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METHOD OF FORMING WALLS WITH PREFABRICATED PANELS

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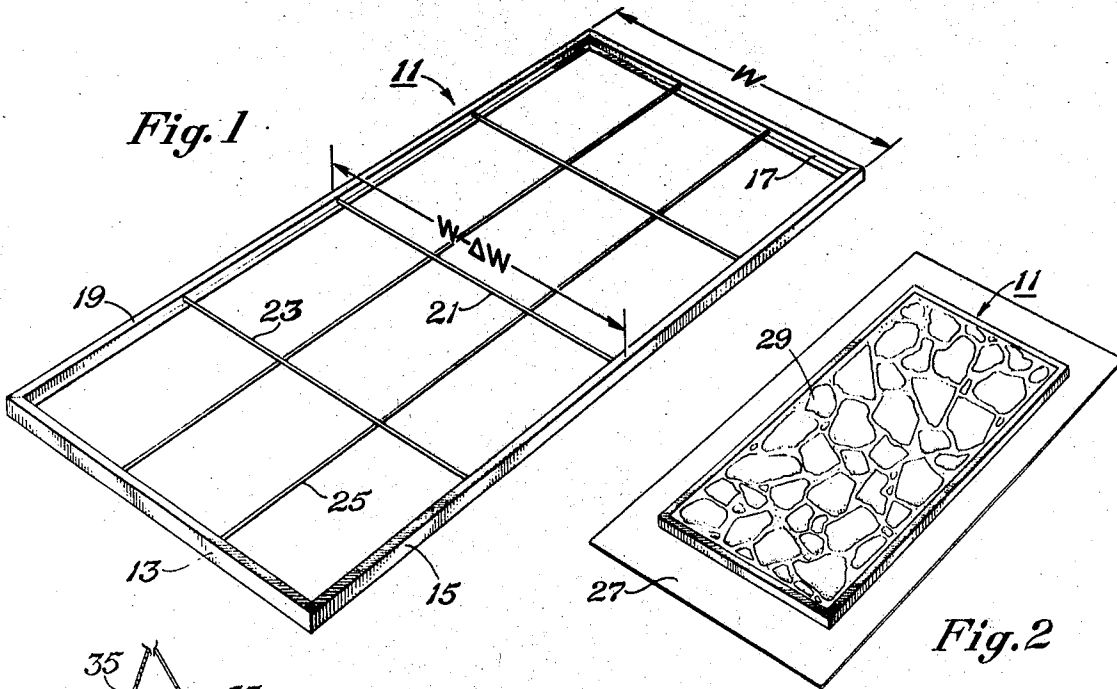
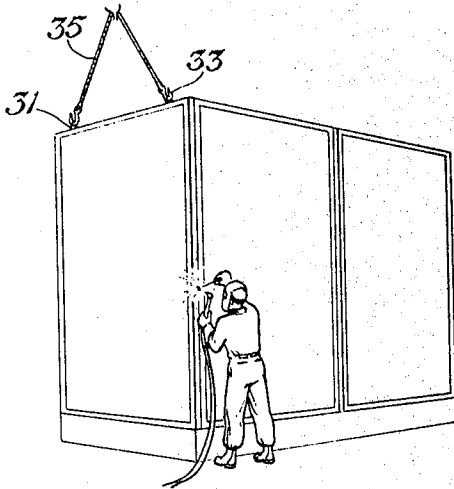
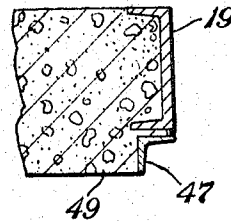
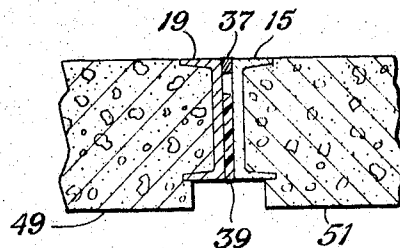
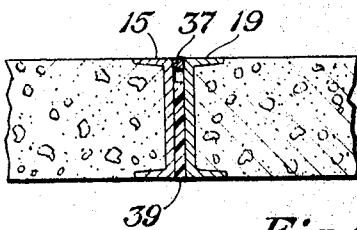
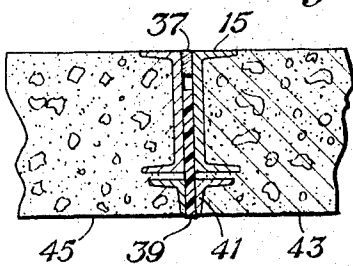
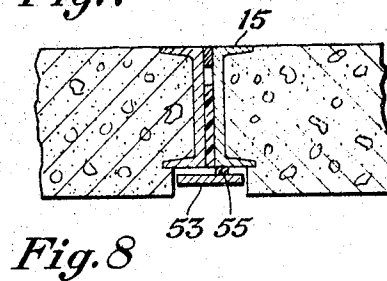


Fig. 5

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METHOD OF FORMING WALLS WITH PREFABRICATED PANELS

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ABSTRACT OF THE DISCLOSURE

This specification discloses a method of forming walls characterized by:

- (a) preparing a plurality of outer metallic skeletal panel frames, each being prepared by joining metallic channels at the periphery of the panel frames, bowing the channels in at the center of the sides to effect a dimension in width at the center less than the width at the top and bottom of the panel frames, and affixing metal reinforcing bars between opposite channel sides of the panel frames;
- (b) preparing a bed for each of the panel frames by forming a horizontal surface larger in dimension than the panel frame and covering the horizontal surface with a hydrophobic bond breaker;
- (c) placing a skeletal panel frame on the bed and pouring a lightweight concrete slurry within the panel frame to produce a prefabricated panel having the metallic channel at its periphery;
- (d) removing the prefabricated panel from the bed and positioning it on a foundation adjacent a second of the plurality of the panels and joining the metallic channels at the periphery of the adjacent panels; and
- (e) effecting a moisture-proof joint between the adjacent panels by filling the space between the metallic channels of the joints with a material that will sealingly expand and contract.

Specific methods of completing the joint between the panels to effect a more finished and better appearing joint are also described herein.

BACKGROUND OF THE INVENTION

(1) Field of the invention

This invention relates to a method of prefabricated construction. More particularly, it relates to a method of forming walls by employing prefabricated panels having metallic channels at the periphery of the panels.

(2) Description of the prior art

The prior art is replete with types of prefabricated construction. Such prior art devices run from prefabricated modular units, which can be assembled to make a small home, to prefabricated trusses for use in a roof. The number and variety of prefabricated techniques attest, in a way, to the lack of a simple, satisfactory solution to rapid, inexpensive construction, using prefabricated units. It is probable that the lack of success of prior art devices stems from attempting to prefabricate modules that were too complex or units of construction that required, in addition, a skeletal framework.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of an outer metallic skeletal panel frame used in an embodiment of the invention.

FIG. 2 is an isometric view of a prepared panel employed on its bed.

FIG. 3 is a partial perspective showing assembly of adjacent panels in forming the walls of a building.

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FIG. 4 is a partial cross-sectional view of a joint employed in one embodiment of the invention.

FIG. 5 is a partial cross-sectional view of another joint employed in a different embodiment of the invention.

FIGS. 6 and 7 are partial cross-sectional views of another type of joint employed in another embodiment of the invention; FIG. 6 illustrating a view of a side of one panel at an intermediate stage in forming the final joint shown in FIG. 7.

FIG. 8 is a partial cross-sectional view of another specific embodiment of the invention.

DESCRIPTION OF PREFERRED EMBODIMENT(S)

In accordance with the invention there is provided a method of forming walls comprising:

- (a) preparing a plurality of outer metallic skeletal panel frames, each being prepared by joining metallic channels at the periphery of the panel frames, bowing the channels in at the center of the sides to effect a dimension in width at the center less than the width at the top and bottom of the panel frame, and affixing metal reinforcing bars between opposite channel sides of the panel frames;
- (b) preparing a bed for each of the panel frames by forming a horizontal surface larger in dimension than the panel frames and covering the horizontal surface with a hydrophobic bond breaker;
- (c) placing a skeletal panel frame on the bed and pouring a lightweight concrete slurry within the panel frame to produce a prefabricated panel having the metallic channel at its periphery;
- (d) Removing the prefabricated panel from the bed and positioning it on a foundation adjacent a second of the plurality of the panels and joining the metallic channels at the periphery of the adjacent panels; and
- (e) Effecting a moisture-proof joint between the adjacent panels by filling the space between the metallic channels of the joints with a material that will sealingly expand and contract.

The invention can be clearly understood in all its aspects by referring to the figures. Referring to FIG. 1, outer metallic skeletal panel frame 11 is prepared by joining metallic channels 13, 15, 17, and 19 at the periphery of the panel frames. Ordinarily this joining comprises welding. The frame 11 is placed in a jig and the side channels are bowed in at the center of the sides to effect a dimension in width $W - \Delta W$, that in rectangular form, is less at the center than the width W at the top and bottom of the panel frame. The bowing in of the sides has been found to be necessary to obtain panels that can be joined properly in forming a wall. The amount ΔW which the sides should be bowed inward will generally run between $\frac{1}{8}$ and $\frac{1}{4}$ inches. To retain the shape of the metallic channels afforded by the jigs, reinforcing bars are affixed between opposite channel sides of the panel frame. For example, reinforcing bar 21 may be welded at the center of channels 15 and 19 to hold the dimension $W - \Delta W$. Other lateral reinforcing bars 23 may be provided as needed. Similarly, longitudinal reinforcing bars 25 may be provided as needed.

Referring to FIG. 2, a bed 27 is prepared for the panel frame. This may be done by forming a horizontal surface such as by pouring a substantially planar concrete slab larger in dimension than the panel frame and covering the horizontal surface with a hydrophobic bond breaker. The horizontal surface may be covered with a hydrophobic bond breaker by spraying a solution of oil containing paraffin wax thereon. Other hydrophobic materials; such as, silicones or hydrophobic surfactant in nonaqueous solutions; can be sprayed on the horizontal surface. Moreover, a hydrophobic material; such as, poly-

ethylene plastic; can be spread over the horizontal surface. Any material can be employed that will prevent the horizontal surface from bonding with the concrete slurry to be poured within the skeletal panel frame on the bed.

Panel frame 11 is placed on the bed and a lightweight concrete slurry is poured within the panel frame to produce a prefabricated panel having metallic channel at its periphery. Once the lightweight concrete has attained sufficient set strength, the desired facing or facade can be inserted to effect the desired exterior surface. The facing may comprise a gravel set and grouted into the concrete slurry. It may comprise rocks 29 as illustrated in FIG. 2 or any other facing desired.

Once the completed panel has dried to sufficient strength it can be removed from the bed and positioned on a foundation adjacent another of a plurality of such panels, as illustrated in FIG. 3. To facilitate lifting and manipulating the finished panels, eyes 31 are affixed to one end of the frame for lifting by hooks 33, attached via cables 35 to a crane or other lifting device (not shown). The panels may be readily removed from their beds because of the hydrophobic bond breaker interposed between them and the horizontal surface. The adjacent panels can be readily joined because their periphery is the metallic channel. Hence, welding, as illustrated in FIG. 3, effects a structurally adequate joint between the metallic channels. Other methods of joining adjacent panels, taking advantage of the metallic channels at the periphery of the panels, can be employed. Because of the metallic channels at the periphery of each of the panels, the walls are structurally adequate without any other supporting skeleton.

To complete the wall, each joint between adjacent panels is made moisture proof by filling the space between the metallic channels of the joint with a material that will sealingly expand and contract. A partial cross-sectional view showing such a joint is illustrated in FIG. 4. Therein, metallic channels 15 and 19 are welded together as shown by welding flux 37 including the solidified molten metal of the welding rod. The joint between the metallic channels is filled with water proof material 39 that will adhere to the metallic channels and will expand and contract as the panels contract and expand.

Materials which are satisfactory in effecting a moisture-proof joint include emulsions or suspensions of butyl rubber, neoprene, polystyrene, or mixtures thereof in a vaporizable solvent. Once the joint is caulked or filled with this dispersed material, the moisture-proof material will adhere to the metallic channels and effect a moisture-proof joint regardless of the temperature or the condition of expansion or contraction of the respective panels.

As can be seen from FIG. 3, there is a discernible joint between the panels of which the walls of the building are comprised. To effect a more nearly uniform and pleasing appearance, it is often desired to join the panels such that a "minimum joint" is effected. By minimum joint is meant a joint that is scarcely perceptible and, in fact, may not be perceptible from a distance. A partial cross-sectional view illustrating this type of joint is shown in FIG. 5. In preparing a joint such as illustrated in FIG. 5, a metallic strip 41 of L-shaped cross-section, commonly referred to as an angle iron, is permanently fastened to the metallic channel with the back side of the metallic strip flush with the periphery of the metallic channel. Ordinarily, the metallic strip 41 is welded to metallic channel after the skeletal frame has been formed in the jig, although it may be fastened by any appropriate means and at any particular time before the panels are joined in the wall. Preferably, angle iron 41 is fastened to metallic channel 15 before the concrete slurry is poured therein.

The lightweight concrete slurry is poured within the metallic strip as well as within the metallic channel such that the surface of the concrete is flush with the edge of the metallic channel on one side and flush with the

metallic strip 41 on the other side. The procedure described hereinbefore is employed in preparing the panels, in removing the prepared panels from the bed and emplacing them side by side on a foundation. When so emplaced, as illustrated in FIG. 5, the joint between the concrete 43 of one panel and concrete 45 of the joining panel is almost invisible. Where the concrete has an elaborate facade, such as that afforded by the imbedment of pea gravel in the concrete, the joint becomes even less perceptible.

The usual method of joining adjacent panels can be employed. For example, the metallic channels at the periphery of the panels can be welded, as shown by welding flux 37 at the interior of the joint.

In another embodiment, the joint is emphasized to form a "shadowline joint," as illustrated in FIGS. 6 and 7. In this embodiment, a metallic strip 47 of L-shaped cross-section is temporarily fastened to the metallic channel 19 with the back side of the metallic strip recessed by the width of the strip from the periphery of the metallic channel. The temporary fastening is readily accomplished by a tack weld between the metallic strip and the metallic channel. As indicated before with respect to forming the minimum joint, the metallic strip may be temporarily fastened to the metallic channel at any step in the process; although, it is preferable that it be tack welded thereto after the panel frame has been formed in the jigs and before the concrete slurry is poured into the skeletal panel frame. Waterproof material 39 fills the space between metallic channels of the joint.

The panel frame containing the temporarily fastened metallic strip 47 is then emplaced upon the bed which has been prepared as previously described and the lightweight concrete slurry poured thereinto. The panel is prepared as described hereinbefore and the desired exterior surface 49, which may or may not include a facade, effected. Once the concrete slurry and the desired exterior surface have been completed and cured to the desired strength, angle iron 47 is removed. The panel is emplaced on a foundation adjacent other panels having a similar construction as illustrated in the partial cross-section of FIG. 7. The joint between metallic channel 15 and metallic channel 19 is formed as described hereinbefore; for example, by welding as shown by welding flux 37 on the interior thereof. In this way, exterior surfaces 49 and 51 protrude beyond the metallic channel and form the desired shadowline joint. Waterproof material 39 fills the space between the metallic channels of the joint.

A further and specific embodiment of the invention is illustrated by partial cross-sectional view of FIG. 8, wherein a shadowline joint is formed as described in connection with FIGS. 6 and 7. In addition, however, a flat strip of metal 53 is fixed to one of the metallic channels; such as, by being welded to channel 15 as shown by second welding flux 55. In this way, the metallic strip 53 is free to move in expansion or contraction with the panel to which it is affixed without imposing stress on the joint or on the adjacent panel.

To mask the joint from view on the interior of the building, the joint is covered by a glass tape bedded in with a hydrophobic, nonasphaltic material. The nonasphaltic material must be hydrophobic to adhere to the inner surface of the panel which has been in intimate contact with the hydrophobic bond breaker on the bed. It is, of course, possible to employ certain surfactants, with or without additional solvents and/or caustics, to change the character of the interior of the panel from a hydrophobic condition to a hydrophilic condition. This is ordinarily unnecessary since hydrophobic, nonasphaltic materials are readily available. Illustrative of such hydrophobic, nonasphaltic materials are the following materials which are commercially available:

(a) A first material is available under the trade name of Krack-Kote and consists essentially of a pigment of titanium, calcium, talc, calcium carbonate, mica and

aluminum stearate, in less than 30 percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier; or

(b) Another material is marketed under the trade name Tuff-Kote and consists essentially of a pigment of titanium dioxide, mica, pentachlorophenol, asbestos fiber and asbestos floats comprising less than 11½ percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier.

To mask the exterior joint or the exterior shadowline joint, glass tape can be bedded in with the hydrophobic, nonasphaltic material in the same manner described with respect to the interior of the joint and the exterior textured out to provide a weather-proof joint of excellent appearance. Specifically, the exterior texturing out of the joint is accomplished with a slurry consisting essentially of an aggregate of volcanic pumice, a pigment of chalk-resistant titanium dioxide, asbestos, mica, and siliceous extenders; all carried in a vehicle of a polyvinyl acetate emulsion with a minor amount of plasticizers, wetting agent, anti-foam ingredient, coalescing agent, antifreeze and fungicide. Such a slurry for texturing out the exterior of the joint is available under the trade name Flex-Kote.

Thus, it can be seen that the invention provides walls which are decorative and structurally adequate without any supplemental skeletal framework. A roof structure may be engrafted directly onto the metallic channels at the upper end of the wall panels and affixed thereto by conventional methods; such as, welding. Buildings as large as school gymnasiums with 20 ft. walls and 60 ft. clear span of ceilings have been formed employing the invention.

Although the invention has been described with a high degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A method of forming walls comprising:

- (a) preparing a plurality of outer metallic skeletal panel frames, each being prepared by joining metallic channels at the periphery of said panel frames, bowing said channels in at the center of the sides to effect a dimension in width $W - \Delta W$ at the center less than the width W normally associated with the top and the bottom of said panel frame, and affixing metal reinforcing bars between opposite channel sides of said panel frame; said metallic channels being sufficiently strong to eliminate the need for any structural support other than the resulting prefabricated panels;
- (b) preparing a bed for each of said panel frames by forming a horizontal surface larger in dimension than said panel frame and covering said horizontal surface with a hydrophobic bond breaker;
- (c) placing a skeletal panel frame on said bed and pouring a lightweight concrete slurry within said panel frame and to full depth thereof to produce a full-thickness prefabricated panel having said metallic channel at its periphery for also preventing chipping of the edges of the concrete panel; said panel being adapted to serve as both the sides and the structural components of said wall;
- (d) removing said prefabricated panel from said bed and positioning it on a foundation adjacent a second of said plurality of said panels and joining the metallic channels at the peripheries of the adjacent panels to form a wall that is structurally adequate when having said panels as its only structural support; and
- (e) effecting a moisture-proof joint between said adjacent panels by filling the space between said metallic

channels of said joints with a material that will bond to said metallic channels and will sealingly expand and contract.

2. The method of claim 1 wherein said ΔW is ⅛ to ¼ inch.

3. The method of claim 1 wherein said outer skeletal frames form a rectangular panel frame and are ⅛ to ¼ inch less in width at the center of the side than at the top and bottom.

4. The method of claim 1 wherein said hydrophobic bond breaker is an oil solution containing a paraffin wax and said covering is effected by spraying.

5. The method of claim 1 wherein said hydrophobic bond breaker is polyethylene plastic.

6. The method of claim 1 wherein said metallic channels of said adjacent panels are joined by welding.

7. The method of claim 1 wherein said space between said metallic channels of said joint is filled with a liquid carrier containing a material which is either butyl rubber, neoprene, polystyrene, or a mixture thereof.

8. The method of claim 1 wherein the interior of said joint is covered by glass tape bedded in with a hydrophobic, nonasphaltic material which is either:

(1) a pigment of titanium, calcium, talc, calcium carbonate, mica, and aluminum stearate, in less than thirty percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier; or

(2) a pigment of titanium dioxide, mica, pentachlorophenol, asbestos fiber and asbestos floats comprising less than 11½ percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier.

9. The method of claim 1 wherein the exterior of said joint is covered by glass tape bedded in with a hydrophobic, nonasphaltic material which is either:

(1) a pigment of titanium, calcium, talc, calcium carbonate, mica, and aluminum stearate, in less than thirty percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier; or

(2) a pigment of titanium dioxide, mica, pentachlorophenol, asbestos fiber and asbestos floats comprising less than 11½ percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier

and textured out with a slurry consisting essentially of an aggregate of volcanic pumice, a pigment of chalk-resistant titanium dioxide, asbestos, mica, and siliceous extenders; all carried in a vehicle of a polyvinyl acetate emulsion with a minor amount of plasticizers, wetting agent, anti-foam ingredient, coalescing agent, antifreeze and fungicide.

10. The method of claim 1 wherein a metallic strip of L-shaped cross-section is permanently fastened to said metallic channel with the back side of said metallic strip flush with the periphery of said metallic channel, and said concrete is also poured within said metallic strip, whereby, a minimum joint is effected when said adjacent panels are joined in said wall.

11. The method of claim 10 wherein the interior of said joint is covered by glass tape bedded in with a hydrophobic, nonasphaltic material which is either:

(1) a pigment of titanium, calcium, talc, calcium carbonate, mica, and aluminum stearate, in less than thirty percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier; or

(2) a pigment of titanium dioxide, mica, pentachlorophenol, asbestos fiber and asbestos floats comprising less than 11½ percent by volume and carried in a

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vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier.

12. The method of claim 10 wherein the exterior of said joint is covered by glass tape bedded in with a hydrophobic, nonasphaltic material which is either:

- (1) a pigment of titanium, calcium, talc, calcium carbonate, mica, and aluminum stearate, in less than thirty percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier; or
- (2) a pigment of titanium dioxide, mica, pentachlorophenol, asbestos fiber and asbestos floats comprising less than 11½ percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier

and textured out with a slurry consisting essentially of an aggregate of volcanic pumice, a pigment of chalk-resistant titanium dioxide, asbestos, mica, and siliceous extenders; all carried in a vehicle of a polyvinyl acetate emulsion with a minor amount of plasticizers, wetting agent, antifoam ingredient, coalescing agent, antifreeze and fungicide.

13. The method of claim 1 wherein a metallic strip of L-shaped cross-section is temporarily fastened to said metallic channel with the back side of said metallic strip recessed by the width of said strip from the periphery of said metallic channel, said concrete is also poured within said metallic strip and said metallic strip is removed before said prefabricated panel is positioned adjacent another prefabricated panel, whereby a shadowline joint is effected when said adjacent panels are joined in said wall.

14. The method of claim 13 wherein a flat piece of metal is welded to the metallic channel of only one of said panels and extends substantially completely across said shadowline joint before the exterior surface of said flat piece of metal is finished for an exterior joint.

15. The method of claim 13 wherein the interior of said joint is covered by glass tape bedded in with a hydrophobic, nonasphaltic material which is either:

- (1) a pigment of titanium, calcium, talc, calcium carbonate, mica, and aluminum stearate, in less than thirty percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier; or
- (2) a pigment of titanium dioxide, mica, pentachloro-

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phenol, asbestos fiber and asbestos floats comprising less than 11½ percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier.

16. The method of claim 13 wherein the exterior of said joint is covered by glass tape bedded in with a hydrophobic, nonasphaltic material which is either:

- (1) a pigment of titanium, calcium, talc, calcium carbonate, mica, and aluminum stearate, in less than thirty percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier; or
- (2) a pigment of titanium dioxide, mica, pentachlorophenol, asbestos fiber and asbestos floats comprising less than 11½ percent by volume and carried in a vehicle of linseed oil, soya marine oil, tung soya oil, chlorinated paraffin, and caustic-reacted oil, 1,10-phenanthrene, and a drier

and textured out with a slurry consisting essentially of an aggregate of volcanic pumice, a pigment of chalk-resistant titanium dioxide, asbestos, mica, and siliceous extenders; all carried in a vehicle of a polyvinyl acetate emulsion with a minor amount of plasticizers, wetting agent, antifoam ingredient, coalescing agent, antifreeze and fungicide.

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