April 30, 1968 J. N. LOWE ETAL 3,381,066

METHOD OF MAKING A TRANSLUCENT PANEL

Filed Sept. 20, 1965 2 Sheets-Sheet 1

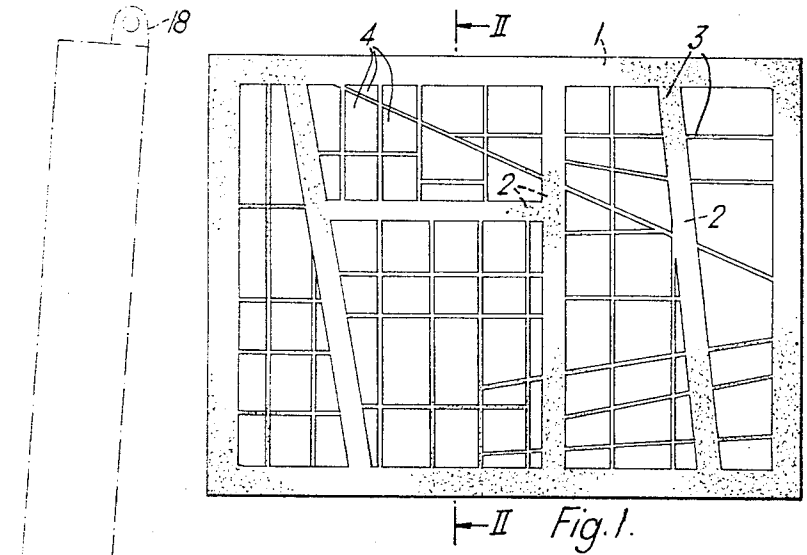


Fig. 1.

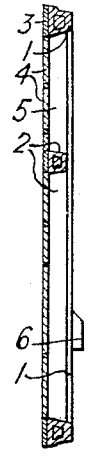
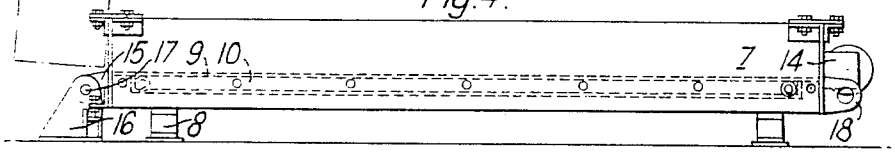


Fig. 2.

Fig. 4.



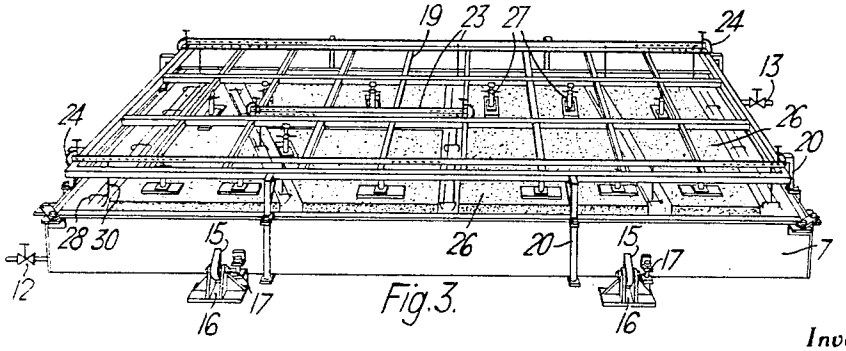


Fig. 3.

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Filed Sept. 20, 1965 2 Sheets-Sheet 2

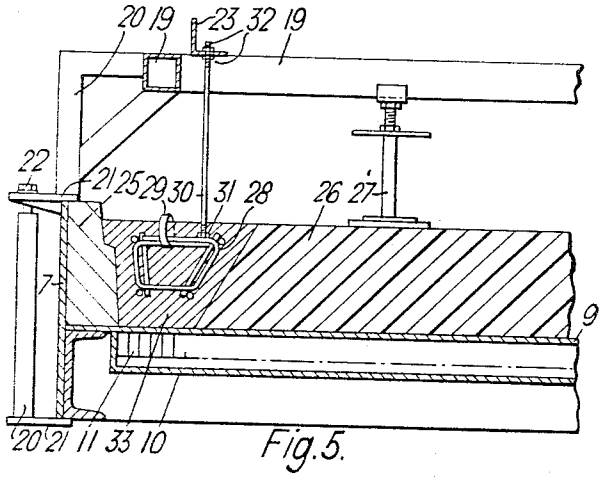


Fig. 5.

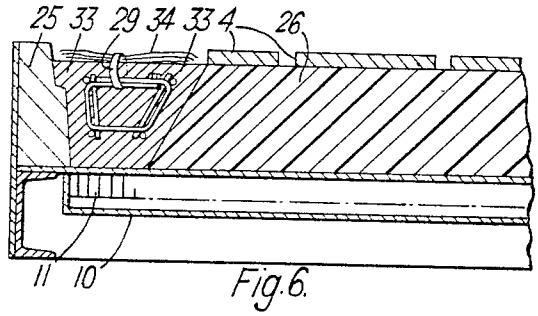


Fig. 6.

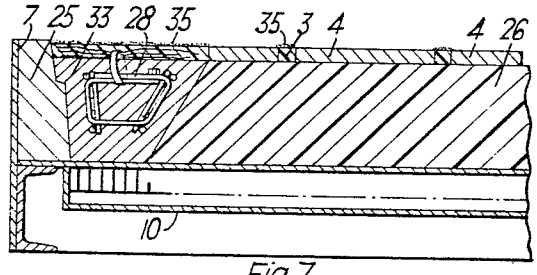


Fig. 7.

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United States Patent Office 3,381,066 Patented Apr. 30, 1968

3,381,066

METHOD OF MAKING A TRANSLUCENT PANEL

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Filed Sept. 20, 1965, Ser. No. 488,326
Claims priority, application Great Britain, Jan. 27, 1965, 3,602/65
9 Claims. (Cl. 264—71)

This invention relates to the method of making translucent panels which are used, for example, as church windows, and which comprise a mosaic of pieces of stained glass or translucent ceramic material supported by a concrete framework. Previously, the pieces of glass have been set directly in a matrix of concrete but difficulties have arisen in making the panel strong enough to be load bearing and in making the bond between the glass and the concrete waterproof and strong enough to withstand the pressure differentials between the inside and outside of large buildings in the walls of which the panels are set.

In accordance with the present invention the method of making a translucent mosaic panel comprises forming a substantially flat reinforced load bearing unitary framework of intersecting concrete beams, and, on one surface of the framework, settings a mosaic of pieces of stained glass or other translucent material in a matrix layer of epoxy resin which adheres to the concrete framework.

With this simple construction, the reinforced concrete framework provides the load bearing strength of the panel and supports the decorative mosaic layer. When the panel is erected, light shines through the apertures between the intersecting concrete beams and through the pieces of translucent glass or other material which are in register with the apertures. The epoxy resin matrix layer adheres extremely strongly to the edges of the pieces of glass or other material and holds them firmly with a weatherproof seal. Although the epoxy resin naturally adheres well to the concrete framework, the layer is preferably reinforced with pieces of glass fibre or other material, for example with glass fibre rovings, and this reinforcement is preferably connected to the reinforcement of the concrete framework. This may be done by providing rings, for example of glass fibre, which are threaded onto the concrete reinforcement and which projects from the surface of the concrete framework into the adjacent layer of epoxy resin. The glass fibre rovings in the epoxy resin layer can then be reeved through the projecting portions of the rings before the epoxy resin layer is cast.

To prevent deterioration of the epoxy resin due to exposure to ultra-violet radiation in the sun rays, the exposed surface of the epoxy resin between the pieces of glass or other material may be coated with slate dust.

The present invention also includes a method of making a translucent panel wherein a number of formwork islands are placed in the bottom of a mould, metal reinforcement is positioned within the mould between the islands, concrete is poured into the mould substantially up to but not above the height of the islands, the concrete is allowed to set to form a unitary reinforced load bearing concrete framework, pieces of stained glass or other translucent material are placed on the islands to form a mosaic, a layer of epoxy resin is cast around the mosaic and on top of the set concrete framework and any exposed parts of the upper surfaces of the islands, the epoxy resin is allowed to set, and the composite panel is separated from the mould and formwork islands. When the exposed surface of the epoxy resin layer is to be

covered with slate dust, this should be sprinkled on the upper surface of the resin layer while it is still tacky but in the mould.

The formwork islands are preferably composed of a foamed plastic material such as formed polystyrene, which can readily be cut to size and shape corresponding to the required mosaic pattern and hence to the required shape of the unitary concrete framework.

In accordance with a further feature of the present invention, a vibratory mould for use in carrying out the above novel method has a carrier which overlies the mould and which is provided both with a number of clamps for holding the formwork islands down against the bottom of the mould during the casting of the concrete framework and with a number of depending supports for supporting reinforcement for the concrete framework out of contact with the bottom of the mould.

The clamps are important in preventing the formwork islands from moving relatively to the mould during vibration of the mould and the supporting of the concrete reinforcement above the bottom of the mould by the supports ensures that no part of the reinforcement will be exposed at the face of the framework remote from that to which the layer of epoxy resin is bonded. The carrier with the clamps and supports are preferably removable from above the mould once the unitary concrete framework has been cast so that the tops of the islands are exposed for laying the pieces of glass or other translucent material and the subsequent casting of the epoxy resin matrix.

The mould is preferably pivotally connected about a horizontal axis along one edge to a fixed support so that the mould can be tilted upwards about the axis into a substantially vertical position after the composite panel has been constructed. In this way the whole surface of the panel is supported while it is being tilted in a substantially vertical position in which it can be handled comparatively easily, for example by means of a forklift truck. The horizontal pivotal connection between the mould and the stationary support should be releasable so that the mould remains only supported on resilient feet during vibration of the mould.

The bottom of the mould is preferably a false metal floor which is arranged to be heated from beneath by means of hot water. In this way, the cast concrete framework can be dried and set as quickly as possible so that the mould is ready for use again at the earliest opportunity.

One example of a translucent mosaic panel, and its construction in a mould, in accordance with the present invention is illustrated in the accompanying drawings in which:

FIGURE 1 is a face view of the completed panel;

FIGURE 2 is a section taken on the line II—II in FIGURE 1;

FIGURE 3 is a perspective view from one side and above of a mould for use in making the panel shown in FIGURES 1 and 2 but before the concrete framework of the panel has been cast;

FIGURE 4 is an end elevation of the mould; and,

FIGURES 5, 6 and 7 are vertical sections through end edge portions of the mould illustrating successive steps in the construction of the composite panel.

As shown in FIGURES 1 and 2, the completed panel comprises a flat unitary reinforced concrete framework of intersecting beams including an edge framework of thicker beams 1 interconnected by thinner internal beams 2. The front surfaces of all the beams are co-planar with one another and are not actually visible in FIGURE 1 because of a covering matrix layer 3 of epoxy resin in which are set a mosaic of pieces of coloured glass 4 in register with the apertures 5 between the concrete beams. The epoxy resin layer 3 securely unites the pieces

of glass 5 to one another and to the framework of the concrete beams 1 and 2. The exposed upper surface of the epoxy resin layer is covered with slate to protect the resin from the effects of ultra-violet radiation in the sun's rays.

A number of the panels are arranged to be mounted alongside one another to form a large stained glass window in for example the wall of the church or public building. When the panels are mounted in position, their weight is taken by reinforced abutments 6 which are integrally cast with and project rearwardly from the vertical edge beams 1 of the panel and which rest on complementary ledges on support columns of the building. The panels may then be rigidly secured in position by means of studs which screw into internally screw threaded hollow sockets that are embedded in the rearwardly facing surfaces of the edge beams 1 of the framework.

The panel is constructed in the rectangular mould illustrated in FIGURES 3 to 7. The mould is made of metal and has four upstanding side and end walls 7 and a base which rests on the floor on a number of rubber feet 8. The bottom of the mould on which the panel is cast is a false metal floor 9 beneath which there is chamber 10 containing a honeycomb network of aluminium foil cells 11. Inlet and outlet ducts 12 and 13 lead to and from the chamber 10 through the end walls of the mould so that hot water from a separate supply can be ducted through the chamber 10 to heat the false floor 9 of the mould.

An electric motor and eccentric vibrator 14 are rigidly mounted on the rear side wall 7 of the mould for vibrating the mould on its resilient feet 8. A pair of ears 15 extend from the front side wall of the mould between bifurcated brackets 16 which are rigidly secured to the floor. Removable pins 17 provide a pivotal connection between the ears 15 and the brackets 16 so that the mould can be tilted into the substantially vertical position shown in chain lines in FIGURE 4 when the hook of an overhead crane is fitted into an eye 18 on the rear side wall 7 of the mould and the hook is raised. When the mould is to be vibrated in the horizontal position by means of the vibrator 14, the pins 17 are removed so that the mould does not suffer any constraint from the brackets 16.

The mould is provided with a rectangular lattice carrier 19 which can be supported horizontally both at the top of the mould by means of a number of brackets 20 which have flanges 21 that grip the tops and bottoms of the side and end walls 7 of the mould between them when they are forced towards one another by screws 22. Additional angle beams 23 are mounted in suitable positions on the carrier 19 by means of finger clamps 24.

When a panel is to be constructed, before the carrier 19 is placed in position, the mould is lined adjacent its side end walls 7 with wooden formwork 25 which defines the overall peripheral shape of the panel. Polystyrene formwork islands 26 corresponding in shape and position to the desired apertures 5 are then placed on the false bottom 9 of the mould. To prevent the concrete, which is placed later, from adhering to the islands, the edges of the islands are covered with polyethylene sheeting, which is not shown. This sheeting has its edge fixed to the top face of the islands by pins or adhesive tape, it then extends down the side edge of the island, with which it is held in close contact by further pins, and its other edge extends across the bottom of the mould towards the adjacent island where it overlaps the edge of another sheet protecting the edge of that island. The carrier 19 is then fitted and secured in position by means of the brackets 20, and hand jacks 27 are interposed between the individual members of the carrier 19 and the tops of the formwork islands 26 to hold the islands firmly down against the bottom of the mould. Welded rod reinforcement 28 on which glass fibre rings 29 have been threaded is then positioned in the troughs between the formwork islands 26 and one another and the wooden formwork 25, that is where the concrete beams 1 and 2 are to be cast. The reinforcement 28 is supported in position at the right height above the bottom of the mould by a number of screw threaded rods 30 which screw at their lower ends into nuts 31 welded to the reinforcement 28 and pass through holes in the horizontal flanges of the angle beams 23 at their upper ends. The heights of the rods 30, and hence the heights of the reinforcement 28 are determined by pairs of nuts 32 which are threaded on to the tops of the rods 30 and engage the upper and lower surfaces of the horizontal flanges of the beams 23.

Concrete is then poured into the mould in the troughs with intermittent vibration of the mould by the vibrator 14 until the concrete 33 is flush with the upper surfaces of the formwork islands 26, care being taken to ensure that parts of the rings 29 project with a loop above the upper surface of the cast concrete 33, this is shown in FIGURE 5. Hot water is ducted through the chamber 10 to heat the bottom of the mould and promote quick setting of the concrete 33 which forms the unitary framework of beams 1 and 2. The rods 30 are then unscrewed from the nuts 31 and removed together with the hand jacks 27, and the bolts 22 are undone to release the brackets 20 so that the carrier 19 and beams 23 can be removed from above the mould.

As shown in FIGURE 6, the pieces of coloured glass 4 which form the mosaic are then placed on the formwork islands and glass fibre rovings 34 are reeved through the projecting loops of the rings 29 and laid on the exposed upper surface of the concrete 33 and islands 26 between the pieces of glass 4. A matrix layer 3 of epoxy resin, which is filled with a mixture of fine sand, coarse sand, quartz flour, and a black colouring, is then cast on top of the concrete 33 and exposed upper surface of the islands 26 between the pieces of glass 4 up to a level flush with the top of the pieces of glass 4. While the epoxy resin is still tacky it is sprinkled with slate dust 35 which unites with the resin as the epoxy resin hardens.

The composite panel as shown in FIGURE 7, is now complete and it is removed from the mould by placing the pins 17 in position so that the front side wall of the mould is pivotally connected to the fixed brackets 16 and the mould is then tilted upwards to the substantially vertical position shown in chain dotted lines in FIGURE 4 by means of an overhead crane. In this position, the panel together with the formwork islands 26 are eased out of the mould onto the prongs of a forklift truck on which the panel is carried away and stacked in the upright position on edge. The formwork islands are then removed from the back of the completed panel and this is facilitated by the cross-sectional shapes of the beams 2 which taper in a rearward direction and by the polyethylene sheeting covering the edges of the islands.

We claim:

1. A method of making a translucent panel comprising the steps of placing a number of formwork islands in the bottom of the mould, positioning metal reinforcement within said mould between said islands, pouring concrete into said mould substantially up to but not above the height of said islands, allowing said concrete to set to form a unitary reinforced load bearing concrete framework, placing pieces of translucent material on said islands to form a mosaic, casting a layer of epoxy resin around said mosaic and on top of said concrete framework and any exposed parts of said islands, allowing said epoxy resin to set, and separating said composite panel from said mould and said formwork islands.

2. A method according to claim 1, further comprising the steps of sprinkling slate dust on said epoxy resin layer between said mosaic before said epoxy resin layer sets.

3. A method according to claim 1, wherein said formwork islands are composed of a foamed plastic material.

4. A method according to claim 1, wherein said mould is vibrated after said concrete has been poured but before said concrete is set and the setting of said concrete is promoted by heating the bottom of said mould.

5. A method according to claim 1, wherein said composite panel is separated from said mould by tilting said mould about a horizontal axis along one edge of said mould into a substantially vertical position.

6. A method according to claim 1, wherein said metal reinforcement is positioned within said mould between said islands prior to and during the pouring of said concrete by supporting it from a carrier which overlies said mould.

7. A method according to claim 4, wherein said formwork islands are positively held down against the bottom of said mould during said vibration of said mould by a number of clamps which are interposed between an overlying carrier and said islands.

8. A method according to claim 1, wherein prior to said casting of said epoxy resin layer, glass fibre rovings

are placed on the upper surface of said concrete framework and formwork islands between said mosaic to provide a reinforcement for said epoxy resin layer.

9. A method according to claim 8, wherein rings are threaded onto parts of said concrete reinforcement and are caused to project above the upper surface of said cast concrete framework when said concrete is cast and said glass fibre rovings are reeved through said projecting portions of said rings.

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