July 14, 1964 J. R. WARD, JR 3,140,565

WALL CONSTRUCTION

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FIG. 1

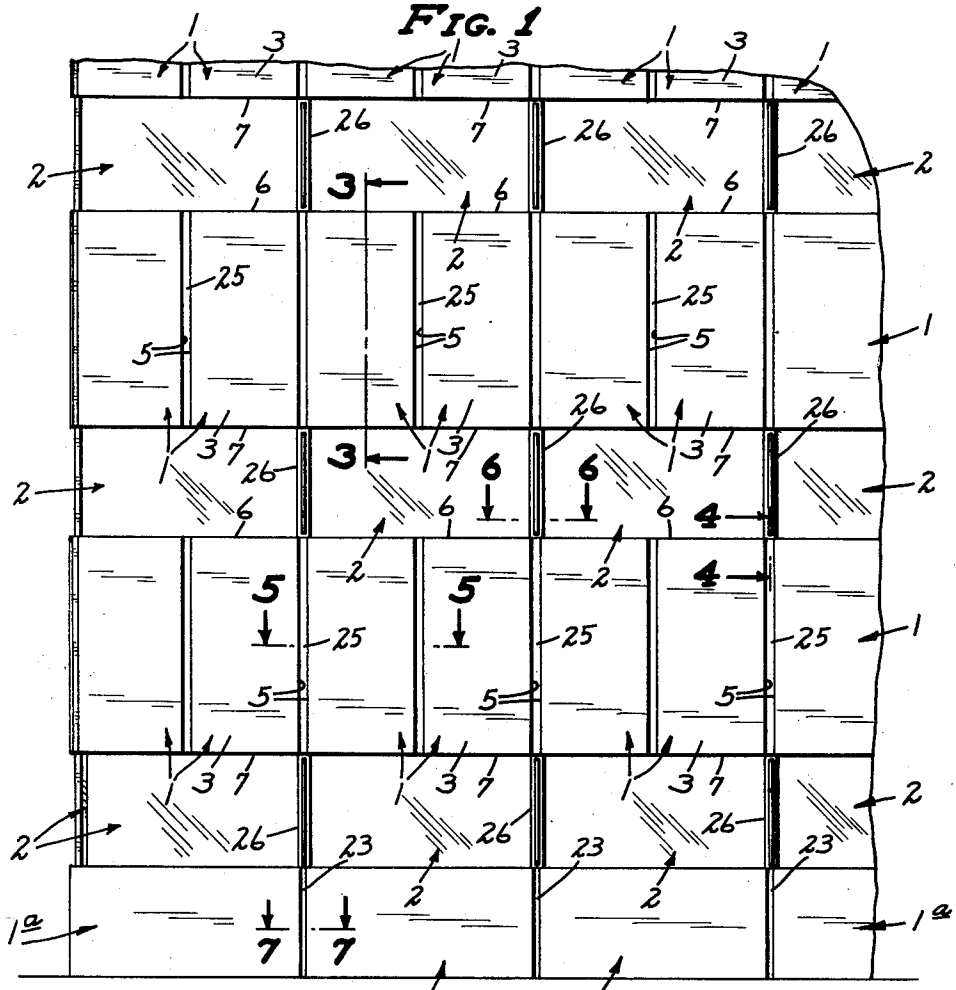


FIG. 5

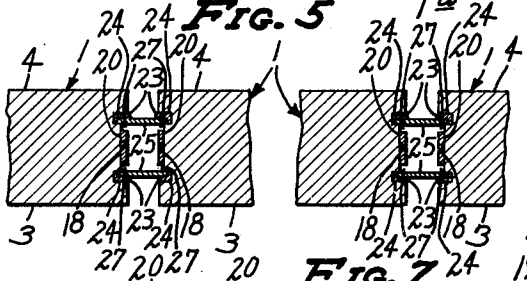


FIG. 7

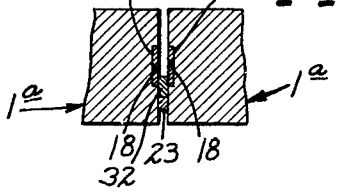
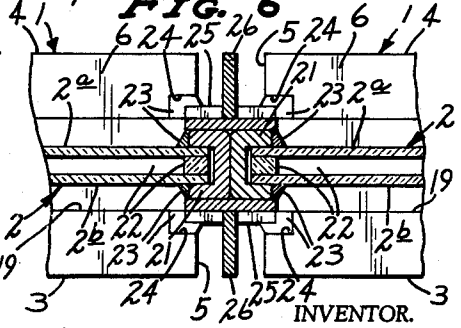


FIG. 6



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FIG. 3

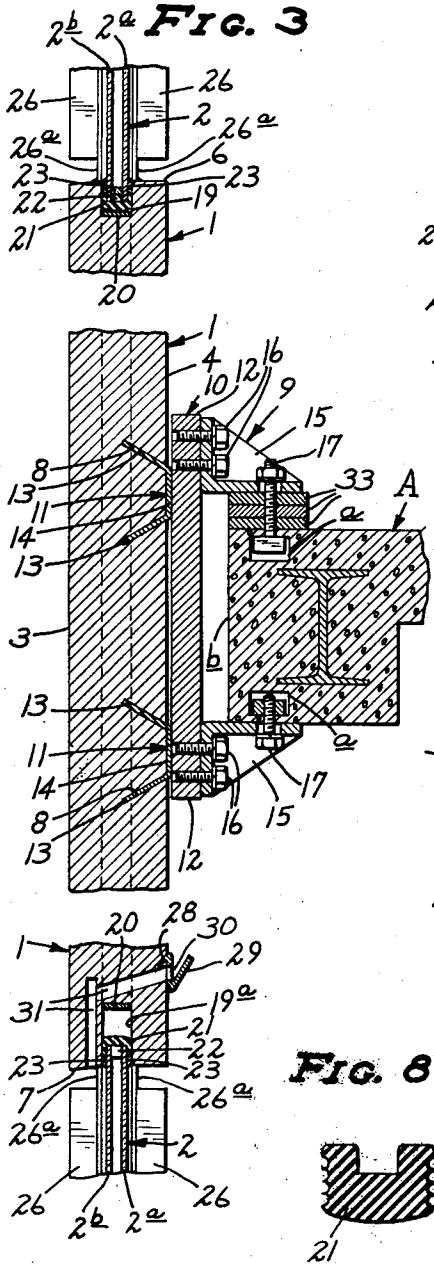


FIG. 2

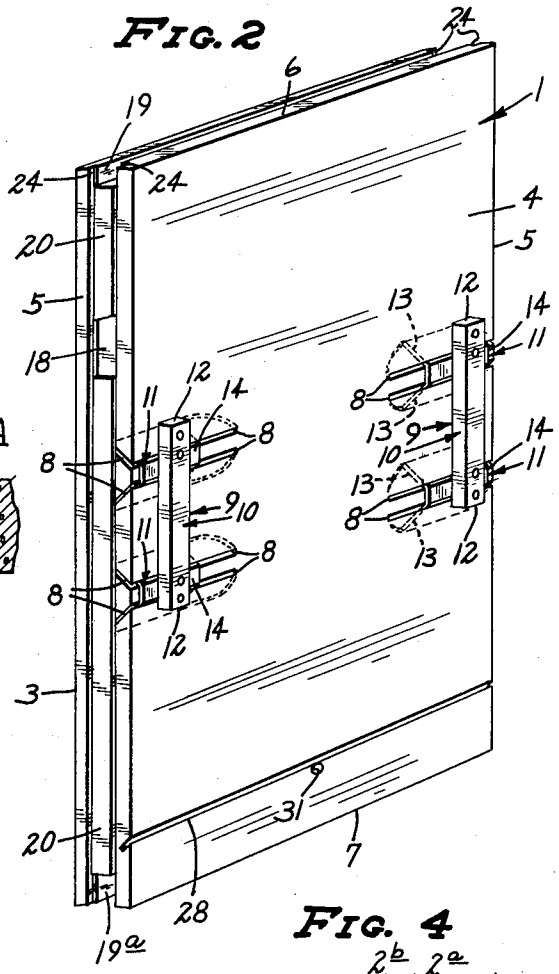
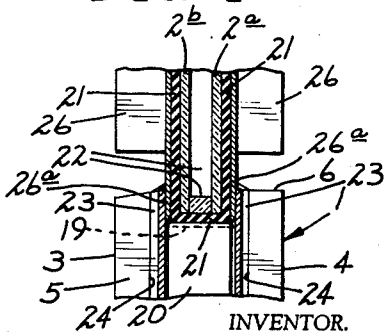


FIG. 8

FIG. 4



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WALL CONSTRUCTION

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6 Claims. (Cl. 50—262)

This invention relates generally to a wall construction, and more particularly it relates to a wall construction wherein generally rectangular panels of substantially different thicknesses are connected to one another and anchored to a structural supporting unit.

This invention has particular significance in relation to the curtain-wall type of building construction wherein the wall of the building is supported by the floor support structure, rather than the older type of construction wherein the floor structure is supported by the wall of the building. Further, this invention comprehends the combination of generally rectangular building panels of stone and the like with other components and panels of other materials, such as glass panels, the invention including the interconnection of said panels and also the connection of the panels to the structural supporting unit of a building.

An important object of this invention is the provision of a wall construction in which the attachment and connection of the wall panels to one another and the anchoring of the same to a building support permits attachment of the panels at any desired location, and also eliminates shelf angles and other commonly used miscellaneous supporting steel.

Another object of this invention is the provision of a wall construction in which the attachment and connection of the wall panels to a building support is designed so as to utilize the strength of the stone building panels for the support thereof.

Another object of this invention is the provision of a novel wall construction in which the attachment and connection of the wall panels to a building support is characterized by fast erection of the panels and installation thereof in a rapid sequence whereby to reduce to a minimum the intermittent idle periods in the operation of erection machinery.

A still further object of this invention is the provision of a wall construction in which the attachment and connection of the wall panels to one another and also to a building support is designed so as to permit flexiblity in erection sequence, and also to permit subsequent replacement of individual panels.

In the handling of stone panels of small thickness relative to the length and width thereof during transportation and installation thereof in a wall structure, fracture of a panel sometimes occurs at the edge or corner portions thereof, as well as transversely or longitudinally through the panels intermediate the sides or ends thereof. Such fracture of a stone panel during the handling thereof, or during its use as part of the building wall, is not only hazardous to the workmen or bystanders, but also involves a substantial replacement expense. An important object of my invention is, therefore, the provision of novel means for reinforcing a stone building panel to minimize the occurrence of cracking or fracture thereof. To this end, I provide a generally rectangular slab-like stone panel having an outwardly opening groove or channel around the periphery thereof, and an elongated metallic reinforcing element tightly encompassing said slab within said groove and locked therein.

A further object of this invention is the provision of a wall construction in which the attachment and connection of building panels of substantially differing transverse dimensions is designed so as to provide maximum edge protection of the panels, to provide positive sealing and seating between the panels, and yet provide for the allowance of structural and thermal movement therebetween.

A further object of this invention is the provision of a wall construction in which the attachment and connection of wall panels of substantially differing transverse dimension greatly reduces the number of joints heretofore used in joining the panels of lesser transverse dimension to one another.

A still further object of this invention is the provision of weepage collecting means adjacent the rear faces of the panels so as to provide for the collection and drainage of any condensation forming on the rear face of the panels.

Other objects of this invention reside in the provision of a wall construction which eliminates expensive framing, is characterized by low maintenance costs, is durable and strong in construction, and highly effective in the vindication of its purposes.

The foregoing and other objects and advantages of this invention will become apparent from the following detailed specification, appended claims and attached drawings.

Referring to the drawings wherein like reference characters indicate like parts or elements throughout the several views:

FIG. 1 is a view in elevation of my wall construction, some parts being broken away;

FIG. 2 is a view in perspective of one of the stone building panels used in the wall construction, and showing the anchoring brackets used in directly attaching the stone building panels to the structural supporting unit of a building;

FIG. 3 is an enlarged view in vertical section taken on the line 3—3 of FIG. 1;

FIG. 4 is an enlarged view in vertical section taken on the line 4—4 of FIG. 1;

FIG. 5 is an enlarged view in horizontal section taken on the line 5—5 of FIG. 1, some parts being broken away;

FIG. 6 is an enlarged view in horizontal section taken on the line 6—6 of FIG. 1;

FIG. 7 is an enlarged view in horizontal section taken on the line 7—7 of FIG. 1; and

FIG. 8 is an enlarged view in transverse section of one element of my invention.

Referring to the drawings, and particularly FIG. 1 thereof, a wall construction is shown which comprises stone building panels, represented in general by the reference numeral 1, and glass secondary panels, represented in general by the reference numeral 2. It should be understood that the stone building panels 1 may be formed of any suitable stone building material or simulated stone building material, such as granite or concrete. It should also be understood that the glass secondary panels 2 are preferably formed to be of substantially less transverse dimension or thickness than the transverse dimension or thickness of the stone building panels 1, the secondary panels 2 being formed from any material which may be architecturally suitably combined with the stone building panels 1. Examples of suitable secondary panels 2 would be plate glass, colored glass, tempered glass, translucent panels, double-wall glass, aluminum, bronze, stainless steel, operable sash, solar shades, and louvers. The secondary panel shown is comprised of inner and outer glass panes secured together at their perimeters by a conventional sealout. As seen in FIG. 3, the reference letter A represents a structural supporting unit, such as a concrete floor structure commonly used in curtain-wall constructions.

Referring now to FIG. 2, the stone building panel 1 defines a front face 3, a rear face 4, side edges 5, a top edge 6, and a bottom edge 7. The stone building panel 1 also defines at both side edges 5 thereof two vertically

spaced pairs of cross-sectionally rearwardly converging grooves or slots 8, which extend in general parallelism generally horizontally inwardly from the side edges 5 of the stone building panel 1 and which open rearwardly at the rear face 4 of said stone panel 1.

For the purpose of directly attaching the stone building panels 1 to the structural supporting unit A, a pair of anchoring devices are provided, the anchoring devices being shown in FIGS. 2 and 3 and represented in general by the reference numeral 9. The anchoring devices 9 are one each associated with each two pair of slots 8 at both side edges 5 of the stone panel 1. The anchoring devices 9 each comprise an elongated generally vertically disposed strut 10 and a pair of elongated vertically spaced generally parallel and generally horizontally disposed channel members 11. The channel members 11 are rigidly secured, as by welding, in general perpendicularity to the strut 10 adjacent the opposite ends 12 thereof. Each of the channel members 11 is formed to define flange portions 13 which diverge outwardly from the web portion 14 thereof. It should be obvious that before the channel members 11 are secured to the strut 10, the vertical spacing thereof is adjusted to conform to the vertical spacing between the pairs of grooves 8 which have been cut in the opposite side edges 5 of the stone panel 1.

Referring to FIGS. 2 and 3, it is shown that each of the channel members 11 are adapted to have their flange portions 13 slidably received within a corresponding pair of grooves 8, said channel members 11 being slidably inserted from the side edges 5 of the front panel 1 so as to dispose said flange portions 13 within the grooves 8 in the above-described manner. FIG. 3 illustrates one method of securing the anchoring devices 9 to the structural supporting unit A; however, it should be obvious that any suitable means for affecting the attachment might be suitably employed. As shown, a pair of angle brackets 15 are one each secured to the opposite ends 12 of each of the anchoring devices 9 by means of cap screws 16. Also, the structural supporting unit A is formed to define vertically opening recesses *a* spaced adjacent the outer edge *b* of the structural supporting unit A. Such a construction permits the attachment of the anchoring devices 9 to the structural supporting Unit A by means of the connection of the angle brackets 15 adjacent the recesses *a*, the angle brackets being secured by bolts 17.

In the light of my novel means for anchoring the stone panels 1 to the structural supporting unit of a building, no necessity further exists for utilizing one stone panel to support another, as has been common practice heretofore in the outer walls of building structures. Hence, in my arrangement, the stone panels 1 may be of considerably less thickness between the front and rear faces 3 and 4 than formerly. The use of a relatively thin stone panel does, however, present problems in transportation, handling and in use, inasmuch as the relatively thin panels are more susceptible to fracture from shock, particularly at the corners or edge portions thereof, than are relatively thick stone blocks. Therefore, I have devised means for increasing the compressive strength and impact resistance of the stone panel 1 whereby to greatly aid in the prevention of fracturing of the stone panel 1, particularly at the edge and corner portions thereof. The stone panel 1 defines at the edges 5–7 thereof a marginal annular laterally outwardly opening groove, which groove is represented at both side edges 5 of the stone panel 1 by the reference numeral 18 and is represented at the top and bottom edges 6, 7 thereof by the reference numerals 19 and 19*a* respectively. A marginal tension band 20 is received within the marginal groove 19, 19, 19*a* and is rigidly secured about the stone panel 1, as by welding, riveting, clipping or any other suitable manner. The tension band 20 may be formed from steel or any other suitable material and is integrally locked around the entire permieter of the stone panel 1 so as to enhance the flexural strength and impact resistance thereof by prestressing the panel 1 with band 20. If, during use, fracture should occur in the stone panel 1, the band 20 positively holds the panel together to prevent severed portions thereof from displacement, thus avoiding possible injury to persons who might be in the immediate vicinity. It should be noted that the marginal tension band 20 is of further functional importance in that after the channel members 11 of the anchoring devices 9 have been received within the grooves 8 of the stone panel 1, the tension band 20 prevents endwise slippage of the anchoring devices 9 from the panel 1 since the tension band 20 overlies the ends of the channel members 11 of the anchoring devices 9. A particular advantage of the direct atachment of panel 1, hereinbefore described, in combination with the safety feature and other advantages of the band 20 allows the use of stone panels 1 in direct cantilever action to resist loads perpendicular to panels 1, such as wind or other forces. This forms an important part and function in the use of stone, such as panels 1, as a more entire structural element and provides for effective, less expensive stone construction.

A further derivative advantage of the above-described means for attaching the stone panels 1 directly to the structural supporting unit A by means of the anchoring devices 9 is that the arrangement permits the secondary panels 2, preferably formed from a material such as glass, to be directly glazed to the edge of the stone panels 1 without the necessity of the use of intermediate metal lintels and frames such as have been heretofore used in connection with previous types of attachment means for stone panels. Since the coefficients of expansion of stone (such as granite) and glass are approximately equal, the glass secondary panels 2 may be directly glazed to the stone panels 1, as shown in FIG. 3. The direct glazing of the glass panels 2 to the stone panels 1, without the use of intermediate metallic glazing frames, as was heretofore common, virtually eliminates any separation between the joints of the stone panels 1 and the secondary panels 2 whereby to eliminate the need for frequent resealing of the joints, which frequent resealing has been heretofore necessary in light of the greatly varying difference between the coefficients of expansion of the intervening metallic frames and the stone glass panels. Referring particularly to FIGS. 3, 4, and 6, it will be seen that each of the glass secondary panels 2 comprises spaced parallel panes 2*a* and 2*b* and a marginal spacing member 22. The panes and marginal spacing member are sealed together in a well-known manner, not comprising the instant invention, the panels 2 in their entireties being commercially available from glass manufacturers. Each of the glass panels 2 is provided with a cross-sectionally generally U-shaped peripheral sealing member 21 which receives the marginal edge of the glass secondary panel 2. The peripheral sealing member 21 is preferably formed from a material such as cellular neoprene, said sealing member 21 being shown in cross section in FIG. 8. The sealing member 21 may be applied to the glass panel 2 before the same is shipped to the erection job site so as to provide edge and fracture protection for the glass panel 2 during transit. As seen in FIG. 3, the glass panel 2 is sealed by means of sealant 23 within the annular groove 18, 19, 19*a* of the stone panel 1. The sealant 23 may be of any suitable sealing material such as a polysulfide sealant. It will be further noted that the marginal groove portion 19*a* of the stone panel 1, is of substantially greater depth than the opposite groove portion 19. With this arrangement, when one of the panels 1 is mounted above another, as shown in FIGS. 1 and 3, with a secondary glass panel 2 therebetween, removal of a secondary panel 2 and replacement thereof may be easily effected. It is only necessary that the panel 2 be raised into the groove portion 19*a* a distance to enable the lower edge of the panel 2 to clear the underlying groove portion 19, and the panel 2 then swung outwardly until the lower edge thereof clears the front sur-

face 3 of the underlying stone panel 1, after which the panel 2 is lowered until the upper edge thereof is clear of the overlying groove portion 19*a*. The thickness and compressibility of the peripheral sealing member 21 permits such removal of the secondary panels 2, and a replacement panel is slipset into position in the revrse manner, and sealed in place.

In some applications for ease of installation of panels 1, it may be more desirable to have the upper marginal grove portion the one of greater depth rather than the lower grove portion; and it should be clear that my invention encompasses this construction also, that is, upper groove portion 19 is of substantially greater depth than the opposite groove portion 19*a* and to an extent sufficient to readily insert panel 1 between two secondary panels 2 or the like, when the latter are in their fixed positions. A further function of the larger groove portion, either 19 at the top or 19*a* at the bottom, is that it provides a space for relative vertical movement or deflection between adjacent panels in the nature of an expansion joint between elements of the wall system.

FIG. 5 discloses the joint construction between the adjoining stone building panels 1. It is noted that the grooves 18 defined at the side edges 5 of each of the stone panels 1 are extended inwardly at both sides thereof so as to define vertically extending channels 24. When the stone panels 1 are fitted into their final position, the channels 24 receive inner and outer vertically disposed mullion bars 25 which are spaced adjacent the side edges of the tension band 20. The mullion bars 25 are sealed within the channels 24 by means of a suitable sealant 23.

FIG. 6 discloses the form of the joints between adjoining glass secondary panels 2. As shown, the secondary panels 2 are disposed in end-to-end relationship with the annular sealing member 21 of each thereof abutted against one another. Also, each of said joints is provided with inner and outer cross-sectionally generally T-shaped stiffener bars 26, which are disposed against the opposite sides of abutted annular sealing members 21, as seen particularly in FIG. 6. It is noted that the stiffener bars 26 are held in the above described position adjacent the joint between the adjoining glass panels 2 by the reception of longitudinally extended flat end portions 26*a* of the stiffener bars 26 within recesses 27 defined intermediate the mullion bars 25 and the tension band 20. Also, the joint is then finished with the usual application of the sealant 23. FIG. 4 is helpful in showing both of the above-described joints in vertical section. Preferably, the stiffener bars 26 are of a length equal to the height of the secondary panels 2, so that the stiffener bars 26 at the front side of the panels 2 may be removed in the same manner as above described in connection with the secondary panels 2, to permit a damaged or broken panel 2 to be removed and a new panel 2 slipset into place.

Referring again to FIGS. 2 and 3 means is provided adjacent the bottom edge 7 of the stone panel 1 for the collection of any condensation that might form on the rear face 4 of the stone panel 1. Therefore, and in accordance with my invention, a horizontally extending groove 28 is cut adjacent the bottom edge 7 of the stone panel 1 at an oblique angle to the plane of the rear face 4 thereof, and is adapted to receive a flange portion of an elongated cross-sectionally generally Z-shaped weepage channel member 29. The weepage member 29 defines a generally intermediately spaced aperture 30 which communicates with a passageway 31 leading to the front portion 3 of the stone building panel 1 so as to collect any condensation forming on the rear face 4 of the panel 1 and permit flow and drainage thereof to the outside of the wall of the building. It should be noted that FIG. 7 discloses the joint construction for a bottom row of stone panels 1*a*, wherein the same is formed by the use of an elongated spacing strip 32 and the application of a sealant 23.

Having specifically described my invention, the fabrication and installation thereof is thought to be readily understandable; however, it might be helpful to briefly state that after the stone panels 1 are formed to the shape shown in FIG. 2, including the cutting of the grooves 8, 24, 28, the anchoring devices 9 are inserted from the side edges 5 of the stone panels 1. At this time the same are ready to be transported to the building job site. It should also be noted that the annular sealing members 21 are installed on the secondary glass panels 2 before shipment thereof to the building job-site. Field erection of the wall construction thereafter merely comprises horizontal adjustment (if necessary) of the anchoring devices 9 on the panels, and subsequent attachment of the stone and glass panels 1, 2 in the above described manner. It should be noted that the angle brackets 15 may be vertically adjusted with respect to the structural supporting unit A by the use of suitable shims 33.

This invention has been thoroughly tested and found to be completely satisfactory for the accomplishment of the above objects; and while I have shown a preferred embodiment thereof, I wish it to be specifically understood that the same may be modified without departure from the scope and spirit of the appended claims.

What I claim is:

1. In a wall construction for mounting on a frame structure, a generally rectangular stone panel having a front face and rear face and having opposed side edges and top and bottom edges, said rear face of said stone panel intermediate said top and bottom edges thereof having pairs of rearwardly opening grooves therein, each pair of said grooves extending generally horizontally inwardly from a different one of the opposite side edges of the panel, the grooves of each pair thereof diverging forwardly from said rear face toward said front face of the panel, and a pair of anchoring devices for attaching said panel to said frame structure, said anchoring devices each comprising a base member and a pair of vertically spaced generally horizontally extending forwardly diverging flanges secured to said base member and slidably received in one respective forwardly diverging groove of a cooperating pair of said grooves longitudinally inwardly from the adjacent side edge of said panel, and bracket elements on said base members for mounting said base members to said frame structure.

2. In a wall construction, a structural supporting unit, a generally rectangular stone building panel having front and rear faces and having side edges and top and bottom edges, said stone building panel defining at both side edges thereof two vertically spaced pairs of cross-sectionally forwardly diverging grooves which extend in general parallelism generally horizontally inwardly from said side edges of said panel and which open rearwardly at the rear face of said panel, and a pair of anchoring devices one each associated with said grooves at each of said side edges of said panel for directly attaching said panel to said structural supporting unit, said anchoring devices each comprising an elongated generally vertically disposed strut, and a pair of elongated vertically spaced generally horizontally extending generally parallel channel members rigidly secured in general perpendicularity to said strut, said channel members having web portions engaging said strut and flange portions which diverge outwardly from the web portions thereof, said channel members each having their flange portions slidably inserted into a corresponding pair of said grooves laterally inwardly from the side edges of said panel so as to dispose said flange portions within said grooves, said struts being readily securable to said structural supporting unit so as to attach said panel thereto.

3. In a wall construction, a structural supporting unit, a generally rectangular stone building panel having front and rear faces and having side edges and top and botttom edges, said stone building panel defining at both side edges thereof two vertically spaced pairs of cross-section-

ally forwardly diverging grooves which extend in general parallelism generally horizontally inwardly from said side edges of said panel and which open rearwardly at the rear face of said panel, said panel also defining at the edges thereof a marginal laterally outwardly opening groove, a pair of anchoring devices one each associated with said diverging grooves at each of said side edges of said panel for directly attaching said panel to said structural supporting unit, said anchoring devices each comprising an elongated generally vertically disposed strut, and a pair of elongated vertically spaced generally horizontally extending generally parallel channel members rigidly secured in general perpendicularity to said strut, said channel members having generally vertical web portions and spaced flange portions which diverge outwardly from the web portion thereof, said channel members each having their flange portions slidably inserted into a corresponding pair of said diverging grooves laterally inwardly from the side edges of said panel so as to dispose said flange portions within said grooves, said struts being readily securable to said structural supporting unit so as to attach said panel thereto, and an elongated marginal reinforcing element received within said marginal groove and rigidly secured about said panel.

4. In a wall construction, a structural supporting unit, a generally rectangular stone building panel having front and rear faces and having side edges and top and bottom edges, said panel having pairs of rearwardly opening diverging grooves in the rear face intermediate said top and bottom edges of said panel, each pair of said grooves extending generally horizontally inwardly from a different one of the opposite side edges of the panel, a pair of anchoring devices, each anchoring device having a pair of diverging flanges received within an associated pair of said grooves directly attaching said panel to said structural supporting unit said stone building panel defining at the edges thereof a marginal laterally outwardly opening groove which communicates with said grooves in said panel, a marginal reinforcing band received within said marginal groove and rigidly secured about said panel holding said anchoring devices within their said associated grooves, a generally rectangular secondary panel of less transverse dimension than the transverse dimension of said marginal groove about said stone building panel, and an annular sealing member received about the marginal edge of said secondary panel, said secondary panel with said sealing member being received within said marginal groove adjacent one edge of said stone building panel whereby to seat said secondary panel within the marginal groove of said stone building panel.

5. In a wall construction, a structural supporting unit, a generally rectangular stone building panel having front and rear faces and having side edges and top and bottom edges, said stone building panel defining at both side edges thereof two vertically spaced pairs of cross-sectionally forwardly diverging grooves which extend in general parallelism generally horizontally inwardly from said side edges of said panel and which open rearwardly at the rear face of said panel, said panel also defining at the edges thereof a marginal laterally outwardly opening groove, a pair of anchoring devices one each associated with said diverging grooves at each of said side edges of said panel for directly attaching said panel to said structural supporting unit, said anchoring devices each comprising an elongated generally vertically disposed strut, and a pair of elongated vertically spaced generally horizontally extending generally parallel channel members rigidly secured in general perpendicularity to said strut, said channel members having generally vertical web portions and spaced flange portions which diverge outwardly from the web portion thereof, said channel members each having their flange portions slidably inserted into a corresponding pair of said diverging grooves laterally inwardly from the side edges of said panel so as to dispose said flange portions within said grooves, said struts being readily securable to said structural supporting unit so as to attach said panel thereto, and an elongated marginal reinforcing element received within said marginal groove and rigidly secured about said panel, said stone building panel further having collecting means disposed adjacent the bottom edge of the rear face of said stone building panel and having a passageway communicating with said collecting means and leading to the front portion of said stone building panel whereby to provide for the collection and disposal of any condensation forming on the rear face of said panel.

6. The structure defined in claim 5 in which said stone panel is formed to provide a horizontally extended groove in its rear face above said passageway, said channel sloping forwardly and downwardly from said rear face, and in which said collecting means further comprises an elongated channel member having a flange portion received in said groove and also having an aperture which communicates with said passageway.

References Cited in the file of this patent

UNITED STATES PATENTS

1,041,990	Freund	Oct. 22, 1912
1,195,643	Baumgartl	Aug. 22, 1916
2,277,984	Jenkins	Mar. 31, 1942
2,315,956	Heath	Apr. 6, 1943
2,351,856	Henderson	June 20, 1944
2,748,592	Kelly	June 5, 1956
2,895,182	Evans	July 21, 1959
2,944,641	Peterson	July 12, 1960

OTHER REFERENCES

Prefabrication, March 1957, pages 221–225.
German printed application 3,865, Mar. 29, 1956.