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PANEL FOR COMPOSITE WALL STRUCTURE

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2 Sheets-Sheet 2

FIG. 3

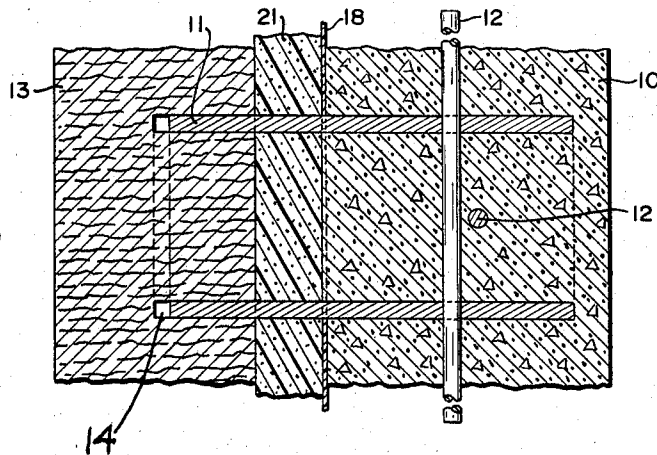


FIG. 4

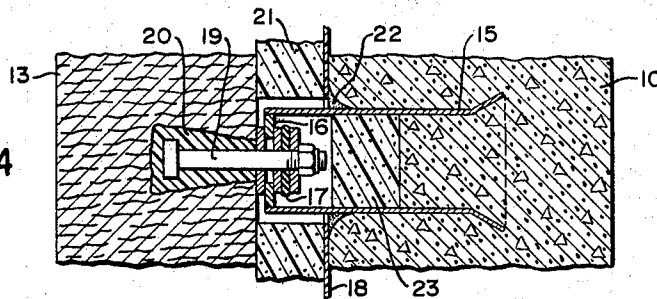
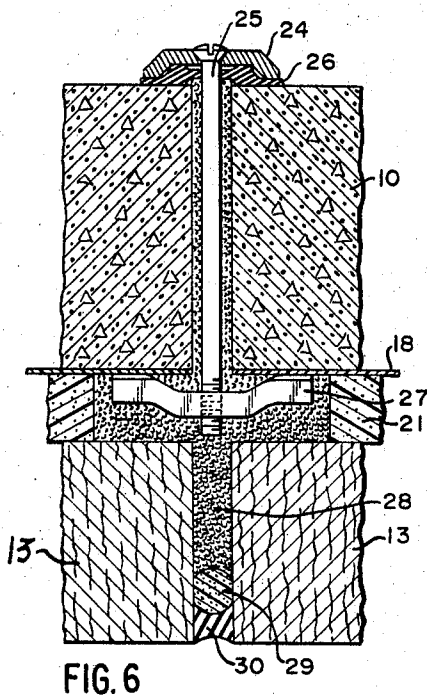


FIG. 5

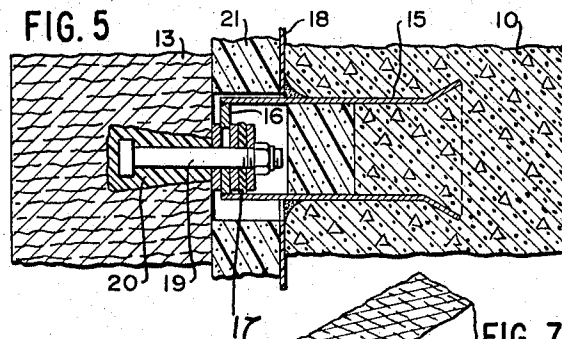
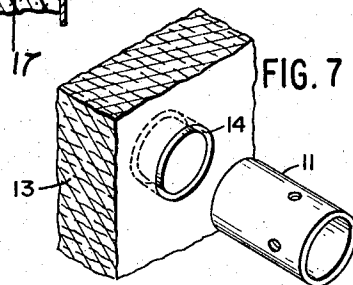


FIG. 7



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ABSTRACT OF THE DISCLOSURE

For use in a composite wall structure, a panel having a solid concrete section precast with a projecting metal sleeve, in combination with a facing section of granite or other stone having a circular groove at its center of gravity in which the sleeve is fitted so that the facing section is suspended for free expansion. A slip anchor is also provided for preventing angular displacement of the two sections and limiting separation thereof.

This invention comprises a new and improved composite wall structure of the panel type in which a stone facing section is bonded to an inner concrete section with novel provision for thermal expansion of the panel sections without impairing a permanent bond between them.

It has been difficult heretofore successfully to attach a stone facing to concrete back-up wall in the building field inasmuch as the inner concrete section remains at approximately constant temperature while the outer stone section is exposed to ambient temperature changes—heat by day, cold by night, heat of summer, cold of winter. The thermal expansion of the stone facing imposes terrific stresses of shear in any common bonded area of two such dissimilar materials. This condition is further aggravated by the difference of thermal linear expansion between granite and concrete.

If the two sections are rigidly restrained in bonded relation the varying expansion imparts bending and shear in the mass resulting in deformed or cracked sections. In a rigid dowel system this flexing imparts bending to the dowel pins with ultimate failure. Many attempts have been made to join concrete directly to granite with some provision for expansion. In those constructions the sections have been separated by isolation sheets of vapor barrier material but no successful solution of the problem has been made prior to the panel of the present invention.

This panel is characterized by an inner solid concrete section precast with a projecting metal sleeve, in combination with a stone facing section having at or near its center of gravity a circular groove adapted to receive the metal sleeve. The facing section thus becomes suspended while still being free to expand in all directions without in any way disturbing its suspended status.

My novel panel is further characterized by the provision of a slip anchor extending between the inner and outer sections and permitting relative limited movement between them without in any way interfering with the initial free suspension of the facing section. One or more of these slip anchors may be provided within the area of the panel and these may be arranged to confine the facing section against angular displacement and against separation beyond that required to compensate for expansion.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof selected for purposes of illustration and shown in the accompanying drawings in which:

FIGS. 1 and 2 are views in front and side elevation of a complete panel with some showing of the supporting building frame,

FIGS. 3, 4 and 5 are fragmentary sectional views on the corresponding lines of FIG. 1,

FIG. 6 is a fragmentary sectional view of the edge to edge relation of two adjacent panels, and

FIG. 7 is a fragmentary detail of the elements of the sleeve and groove connection.

The panel is herein shown as of rectangular shape and of a full story height with a granite outer section and a concrete inner section, together with insulation and vapor barrier and with an electrical heating unit on the concrete section. In the illustrated panel the concrete section is separated from the granite section by a definite and substantial amount so that the inner concrete section may be heated and isolated from the unheated and exposed facing section. In practice insulation up to three inches in thickness has been successfully used although in other installations no ply of insulating material has been found necessary beyond a thin film of vapor barrier material.

The salient feature of my invention consists in a shear sleeve or hub inserted at a neutral point, such as the center of gravity, of the outer stone section. This sleeve may be deformed or anchored to bond it rigidly into the concrete section and to fit into a circular groove cut by a hollow diamond core bit in the center. The fit is a push fit and although the stone section is free to move upon the sleeve it is accurately fitted for the most favorable distribution of compressive stresses incident to the weight of the stone section.

This hub or sleeve supports the stone section from the concrete and is the sole means of support in shear. It should be noted that with free clearance the stone section can expand away from the concrete by sliding out on the sleeve but it cannot slip downward in shear.

The construction of my novel panel allows a stone facing section to be retained in shear and tension from a concrete back-up wall, to slip longitudinally, transversely and laterally, being at all times adequately supported but with full compensation for linear expansion free of destructive stresses in all material involved.

The panels shown in FIGS. 1 and 2 may be a rectangle 4 x 8 feet in size or it may correspond in dimensions to one story of the building in which it is to be used. It comprises a solid concrete section 10 precast with a projecting metal sleeve or hub 11 which is pierced by anchoring or reinforced rods 12. This section may be precast in a mold in which the sleeve 11 and its rods 12 are accurately located before the concrete is poured. The usual reinforcing rods 34 for the concrete may be placed in the mold.

The panel also includes a granite slab 13 of the same shape as the concrete section and this is provided with a circular slot 14 located substantially concentric with its center of gravity and arranged to receive the projecting end of the sleeve 11. As indicated in FIGS. 1 and 2 a series of slip anchors are distributed over the area of the panel sections and these include a tubular member 15 having a flared inner end and precast into the concrete section 10 so as to project somewhat beyond its inner surface. The outer end of each tubular member is closed by a disk or washer 16 having an enlarged clearance hole for a bolt 19. A cushion washer 17 is interposed between the closing washer 16 and a nut on the end of the bolt 19. The bolt is leaded into the stone section 13 by lead or a suitable polyester resin 20.

It will be apparent that these slip anchors permit a limited slipping and compensating movement between the two sections but only to the extent that might be required to compensate for expansion of the connected sections. A gasket or sheet 18 of vapor barrier, such as aluminum-Mylar, may be placed between the connected sections and the space between them filled with sheet urethane or other material of good heat insulating properties. In FIGS.

4 and 5 a plug 23 of this material is shown as located within the tubular member 15 for the purpose of preventing concrete from entering its open end in the pre-casting operation. The plug 23 remains embedded in the finished structure. The tubular member 15 may be further secured in place by a corking ring or flange 22.

The edge-to-edge connection of adjacent panels is shown in FIG. 6. The butting edges of the sections 10 and 13 are formed with shallow channels covered by a molding strip 24 perforated every few feet to receive screw bolts 25. At its inner end the bolt makes threaded engagement with a head 27 of sufficient width to engage two adjacent panels. On the granite side of the wall the space for the resin 28 is limited by an inserted gasket 28 and a filler strip 30 of cushion consistency. By turning the screw bolts 25 the edges of adjacent panels are clamped together between the strip 24 and the heads 27.

Referring again to FIGS. 1 and 2 it will be noted that each unit panel is provided with an eye bolt precast in its upper end for convenience in handling and assembling the panels.

Electric heating units 35 are included in the concrete inner section 10 and these are controlled from temperature switches 36 in the same section.

In erecting a composite wall from the panels herein described the inner concrete section 10 is secured in place by bolts 32 upon a structural cross beam 31 with an interposed cushion gasket 33. The entire weight of the panel is therefore carried by the thus supported inner concrete section 10.

While the concrete and granite sections are shown herein as of the same size it is within the scope of my invention to suspend two or more granite sections from a back-up wall of greater area.

Having thus disclosed my invention what I claim as new and desire to secure by Letters Patent is:

1. In a composite wall structure, a panel comprising a solid concrete section having a metal sleeve projecting transversely from an upright surface thereof, a stone section suspended in shear at approximately its center of gravity from said sleeve, and a slip anchor between the concrete section and the stone section permitting limited relative shifting of one section with respect to the other.

2. A panel for a composite wall structure as defined in claim 1, further characterized in that one end of the metal sleeve is completely hidden within the concrete section and the other end is completely hidden within the stone section.

3. A panel for a composite wall structure as defined in claim 1, further characterized in that the metal sleeve which projects from the concrete section fits into a circular groove provided for that purpose in the inner face of a stone section.

4. A panel for a composite wall structure as defined in claim 1, further characterized in that the slip anchor includes a tubular member projecting from the concrete wall section and a bolt projecting from the stone section and having a head making lost motion connection with the tubular member.

5. A panel for a composite wall structure as defined in claim 1, in combination with a horizontal structural girder supporting the said solid concrete wall section independently of the associated stone section.

6. A panel for a composite wall structure as defined in claim 1, further characterized in that a cushion of insulating material is interposed between the opposed inner faces of the concrete wall section and the stone section.

7. A composite wall structure having panels as defined in claim 1, further characterized by a plurality of slip anchors spaced from each other throughout the area of a single stone panel section.

8. A composite wall structure having panels as defined in claim 1, further characterized in that the slip anchors are adjusted to maintain the stone and concrete panel sections spaced one from the other and that the space thus provided contains electrical heating means and insulating board.

9. A composite wall panel as defined in claim 1, complete with the combined stone and concrete wall sections which are connected in spaced relation substantially at their centers of gravity by fixed metal sleeves and in other areas by the slip anchors and having incorporated between them a heating unit and heat insulating material.

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52—125, 173, 220, 235, 410, 513, 573