an adjoining panel 310. The panels 310 are provided with vertically disposed hanger plates 350 and 351, the former at the lefthand and the latter at the righthand side. As disclosed in panel 10 the hanger plates extend substantially the full length of the panel whereas in panel 310, as shown, there is a separate hanger plate for each connection. A typical hanger plate, such as 350, comprises a flange 353 engaging and welded to the rear of the face of the pan and a web 354 and edge flange 355 (see Fig. 24). Hanger plate 351, other-hand to 350, has a corresponding web 363, web 364 and flange 365. These hanger plates 350 and 351 do not extend the full length of the panel but are short length pieces or straps; there being one for each connection to the mullion; three on each side being arranged for flexible connection and one on each side arranged for fixed or rigid connection in similar manner as the previously described panels 10. Or, if desired, the hanger plates may be a single piece as hanger plates 50 and 51 of panel 10, which provide three flexible connections and one fixed connection as shown, for example, in Fig. 13. The clips, of which clips 359 and 369 are typical, may be constructed as shown in Fig. 25 or they may be of the same construction as a typical clip 67 (see Fig. 14). As shown in Fig. 25, the clip 369 comprises a strip of springy metal having a V-shaped portion 310 one leg of which terminates in a base portion 312 engaging and welded to hanger plate 350 and the other leg of which terminates in a flange 316 having an aperture 317; it being noted that the flange 316 lies parallel to but a short distance from the plane of the hanger plate 350. The aperture 317 will accommodate a mounting bolt such as bolt 420.

The drip plate 316 comprises an upstanding flash flange 375, a horizontal web 376, an apron portion 377 and side flanges 382 and 383. It will be observed that the flash flange portion 375 lies in a plane parallel to the apron 377 but offset therefrom by horizontal web 376 a width sufficient to cover the upper open end of the channel formed by the webs 329, 334, and flange 339 when the panels 310 are mounted in place on the mullions 314 (see Figs. 21 and 22).

The panels and drip plates may be installed to form the wall structure as follows. A row 311a (see Figs. 21 and 22) are mounted on mullions 314 in substantially the same way as described in connection with the mounting of the panels 10 on mullions 14. That is, the hanger plates 350 and 351 are secured to the mullions 314 by means of bolts, inserted through the clips and hanger plates as described in connection with the panels 10, in the foregoing description. Then a drip plate 316 is installed over the vertical joint where each two panels 310 in a row meet. Referring to the exploded view Fig. 22, it will be seen that the panels in row 311a meet to form a vertical joint. The inturned flange 330 of panel 310j extends into the channel formed by webs 329, 334 and edge flange 339 of the panel 310k. Clamping bolts 488 extending through registering holes in the flanges 330, 329 secure the panels together after a plastic impregnated felt strip 473 is inserted between the flanges. A sufficient number of bolts 488 spaced along the flanges are used to insure a tight vertical joint (see Fig. 24). A row of panels having been installed, a drip plate is then mounted on the top edges of the panels at each vertical joint. As illustrated in the exploded view (Fig. 24), the horizontal web 376 of the drip plate overlies and covers the upper open end of the channel formed by the panel webs 329, 334 and flange 339. The apron 377 overlaps the flash flanges 336k and 336j of panels 310k and 310j in row 311a. Consequently, any rain striking the drip plate is

constrained to run out and down the exterior surface of the panels. After installing row 311a of panels 310 and the drip plates 316 at the joints, then the next superjacent row 311b of panels is installed and mounted on the mullions 314 as previously described.

It will be observed that slot 344 of panel 310g and slot 345 of panel 310f register with and receive respectively the side flanges 382 and 383 of the drip plate to permit the overhanging portions 343 of panels 310f and 310g to overlap the flash strips 336j and 336k of the panels immediately below as illustrated in Fig. 21.

The wall is thus built up course upon course and it will be seen that the horizontal joints or seams are weatherproof. That is, any rain that may be blown in the space 445 between the bottom wall 328 and the top wall 327 of the panels cannot work its way up over the flash strip 336 formed by the panels, the water being constrained to run to the outside and down the face of the panels. Water cannot work its way into the vertical seam where the flanges 330 and 329 meet because of the weatherproof strip 473. And what is perhaps most significant is the provision for weatherproofing the joint where the horizontal and vertical seams meet at the four corners of four adjacent panels. It will be seen that the drip plate 316 will not permit rain to work its way up over the flash flange 375 and the side flanges 382 and 383 and any water striking the drip plate is constrained to run outwardly and down over the apron 377 and the water will then run ultimately down the outside face of the wall but it cannot find way to the back of the wall.

The terms and expressions which have been employed herein are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalent of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of invention claimed.

What is claimed is:

1. In a metallic wall structure a plurality of substantially rectangular metallic panels mounted to form courses and columns, each of said panels being mounted on vertical frame members disposed in vertical parallel relation, the lefthand side of each panel being mounted on a given vertical frame member and the righthand side of that panel being mounted on the next adjacent vertical frame member to the right of said given vertical frame member, each panel in a given course having an upstanding flash strip portion and each panel in a course having an overhanging portion at its lower end overlapping the flash strip portion of the panel in the course below it in the same column, means weatherproofing the vertical joints between adjacent panels in the same course, and a drip plate covering and weatherproofing the joint where the four corners of two adjacent panels in a given course and two adjacent panels in the course above said given course meet, said drip plate having vertically disposed flanges and a horizontal web constraining rain striking said drip plate to flow outwardly and downwardly over the face of said wall.

2. In a metallic wall structure a plurality of substantially rectangular metallic panels each having a vertical edge flange on its left and on its right side, vertical frame members arranged in spaced parallel relation, said panels being mounted on said vertical frame members and forming courses and columns, the lefthand side of each panel being mounted on a given vertical frame member and the righthand side of that panel being mounted on the next adjacent vertical frame member to the right of said given vertical frame member and the lefthand side edge flange of each panel meeting the righthand edge flange of the next adjacent panel in the same course to form a vertical joint, each panel in a given course having an upstanding flash strip portion and each panel in a course having an overhanging portion at its lower end overlapping the flash strip portion of the panel in the course immediately below it in the same column, a vertical channel member covering and weatherproofing said vertical joints between adjacent panels in the same course, means securing said channels over said vertical joints, and a drip plate covering and weatherproofing the four-corner joint where the four corners of two adjacent panels in a given course and two adjacent panels in the course above said given course meet, said drip plate having vertically disposed flanges and a horizontal web preventing rain

from passing through said four-corner joint to the interior surface of said wall and constraining rain striking said drip plate to flow outwardly and downwardly over the face of said wall.

3. A wall comprising a plurality of panels assembled in courses and columns with their adjacent vertical edges forming vertical seams and their horizontal edges forming horizontal seams, the lower portions of the panels in a given course overhanging the upper portions of the panels in the next adjacent lower course, a plurality of spaced vertical frame members supporting said panels, an integrally formed drip plate member covering the joint at the seams where the corners of four adjacent panels meet, said drip plate having an upstanding flash flange lying behind the vertical seam between the lower portions of the upper two of said four adjacent panels, a horizontally disposed web in engagement with and overlying the upper edges of the lower two of said four adjacent panels, an apron portion overlapping the vertical seam between the upper portions of said two lower panels, and side flanges interlocking with the lower portions of the two upper panels of said four adjacent panels, said drip plate preventing rain from working its way through said wall at the juncture where a horizontal seam meets a vertical seam.

4. A wall comprising a plurality of metallic panels assembled in courses and columns with their adjacent vertical edges forming vertical seams and their horizontal edges forming horizontal seams, the lower portions of the panels in a given course overhanging the upper portions of the panels in the next adjacent lower course; a plurality of spaced vertical frame members; means supporting said panels on said frame members, said panel supporting means comprising a fixed connection on each vertical side of each panel intermediate its upper and lower ends and a plurality of flexible connections on each vertical side of each panel intermediate its upper and lower ends, said flexible connections permitting expansion and contraction of the panel due to temperature changes; an integrally formed drip plate member covering the joint at the seams where the corners of four adjacent panels meet, said drip plate having an upstanding flash flange lying behind the vertical seam between the lower portions of the upper two of said four adjacent panels, a horizontally disposed web in engagement with and overlying the upper edges of the lower two of said four adjacent panels, an apron portion overlapping the vertical seam between the upper portions of said two lower panels, and side flanges interlocking with the lower portions of the two upper panels of said four adjacent panels, said drip plate preventing rain from working its way through said wall at the juncture where a horizontal seam meets a vertical seam.

5. A wall comprising vertical mullions arranged in parallel spaced relation, a plurality of rectangular shaped panels assembled in courses and columns mounted on said mullions with their adjacent vertical edges forming vertical seams and their upper and lower portions forming horizontal seams, each of said panels having a pan portion of generally rectangular shape and web portions extending outwardly from the vertical sides of said pan portion and terminating in said vertical edges and said panels having a flash strip portion extending upwardly from the upper end of said pan portion, the lower ends of the pan portions of said panels in a given course overhanging and overlapping the flash strip portions of the panels in the next adjacent lower course, an integrally formed drip plate member covering the four-corner joint at the seams where the corners of four adjacent panels meet, said drip plate having an upstanding flash flange lying parallel with the face of said wall and behind the lower end portion of the vertical seam between the upper two of said four adjacent panels, a horizontally disposed web in engagement with and overlying the upper edges of the flash strip portions of the lower two of said four adjacent panels, an apron portion overlapping the upper end portion of the vertical seam between the vertical edges of said two lower panels, and side flanges extending outwardly at right angles from said upstanding flash flange and interlocking with the lower portions of the pans of the upper two panels of said four adjacent panels, said drip plate preventing rain from working its way through said wall at said four-corner joint.

6. A wall structure comprising a plurality of substantially rectangular metallic panels mounted to form courses and columns, vertical frame members arranged in parallel spaced relation, each of said panels being mounted on two of said vertical frame members, the lefthand side of each panel being mounted on one of said two vertical frame members and the righthand side of that panel being mounted on the next adjacent vertical frame member to the right of said two vertical frame members, each panel in a given course having an upstanding flash strip portion and each panel in a course having an overhanging portion at its lower end overlapping the flash strip portion of the panel in the course below it and in the same column, means weatherproofing the vertical joints between adjacent panels in the same course, and a drip plate covering and weatherproofing the four-corner joint formed where the corners of two adjacent panels, hereinafter referred to as panel P1 and panel P2, in a given course and two adjacent panels, hereinafter referred to as panel P3 and panel P4, in the course above said given course meet, said drip plate having vertically disposed flash flanges, one of said flash flanges lying behind and overlapped by the lower end portions of said panels P3 and P4, a horizontal web overlying the upper edges of said panels P1 and P2, and an apron portion overlapping the flash strip portions of said panels P1 and P2, said drip plate preventing rain water from passing through said four-corner joint to the interior surface of said wall.

7. A wall structure comprising vertical frame members arranged in parallel spaced relation, a plurality of substantially rectangular metallic panels mounted on said frame members to form courses and columns, the lefthand side of each panel being mounted on a given vertical frame member and the right-hand side of that panel being mounted on the next adjacent vertical frame member to the right of said given vertical frame member, each panel in a given course having an upstanding flash strip portion and each panel in a course having a pan portion the lower end of which provides an overhanging portion overlapping the flash strip portion of the panel in the course below it and in the same column, said pan portion having horizontally disposed top and bottom walls and vertically disposed side walls, and a face, means including a channel member weatherproofing the vertical joints between adjacent panels in the same course, and a drip plate covering and weatherproofing the four-corner joint formed where the four corners of two adjacent panels, hereinafter referred to as panel P1 and panel P2, in a given course and two adjacent panels, hereinafter referred to as panel P3 and panel P4, in the course above said given course meet, said drip plate having a vertically disposed flash flange lying parallel to the face of the wall structure and behind and overlapped by the lower end portions of said panels P3 and P4, a horizontal web overlying the upper edges of said panels P1 and P2, and an apron portion overlapping the flash strip portions of said panels P1 and P2, said drip plate also having side flanges extending outwardly at right angles to said first mentioned flash flange, one of said side flanges lying behind the face of panel P3 and the other side flange lying behind the face of panel P4.

8. A metal panel adapted to be mounted on a pair of mullions disposed in vertical parallel relation which comprises a pan portion having a face of generally rectangular shape, a bottom, a top, and vertical side walls extending rearwardly from the edges of said face and at substantially right angles to said face; a flash strip extending upwardly from the rear edge of said top wall in a plane substantially parallel to the plane of said face; a web portion extending outwardly from the rear vertical edge of each of said side walls and extending from the top of said flash strip to a locus short of the bottom of said pan portion, and in a plane substantially parallel to the plane of said face, each of said webs being bent forwardly at right angles to the web and then outwardly forming an edge flange lying in a plane substantially parallel to the plane of said face; a pair of hanger plates secured to the inner surface of said pan portion, one of said hanger plates extending vertically along the lefthand side of said pan portion and the other of said hanger plates extending vertically along the righthand side of said pan portion, said hanger plates having portions extending rearwardly from the

plane of said flash strip; a plurality of pairs of oppositely disposed flexible hanger clips disposed on said hanger plates, said pairs of flexible clips being vertically spaced along said hanger plates and providing a plurality of flexible connections; and means intermediate the top and bottom ends of said hanger plates providing a pair of oppositely disposed rigid connections, said connections being adapted for mounting said panel on said pair of vertically disposed mullions.

9. A wall structure comprising metallic panels of generally rectangular shape mounted in courses and columns on mullions disposed in vertical parallel relation, and having a four-corner joint where the horizontal and vertical seams formed by said courses and columns cross; and a drip plate flash member weatherproofing said four-corner joint; said drip plate flash member comprising a vertically disposed flange portion lying behind the lower end portion of the vertical seam formed by two adjacent panels in a given course; a horizontally disposed web portion extending outwardly from said flash flange portion overlying the upper vertical edges of two adjacent panels in the course immediately below said given course and immediately below said two adjacent panels in said given course; an apron portion extending downwardly from said web portion overlapping the upper end portion of the vertical seam between said adjacent panels in the course immediately below said given course; and side wall flanges extending outwardly at right angles from said first mentioned flash flange portion and apron portion interconnecting with the lower end portions of said two adjacent panels in said given course, said drip plate preventing rain from working its way through said wall at said four-corner joint.

10. In a metallic wall structure comprising metallic panels of generally rectangular shape arranged in rows and columns; and in which wall structure said panels are mounted along their vertical sides on vertical frame members secured in fixed parallel spaced relation; a first panel (hereinafter referred to as panel P3) in a given row (hereinafter referred to as row R2) and in a given column (hereinafter referred to as column C1); a second panel (hereinafter referred to as panel P4) in row R2 and in the next adjacent column (hereinafter referred to as column C2) immediately to the right of column C1; a third panel (hereinafter referred to as panel P1) in column C1 and in the next adjacent lower row (hereinafter referred to as row R1); a fourth panel (hereinafter referred to as panel P2) in column C2 and row R1; said panels P1, P2, P3 and P4 meeting to form vertical and horizontal seams and a four-corner joint; said panels being of uniform construction which comprises a pan portion having a face of generally rectangular shape, a top horizontally disposed web extending from the upper edge of said face at substantially right angle, a bottom horizontally disposed flange extending from the bottom edge of said face at substantially right angle, a left vertically disposed web extending from the lefthand edge of said face at substantially right angle and a right vertically disposed web extending from the righthand edge of said face at substantially right angle, a vertically disposed flash strip extending upwardly from the rear edge of said top web, a left edge flange connected with the rear edge of said left web of said pan portion and a right edge flange connected with the rear edge of said right web of said pan portion, a vertically disposed left hanger plate extending rearwardly from the left side of said pan portion and having a vertical slot at its lower end adjacent said pan portion, and a vertically disposed right hanger plate extending rearwardly from the right side of said pan portion and having a vertical slot at its lower end adjacent said pan portion; a drip plate at said four-corner joint, said drip plate having a vertically disposed flash flange lying behind the vertical seam formed by the right edge flange of panel P3 and the left edge flange of panel P4 and having a web portion overlying the upper edges of the flash strips of panels P1 and P2 and having an apron portion overlying the vertical seam formed by the right edge flange of panel P1 and the left edge flange of panel P2 and having an outwardly extending flange interlocked with the slot in the right hanger plate of panel P3 and having an outwardly extending flange interlocked with the slot in the left hanger plate of panel P4; said panels being mounted on said

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frame members so that the lower portions of the pan portions of panels P3 and P4 overlap the upstanding flash strips of panels P1 and P2.

11. Structure according to claim 10 in which the hanger plates include means flexibly mounting said panels on said frame members at a plurality of pairs of oppositely disposed points. 5

12. Structure according to claim 10 in which the hanger plates have a plurality of oppositely disposed flexible hanger clips flexibly mounting said panels on said frame members at a plurality of pairs of oppositely

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disposed points and a pair of oppositely disposed connections fixedly mounting said panels at oppositely disposed points intermediate the top and bottom ends of said panels.

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