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Fischer(10) **Pub. No.: US 2008/0184650 A1**(43) **Pub. Date: Aug. 7, 2008**(54) **INSULATED BLOCK WITH
NON-LINEAR THERMAL PATHS FOR
BUILDING ENERGY EFFICIENT BUILDINGS****Publication Classification**

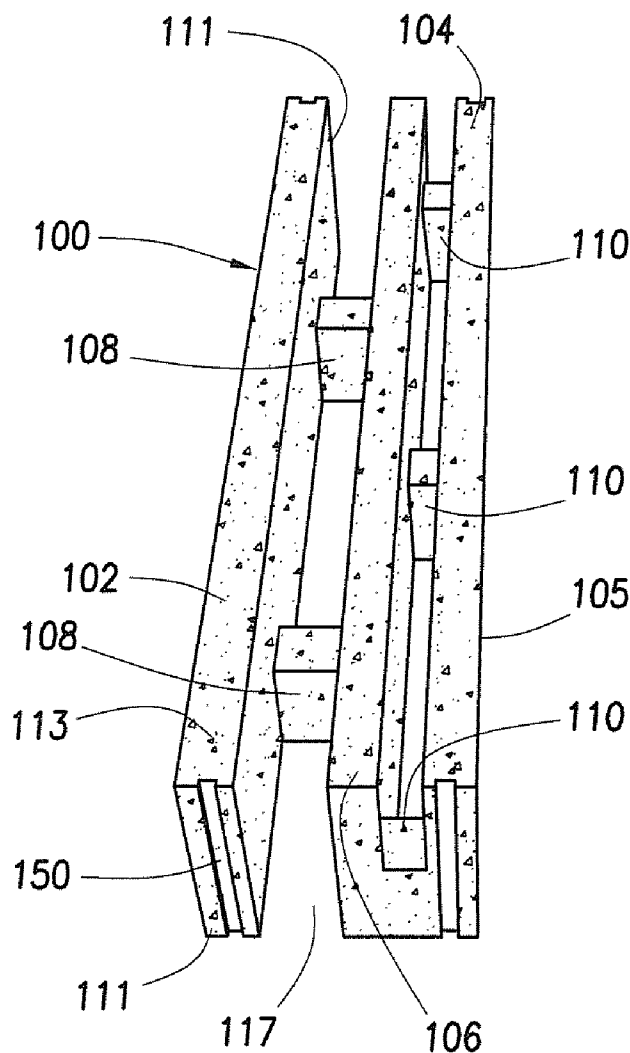
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E04C 1/40 (2006.01)
E04B 1/74 (2006.01)
E04B 2/02 (2006.01)
(52) **U.S. Cl.** **52/606; 52/404.1**
(57) **ABSTRACT**

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(21) **Appl. No.:** **11/765,319**(22) **Filed:** **Jun. 19, 2007****Related U.S. Application Data**(60) **Provisional application No. 60/805,152, filed on Jun.**
19, 2006.

According to one aspect of the invention, a block for building construction is provided. The block includes: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) non-linear thermal paths of the body material across the block by offsetting and restricting the cross webbing of the block; and (c) at least two cavities in the block. According to another aspect, a block for building construction is provided, wherein the block includes: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) at least two cavities in the block; and wherein the block has nominal dimensions of 6"x6"x24".



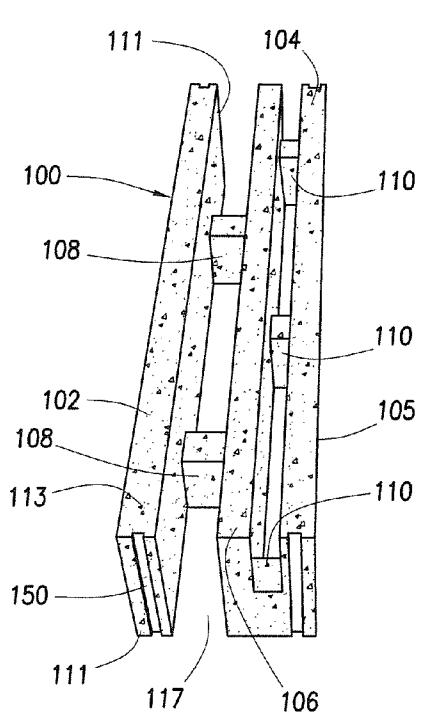


FIG. 1

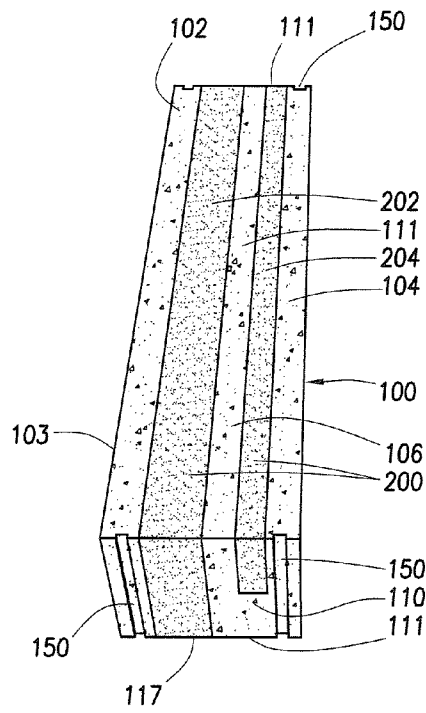


FIG. 2

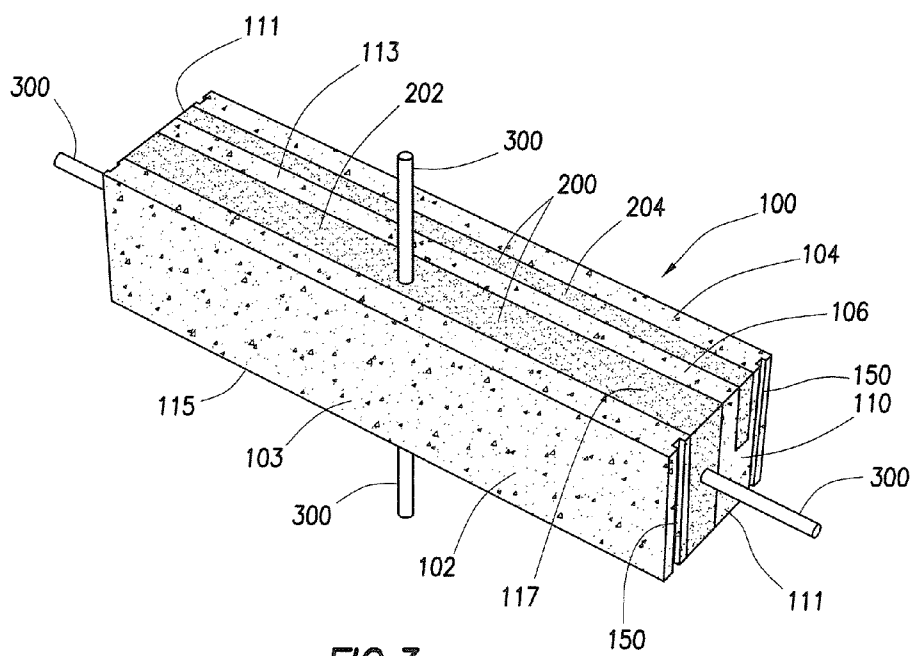


FIG. 3

FIG. 6

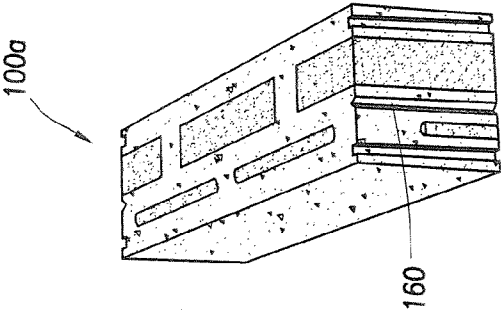


FIG. 8

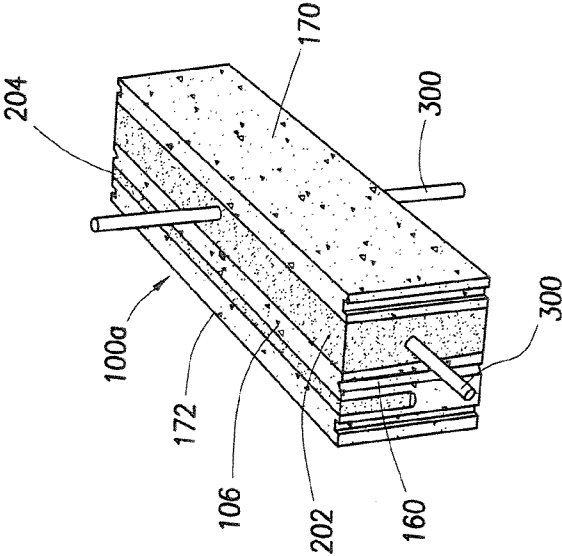


FIG. 9

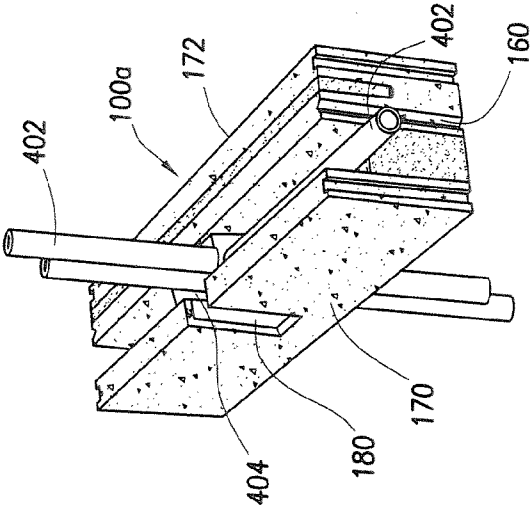


FIG. 10

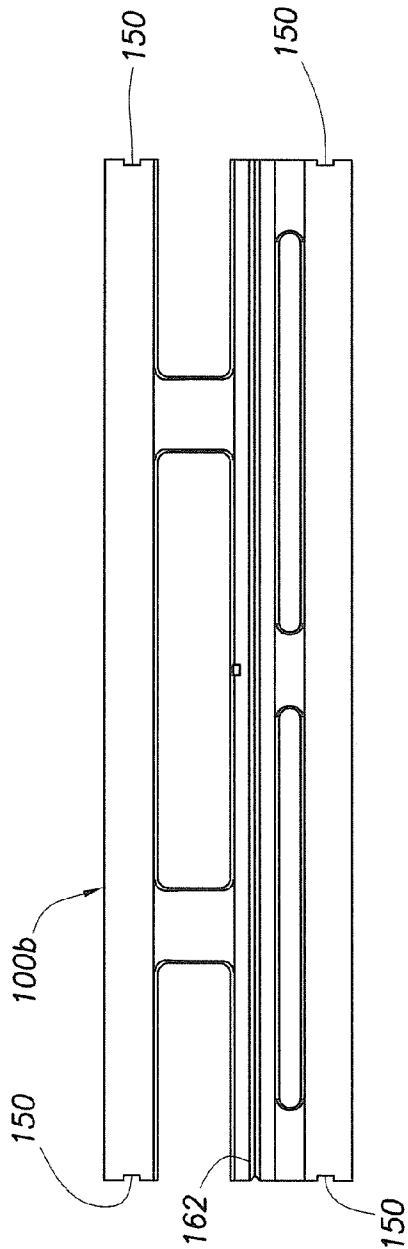


FIG. 12

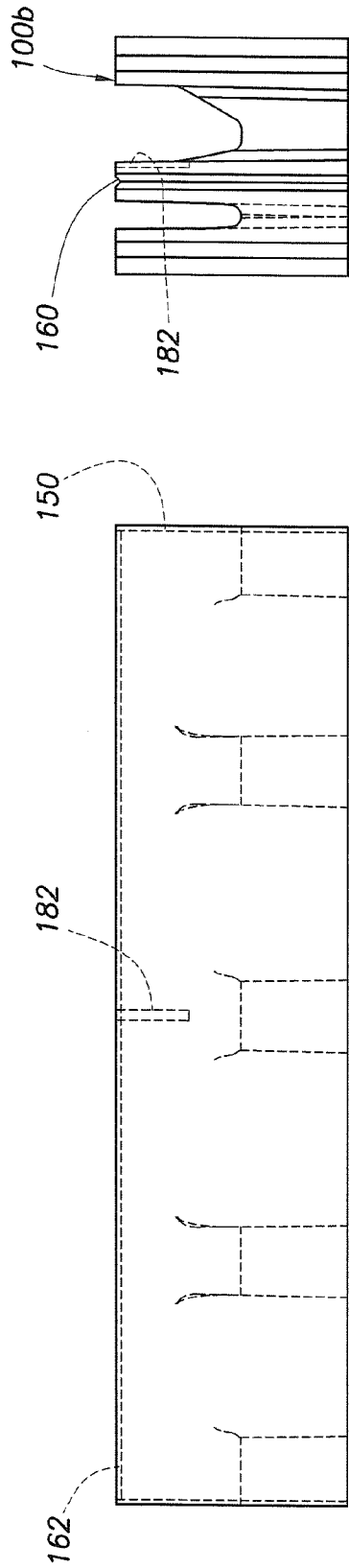


FIG. 11

FIG. 13

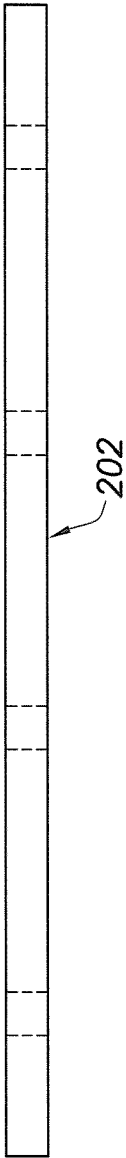


FIG. 15

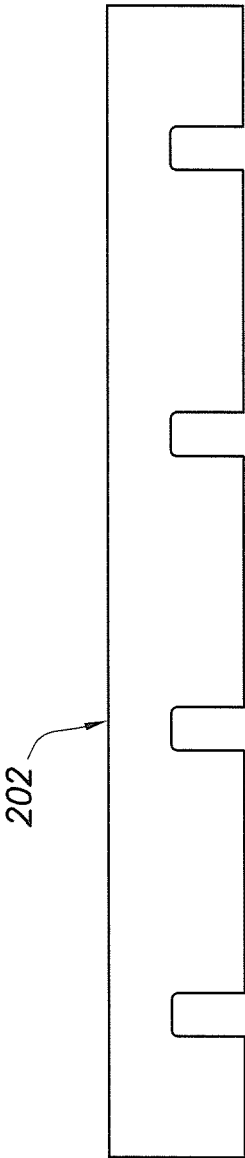


FIG. 14

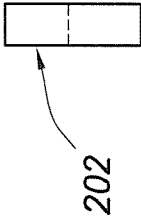


FIG. 16

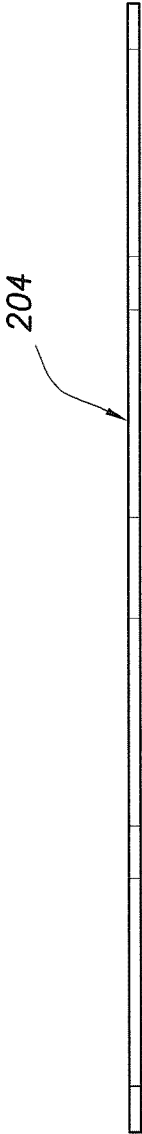


FIG. 18

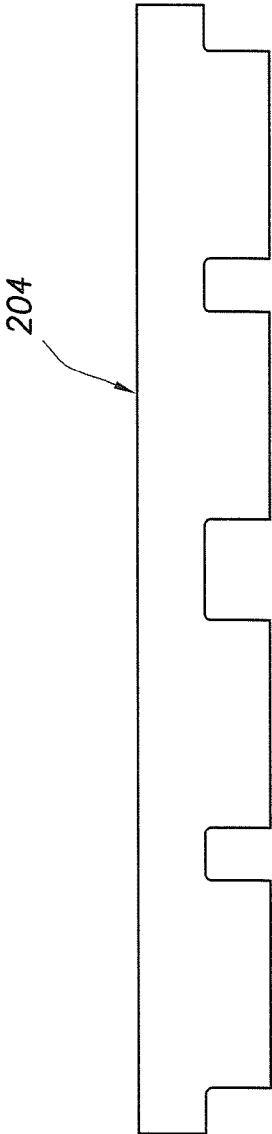


FIG. 17

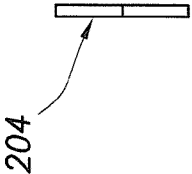
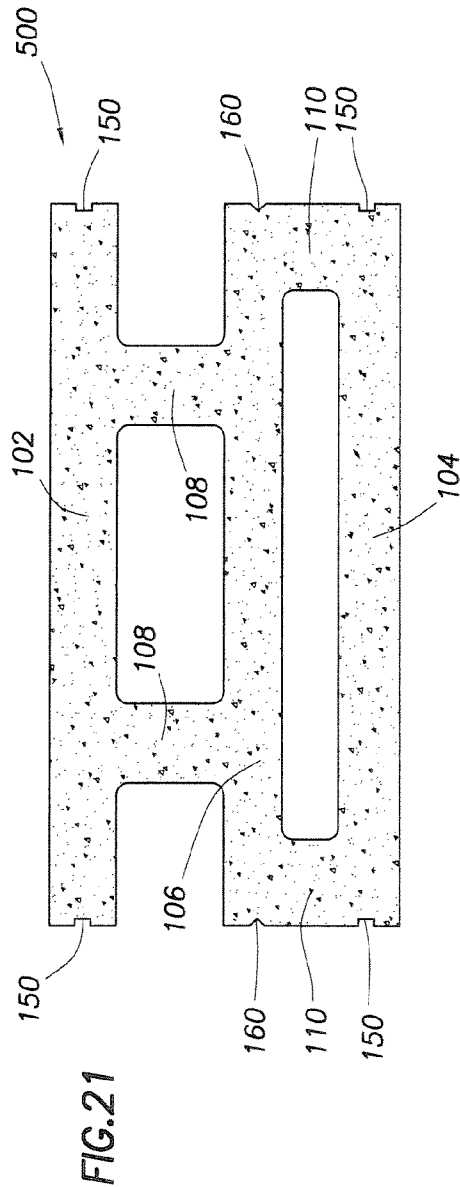
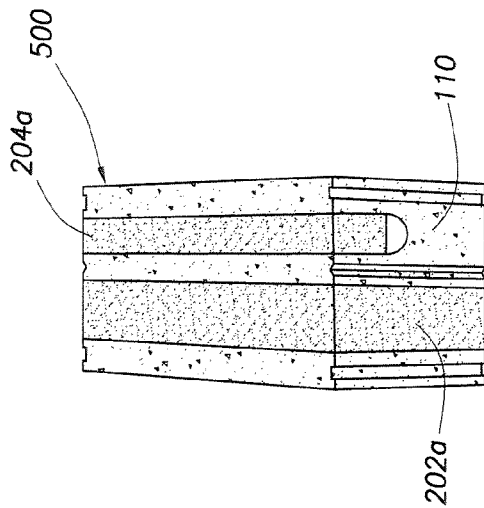
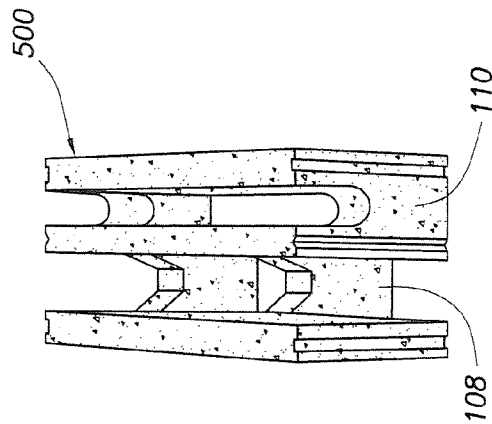


FIG. 19



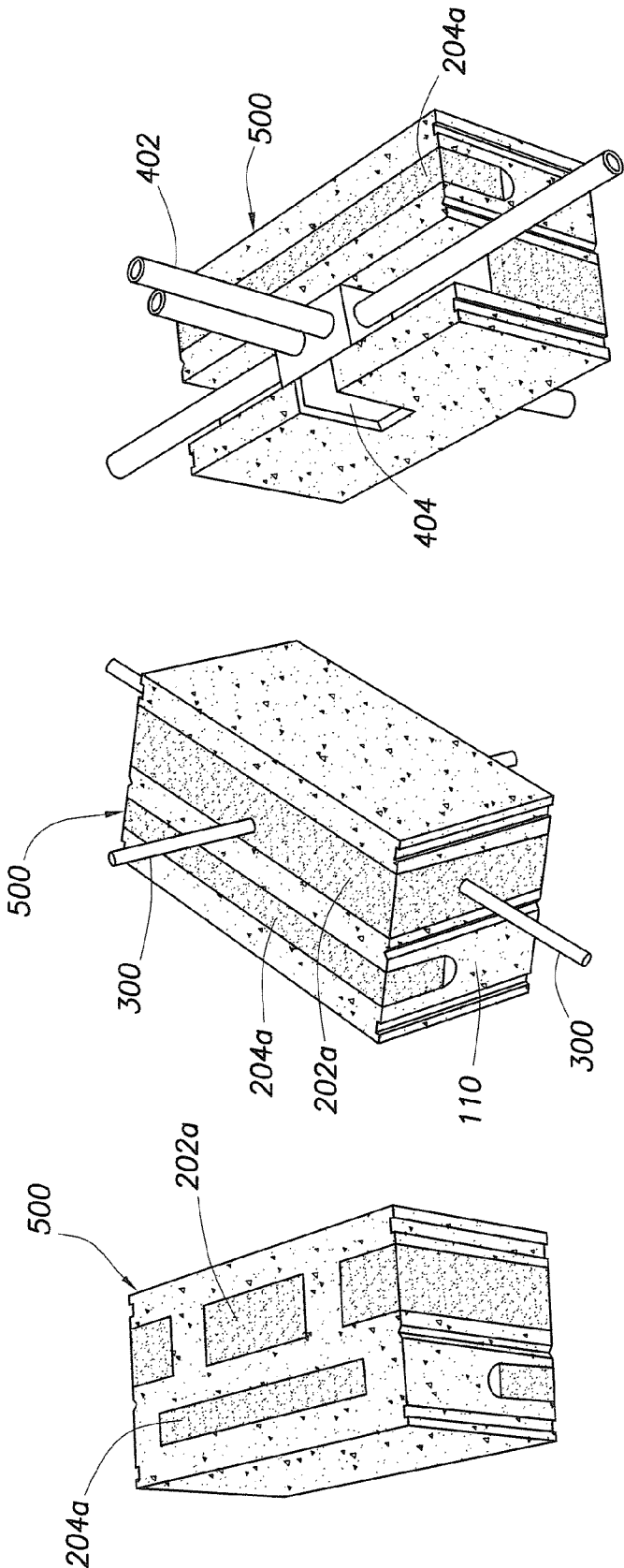


FIG. 25

FIG. 24

FIG. 23

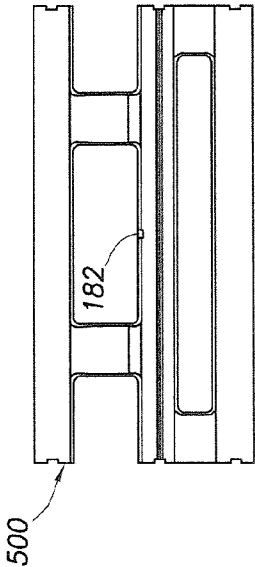


FIG. 28

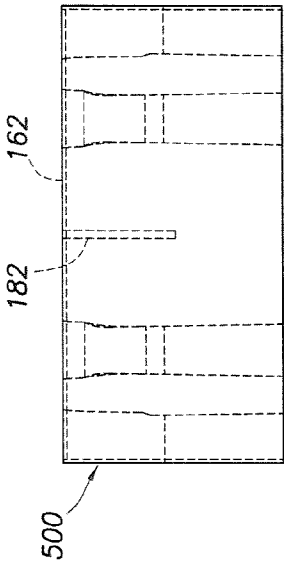


FIG. 27

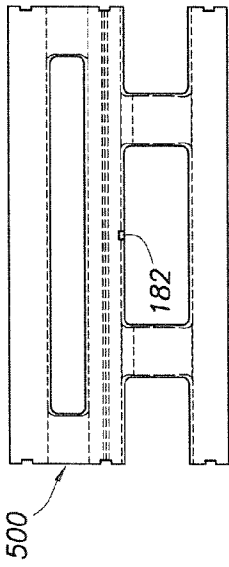


FIG. 29a

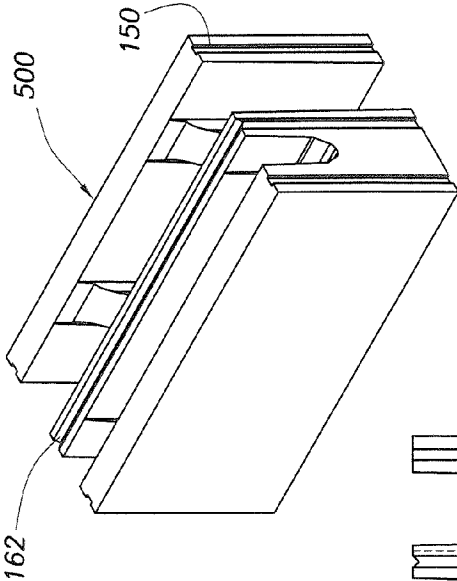


FIG. 26

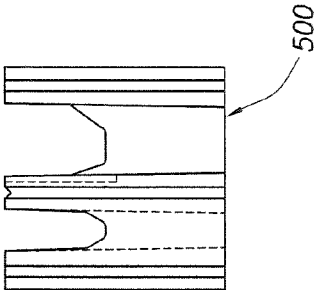


FIG. 29

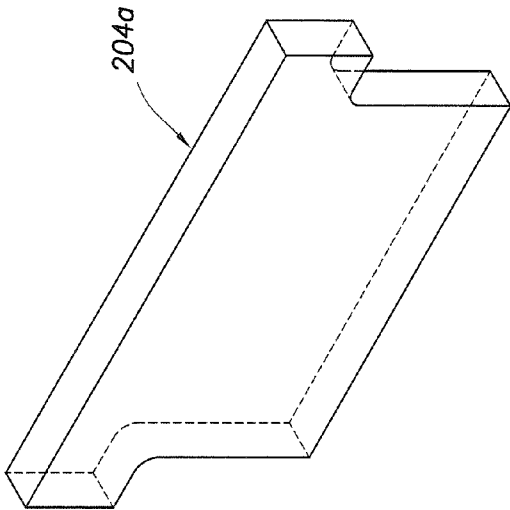


FIG. 30

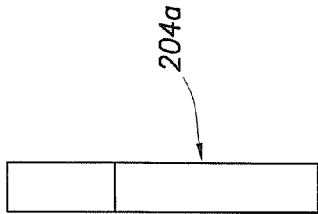


FIG. 33

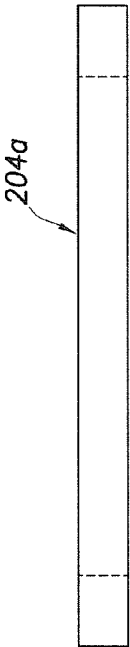


FIG. 32

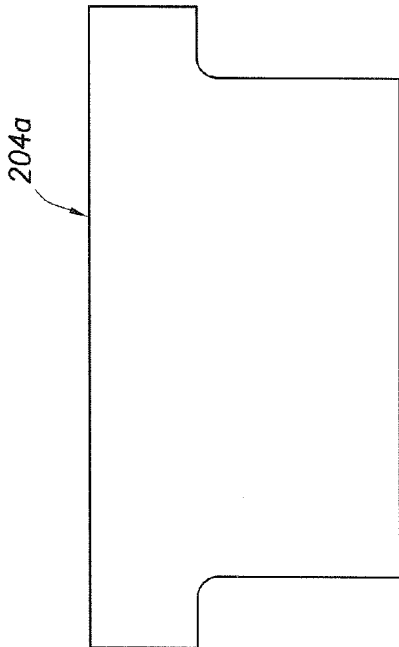


FIG. 31

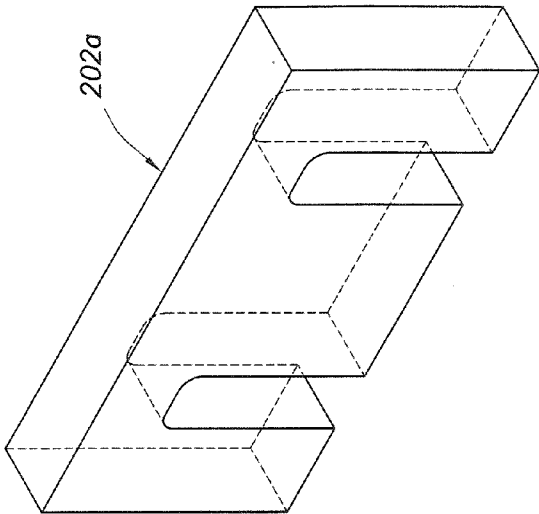


FIG. 34

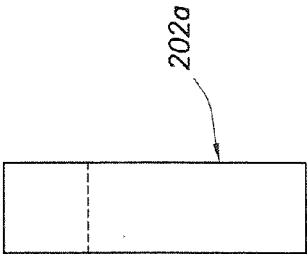


FIG. 37

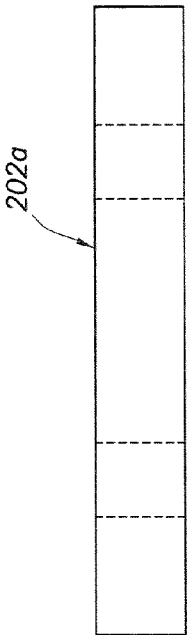


FIG. 36

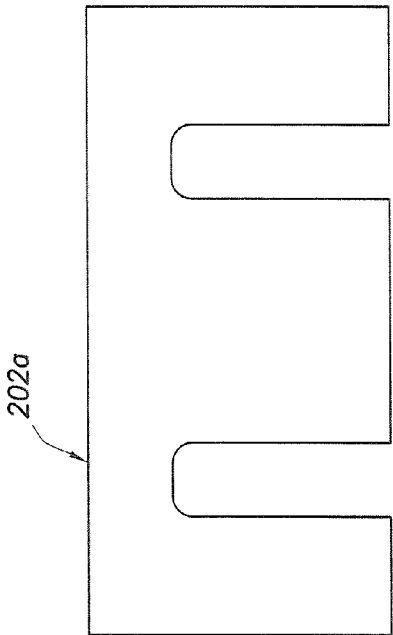
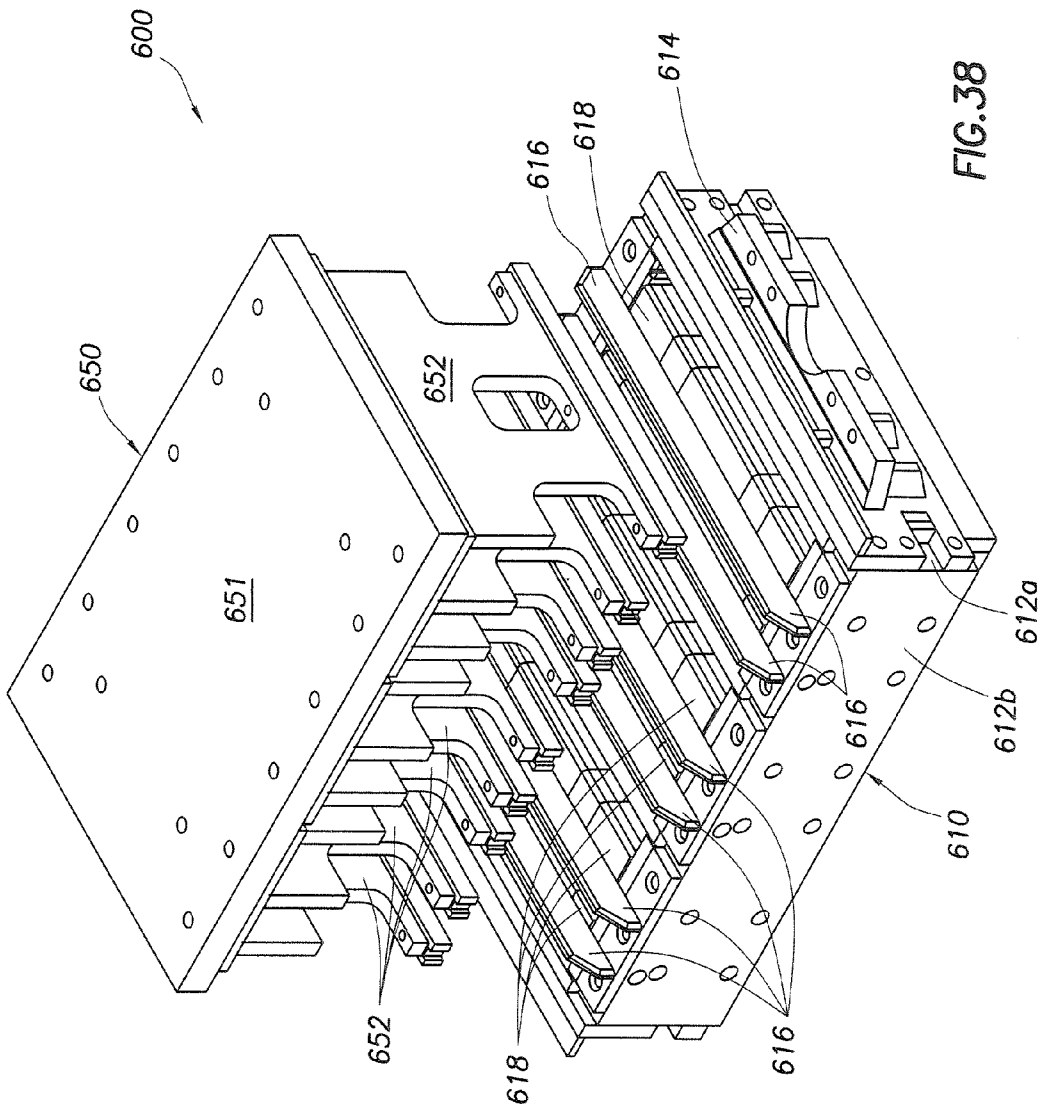
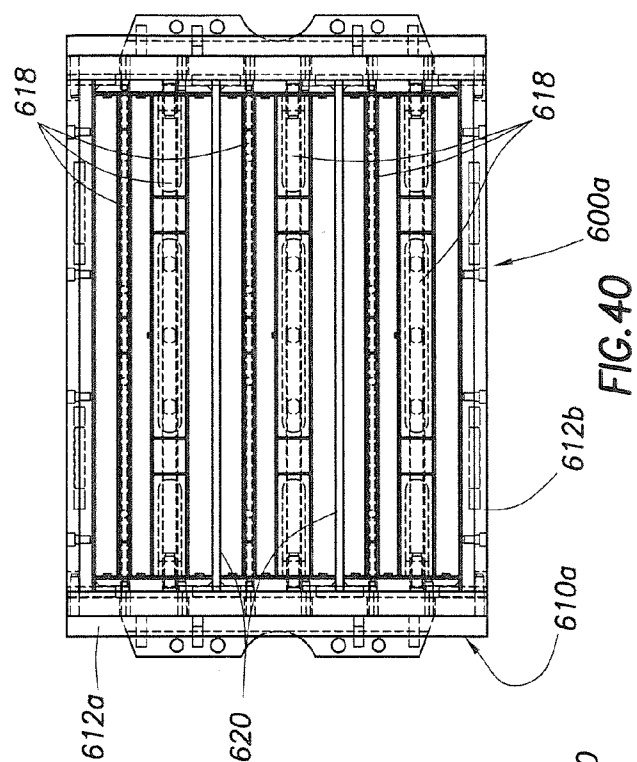
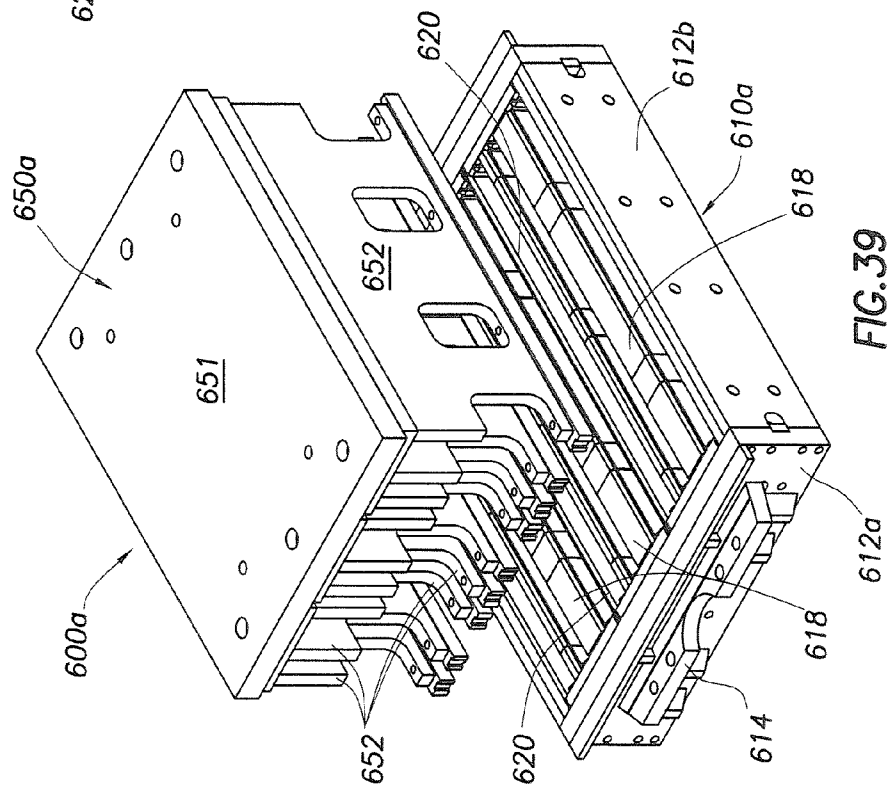
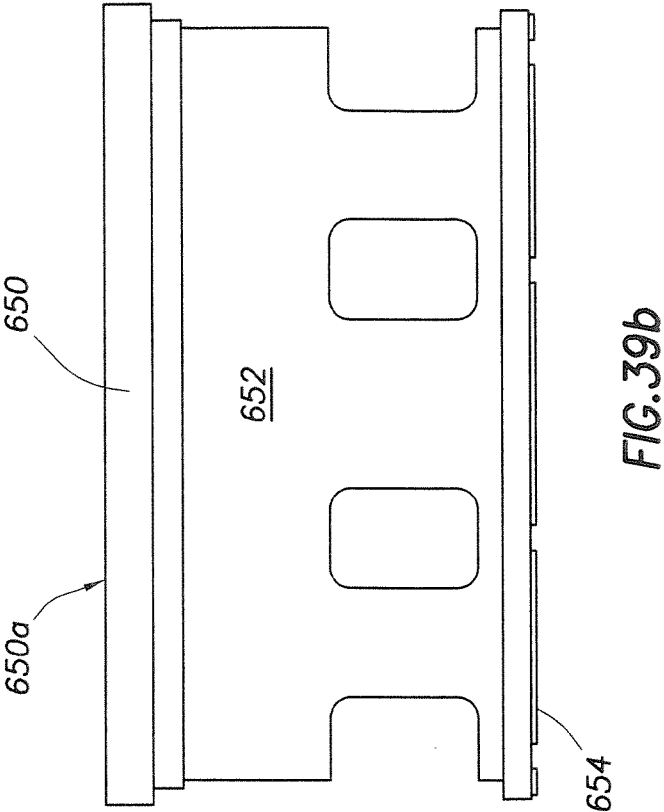
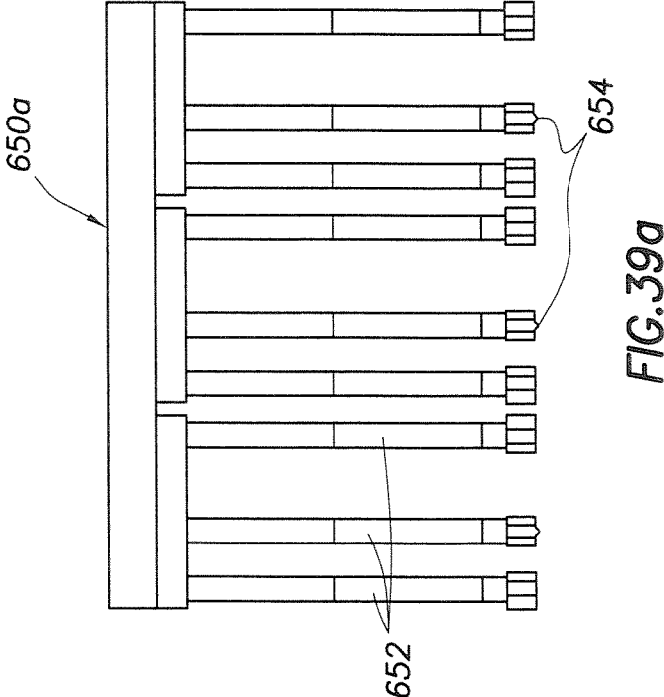


FIG. 35







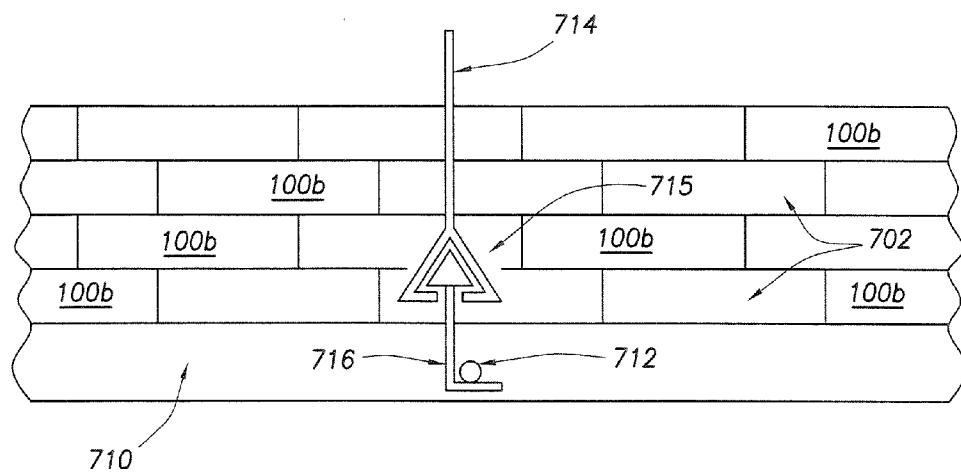


FIG. 41

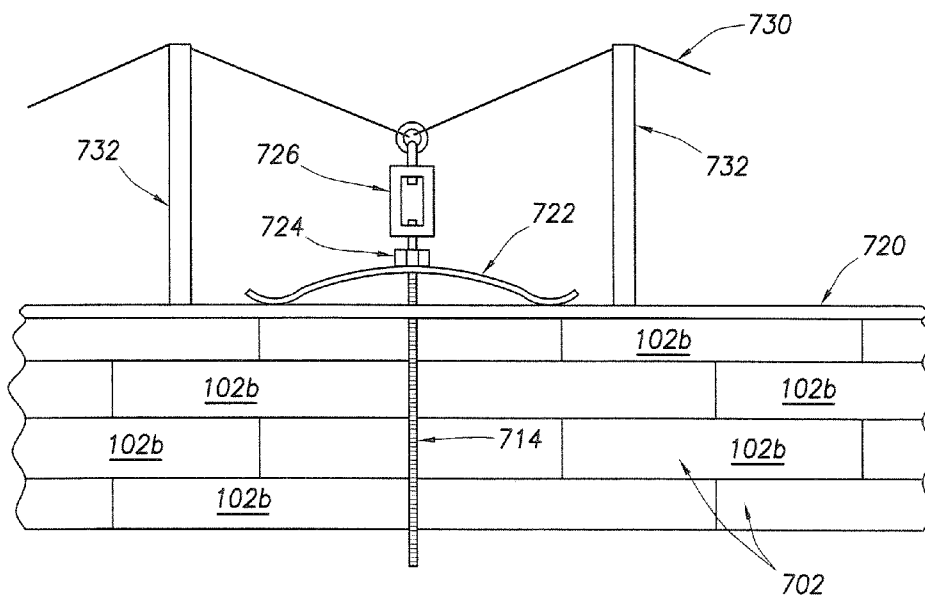


FIG. 42

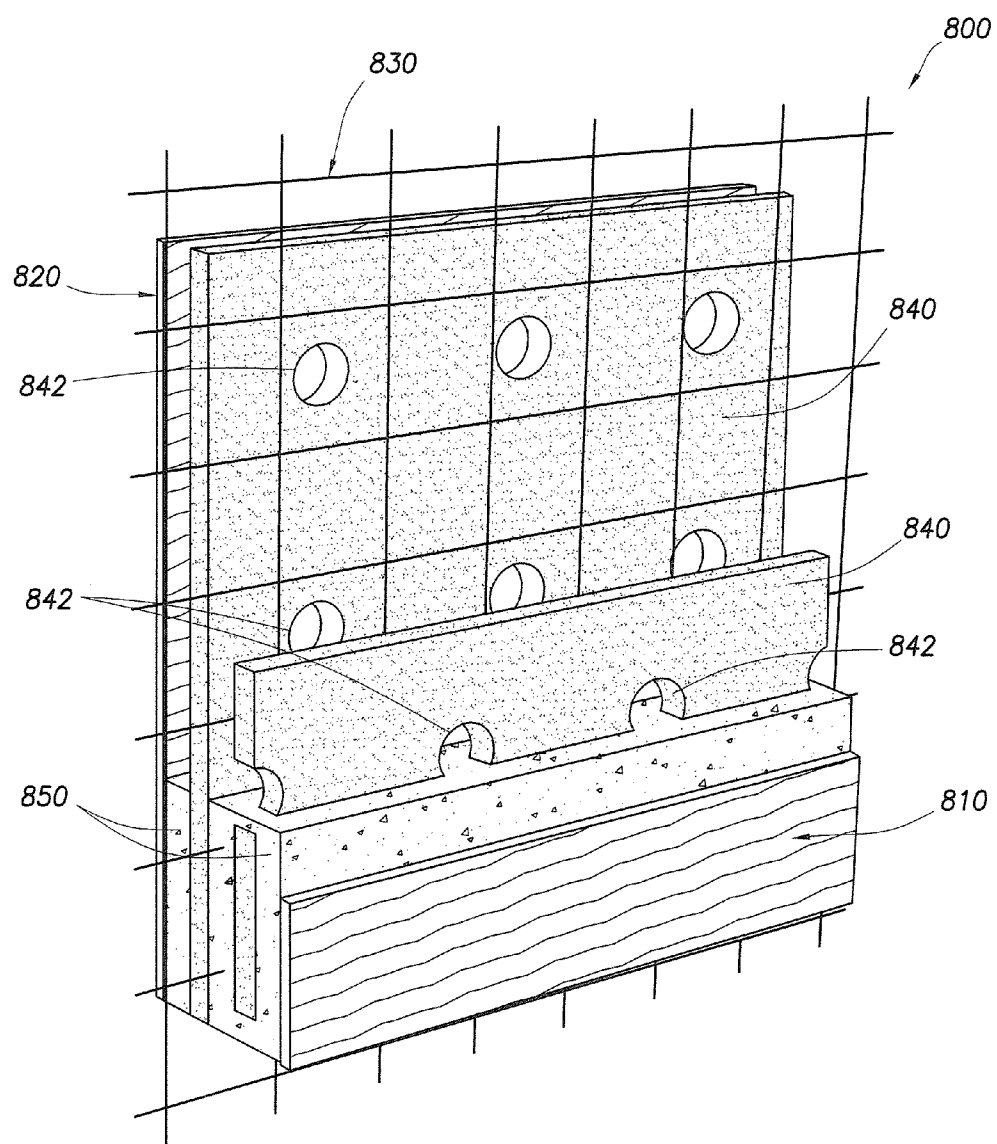


FIG. 43

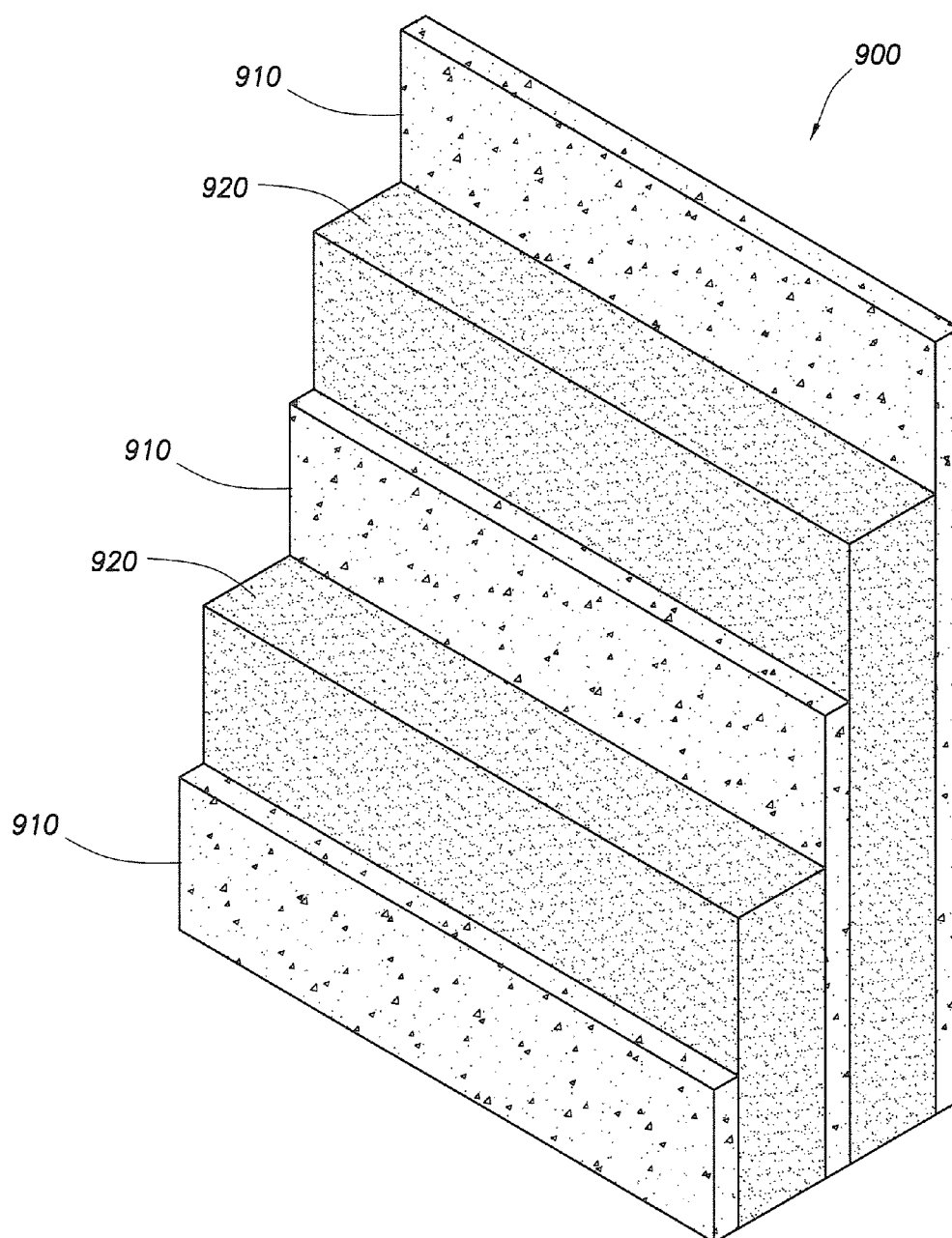


FIG. 44

INSULATED BLOCK WITH NON-LINEAR THERMAL PATHS FOR BUILDING ENERGY EFFICIENT BUILDINGS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. provisional application Ser. No. 60,805,152 filed on Jun. 19, 2006.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable

REFERENCE TO MICROFICHE APPENDIX

[0003] Not applicable

SUMMARY OF THE INVENTION

[0004] Standard concrete block are referred to as "concrete masonry units" or "CMU". Insulated concrete block are sometimes referred to as "ICMU".

[0005] However, block is not limited to cement based mixes. Block may be derived from glass, plastic, clay, etc, therefore "block" herein refers to all block, insulated or not, with or without cement.

[0006] The block incorporates engineering designs that create non-linear thermal paths across the block, thereby extending and increasing the thermal mass properties by offsetting and restricting the cross webbing of the block. Details include electrical, rebar and grout reinforcement systems, post-tension systems, dry stacked or mortared, foam filled or not. Typically, foam fills a majority of the interior and all of the exterior cavities, increasing insulation values, and filling voids creating a relatively solid unit. The system has no wood or sheetrock requirements. As an inorganic block wall system it is not food or fuel for mold, termites, ants, or fire. As used herein, "inorganic" means being or composed of matter other than plant or animal. Being solid and free of voids there are no significant spaces for air to fuel fire, water to support mold growth, or places for insect habitation. The block is impervious to flood water damage and as a heavy weight system, the block, or the building, would not float. Combined with a quality roof, storm shutters, and a generator, the system can be used to effectively create an energy efficient, floodable, hurricane resistant home with an option not to evacuate. The design negates the need for abandoning and or gutting walls after a flood.

[0007] According to one aspect of the invention, a block for building construction is provided. The block includes: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) non-linear thermal paths of the body material across the block by offsetting and restricting the cross webbing of the block; and (c) at least two cavities in the block.

[0008] According to another aspect of the invention, a mold for manufacturing a block is provided. The block comprises: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) non-linear thermal paths of the body material across the block by offsetting and restricting the cross webbing of the block; and (c) at least two cavities in the block. The mold comprises: (a) a mold box adapted for receiving and molding an inorganic material on a manufacturing pallet into the form of at least one

of the block; and (b) a plunger bead adapted for compacting and vibrating the inorganic material in the mold box, and after the inorganic material is sufficiently set, pushing the molded inorganic material through the bottom of the mold box as the mold box is raised off the manufacturing pallet. Preferably, the mold box does not have core bars across the top, whereby the block can be molded in the mold box sideways to the direction of normal raking across the top of the mold box without interference by any core bars.

[0009] According to yet another aspect of the invention, a wall system for a building construction is provided. The wall system includes a plurality of blocks, wherein each of the blocks comprises: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) non-linear thermal paths of the body material across the block by offsetting and restricting the cross webbing of the block; and (c) at least two cavities in the block.

[0010] According to yet another aspect of the invention, a building is provided wherein the building includes a plurality of walls, wherein at least one of the walls comprises a plurality of blocks, and wherein each of the blocks comprises: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) non-linear thermal paths of the body material across the block by offsetting and restricting the cross webbing of the block; and (c) at least two cavities in the block.

[0011] According to still another aspect of the invention, a block for building

construction is provided, wherein the block includes: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) at least two cavities in the block; and wherein the block has nominal dimensions of 6"x6"x24".

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The accompanying drawings are incorporated into and form a part of the specification to illustrate several examples of the present inventions. These drawings together with the description serve to explain the principles of the inventions. The drawings are only for illustrating preferred and alternative examples of how the inventions can be made and used and are not to be construed as limiting the inventions to the illustrated and described examples. The various advantages and features of the present inventions will be apparent from a consideration of the drawings in which:

[0014] FIG. 1 is a perspective view of a concrete block having overall dimensions of about 6"x6"x24" according to the invention without any insulating foam or rebar positioned therein;

[0015] FIG. 2 is a perspective view of a concrete block according to FIG. 1 having insulating foam shown positioned therein;

[0016] FIG. 3 is a perspective view of a concrete block according to FIG. 1 having both insulating foam and steel rebar shown positioned therein;

[0017] FIG. 4 is a perspective view of a concrete block according to FIG. 1 having insulating foam and electrical conduit shown positioned therein, including for servicing an electrical junction box or outlet shown positioned in a cut-out of the concrete block face.

[0018] FIG. 5 is an end perspective view of a concrete block similar to FIG. 1, with the addition of interior wall side and exterior wall side surface brushes.

[0019] FIG. 6 is a plan view of a concrete block according to FIG. 5.

[0020] FIGS. 7 and 8 are perspective views of a concrete block according to FIGS. 5 and 6, having insulating polystyrene or polyurethane foam inserts or spray filled shown positioned therein.

[0021] FIG. 9 is a perspective view of a concrete block according to FIG. 5, having both insulating foam and rebar shown positioned therein.

[0022] FIG. 10 is a perspective view of a concrete block according to FIG. 5, having insulating foam and electrical conduit shown positioned therein, including for servicing an electrical junction box or outlet shown positioned in a cut-out of the concrete block face.

[0023] FIGS. 11-13 are side, plan, and end views, respectively, without showing any exterior finish. Where appropriate, the block can be cut to any desired length.

[0024] FIGS. 14-16 are side, plan, and end views, respectively, with presently most preferred dimensions of a "large" polystyrene foam insert for a concrete block as shown in FIGS. 1-4 or 5-10, or 11-13 having nominal 6"x6"x24" dimensions, wherein the "large" foam insert has a nominal length of 48" and spans across more than one such concrete block to help insulate the blocks. Where appropriate, the "large" foam insert can be cut to any desired length.

[0025] FIGS. 17-19 are side, plan, and end views, respectively, of a "small" polystyrene foam insert for a concrete block as shown in FIGS. 1-4, or 5-10, or 11-13, wherein the "small" foam insert has a nominal length of 48" and spans across more than one such concrete block to help insulate the blocks. Where appropriate, the "small" foam insert can be cut to any desired length.

[0026] FIG. 20 is an end perspective view of a concrete block similar to FIG. 1, except for having nominal 8"x8"x16" dimensions.

[0027] FIG. 21 is a plan view of a concrete block according to FIG. 20 (not to the scale of the others).

[0028] FIGS. 22 and 23 are perspective views of the concrete block according to FIGS. 20 and 21, having insulating polystyrene foam shown positioned therein.

[0029] FIG. 24 is a perspective view of a concrete block according to FIG. 20, having both insulating polystyrene foam and rebar shown positioned therein.

[0030] FIG. 25 is a perspective view of a concrete block according to FIG. 20, having insulating foam and electrical conduit shown positioned therein, including for servicing an electrical junction box or outlet shown positioned in a cut-out of the concrete block face.

[0031] FIGS. 26-28 are perspective, side, top plan, end, and bottom plan views, respectively of a concrete block according to the invention as shown in FIG. 20 having nominal dimensions of 8"x8"x16". Where appropriate, the block can be cut to any desired length.

[0032] FIGS. 30-33 are perspective, side, plan, and end views, respectively, of an "outside cell" polystyrene foam insert for a concrete block as shown in FIG. 20 having nominal 8"x8"x16" dimensions, wherein the "outside cell" foam insert has a nominal length of 16," but it can be made to span across more than one such concrete block to help insulate between the adjacent heads of the blocks. Where appropriate, the "outside cell" foam insert can be cut to any desired length.

[0033] FIGS. 33-37 are perspective, side, plan, and end views, respectively, of an "inside cell" polystyrene foam insert for a concrete block as shown in FIG. 20 having nomi-

nal 8"x8"x16" dimensions, wherein the "outside cell" foam insert has a nominal length of 16" but it can be made to span across more than one such concrete block to help insulate between the adjacent heads of the blocks. Where appropriate, the "small" foam insert can be cut to any desired length.

[0034] FIG. 38 is a perspective view, without dimensions, of the two major parts (lower mold box and upper plunger head) of a mold for manufacturing block according to the invention, which mold box uses core bars to help support the mold cans for the cross-web structures of the block, wherein the two major mold parts are shown near one another in an aligned position as they would be used in molding block.

[0035] FIG. 39 is a perspective view, without dimensions, of the two major parts (lower is mold box and upper is plunger head) of a mold for manufacturing a block according to the invention without the need to use any core bars in the manufacturing, wherein the two major mold parts are shown near one another in an aligned position as they would be used in molding block. FIGS. 39a and 39b are end and side views, respectively, of the plunger head of a mold for manufacturing according to the invention.

[0036] FIG. 40 is a cross-sectional plan view of the mold box.

[0037] FIG. 41 is a side view of the lower part of a block wall set on a footing,

[0038] wherein a vertical rebar is set in the foundation and can be used to apply post-tension to the block wall system.

[0039] FIG. 42 is a side view of the upper part of a block wall, showing how the upwardly extending rebar from the foundation on which the wall is built (as shown in FIG. 41) can be used to apply post-tension to the block wall system.

[0040] FIG. 43 is a perspective cut-away view of a formed-wall system according to the invention, wherein a structural form of two, spaced-apart structural sheets is used to pour a concrete-based mixture around a webbing of rebar and at least one insulating sheet therebetween to build the formed-wall system.

[0041] FIG. 44 is a perspective cut-away view of a wafer-wall section according to the invention, wherein an outer wall layer, a middle layer, and an inner wall layer, which can be of rebar reinforced concrete or similar structural material, sandwich insulating material, which can be foam, between the structural layers. The layers of structural material and insulating material can be simply glued together.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0042] As used herein, the words "comprise," "has," and "include" and all grammatical variations thereof are each intended to have an open, non-limiting meaning that does not exclude additional elements or steps.

[0043] In general, as used herein, words describing relative orientation or position, such as "inward," "outward," "head" or "end," "top" and "bottom," and similar terms regarding various elements in the views of the drawing are with respect to the perspective of a block as it is to be normally used in the position as shown in FIGS. 1-4, wherein an electrical outlet box would normally be positioned as shown in FIG. 4 toward the interior side of a wall made with the blocks. It is to be understood, of course, that a block could be used in an upside down orientation, as in the header for a window or door in a wall formed of the blocks.

[0044] The same reference numerals are used for similar parts in the various embodiments of the invention and as shown in the Figures of the drawing.

[0045] Referring first to FIGS. 1-4 of the drawing, a presently preferred embodiment of a block is 100 is illustrated. In this embodiment, the block has nominal dimensions of 6"x6"x24", which may be referred to herein simply as a "6x24" block.

[0046] The block 100 includes an inward rib 102, where "inward" here means that when used to build an exterior wall for a building, it is normally intended to face toward an interior of the building. The inward rib 102 has an inward rib face 103 (visible in FIGS. 1-3, but not visible in the view of FIG. 1), which is similarly normally intended to face toward an interior of a building.

[0047] The block 100 also includes an outward rib 104, where "outward" here means that when used to build an exterior wall for a building, it is normally intended to face toward an exterior of the building. The outward rib 104 has an outward rib face 105, (visible in FIGS. 1 and 4, but not in the views of FIGS. 2-3), which is similarly normally intended to face toward an exterior of a building.

[0048] The block 100 further includes a middle rib 106. The middle rib 106 is located between and spaced apart from the inward rib 102 and the outward rib 104. The middle rib 106 provides additional structure and strength to the block.

[0049] The block 100 further includes a plurality of inner cross-webs 108 between the inward rib 102 and the middle rib 106. Preferably, the block 100 includes two spaced-apart inner cross-webs 108 (visible in FIG. 1, but not in FIGS. 2-4), and for such a block, such as a 6x24 block, a pair of cross-webs 108 are structurally sufficient.

[0050] The block 100 further includes a plurality of outer cross-webs 110 between the outward rib 104 and the middle rib 106. The block 100 includes at three spaced-apart inner cross-webs 110 (at least one of which is partially visible in each of FIGS. 1-4), and for such a block, such as a 6x24 block 100, three cross-webs 110 are structurally sufficient.

[0051] The cross-webs 108 and 110 provide sufficient structure across the block 100, but the cross-sections of the cross-webs 108 and 110 are minimized to minimize thermal pathway across the block, as the inorganic material, e.g., concrete, has a relatively low insulation factor to the transmission of heat energy through such material. Furthermore, the cross-webs 108 are staggered or off-set from the cross-webs 110 (and vice-versa, of course), whereby the thermal pathway provided by the cross-webs 108 and 110 and the middle rib 106 is a non-linear pathway between the inward rib 102 and the outward rib 104 of the block.

[0052] The overall structure of the ribs 102, 104, and 106 defines the nominal dimensions of the block 100, including bounded by the inward rib face 103, the outward rib face 105, the heads 111 (defined by ends of ribs 102, 104, and 106), the top 113 defined by the tops of the ribs 102, 104, and 106), and the bottom 115 (defined by the bottoms of ribs 102, 104, and 106).

[0053] Continuing to refer to FIGS. 1-4, the inward rib 102 and middle rib 106 and the cross-webs 108 define an inward cavity 117. The outward rib 104 and middle rib 106 and the cross-webs 110 define an outward cavity 119. Preferably, both the inward cavity 117 and the outward cavity 119 are completely open along the entire length of the top 113 of the block 100, and both the inward cavity 117 and the outward cavity 119 have open portions along the bottom 115 of the

block. In addition, preferably both the inward cavity 117 and the outward cavity 119 are at least partially open at either end or header 111 of the block 100.

[0054] Preferably, the inward cavity 117 is substantially larger than the outward cavity 119. As partially shown in FIGS. 2-4, the cavities 117 and 119 are adapted to accept insulating material 200, such as in the form of foam inserts 202 and 204 adapted for the cavities 117 and 119, respectively. The insulating material 200 in the form of foam inserts 202 and 204 may be inserted into the cavities 117 and 119 as courses of a wall formed of a plurality of the blocks 100 are laid. The large openings to the cavities 117 and 119, respectively, especially at the ends or headers 111 of the block 100, allows for placement of insulating foam inserts filling spanning the headers of adjacent blocks placed in courses forming a wall, which provides for better thermal insulation.

[0055] Alternatively, for example, and as will be appreciated by those of skill in the art, flowable beads or small pellets (not shown) of insulating material 200 can be blown downward from an upper course of a wall downward into the cavities 117 and 119 of stacked block 100 after a wall is constructed with a plurality of blocks 100, where the adjacent cavities 117 and 119 allow for downward flowing of such a flowable insulation material 200 to fill the cavities of lower blocks first, filling up the wall with insulation.

[0056] According to one embodiment of the invention, a foam insert 202 would be used for the inward cavities 117 of block after being placed into courses for a wall, whereas a flowable insulating material would be used for filling the outward cavities 119 of adjacent blocks from the top of a wall of the blocks 100.

[0057] Further, the inward cavity 117 is preferably made to be wider across than the outward cavity 119, whereby the inward cavity can accept not only insulating material, but also rebar 300 (as shown in FIG. 3) and electrical conduit 402 and junction box or outlet 404 (as shown in FIG. 4).

[0058] The inward cavity 117 is adapted to be sufficiently wide between the inward rib 102 and the middle rib 106 across to substantially accept electrical items, such as electrical conduit 402 and a standard-sized electrical junction box 404. Typically, an electrical junction or outlet box 404 has a ground screw 406 (not shown in FIGS. 1-4) projecting through the back of the junction or outlet box 404. A cut-out in the inward rib 102 can be made in a block 100 as desired during building of a wall with the blocks 100. If desired, a cut-out can be pre-formed during manufacture of the block, as in many applications for the blocks 100 an interior surface material is expected to be applied over the inward wall face 103, which would cover such unused wall access cut-outs.

[0059] Continuing to refer to FIGS. 1-4, the block 100 preferably includes vertical mortar grooves 150 in the ends of the inward rib 102 and the outward rib 104, whereby mortar can be placed between adjacent blocks 100 in a course of blocks. As shown in the figures, these mortar grooves 150 preferably have a rectangular shape, for added strength.

[0060] FIGS. 5-10 are various views of a concrete block 100a similar to the block 100 shown in FIGS. 1-4, with the addition of a vertical sealant groove 160 (preferably V-shaped) in middle rib 104 of the ends or head for helping in the placement of insulating foam or weather stripping. The vertical sealant groove 160 can be only one of either end of the block or in both the ends or heads of the block. In addition, the concrete block 100a includes an interior wall side surface finish 170, which can be of any desired texture or color,

preferably appropriate for indoor purposes, and similarly an exterior wall side surface finish 172, which can be of any desired texture or color, preferably appropriate for outdoor purposes. FIGS. 7-10 show the inclusion of foam inserts 202 and 204. FIG. 9 shows the positioning of rebar 300 in the block 100a, and FIG. 10 shows the positioning of conduit 402 and an electrical junction box or outlet 404 in a cut-out 180 made in the inward rib 102.

[0061] FIGS. 11-13 are side, plan, and end views, respectively, of the block 100b similar to the block shown in FIGS. 5-6 having nominal 6"x6"x24" dimensions, but with a V-shaped sealant groove 160 in only one end of the block 100b, a horizontal sealant groove 102 (preferably V-shaped) in top of the block 100b for foam/weather stripping/sealant, and without showing any interior or exterior surface finishes. Where appropriate, the block can be cut to any desired length. As best shown in FIGS. 11-13, the block 100b preferably also includes an electrical box guide groove for a ground screw that may protrude from the back side of a typical electrical junction or outlet box 404 (not shown in FIGS. 11-13).

[0062] FIGS. 14-16 are side, plan, and end views, respectively, of a "large" polystyrene foam insert 202 for a concrete block 100, 100a, or 100b as shown in FIGS. 1-4, or 5-10, or 11-13, respectively, having nominal 6"x6"x24" dimensions, wherein the "large" foam insert has a nominal length of 48" and spans across more than one such concrete block to help insulate the blocks. Where appropriate, the "large" foam insert can be cut to any desired length. The insert 202 has leg portions that fill the cavity 117 adjacent or between the cross-webs 108 of block 100, 100a, or 100b.

[0063] FIGS. 17-19 are side, plan, and end views, respectively, of a "small" polystyrene foam insert 204 for a concrete block 100, 100a, or 100b as shown in FIGS. 1-4, or 5-10, or 11-13, respectively, having nominal 6"x6"x24" dimensions, wherein the "small" foam insert has a nominal length of 48" and spans across more than one such concrete block to help insulate the blocks. Where appropriate, the "small" foam insert can be cut to any desired length. The insert 204 has leg portions that fill the cavity 119 adjacent or between the cross-webs 110 of block 100, 100a, or 100b.

[0064] FIGS. 1-4 or 5-10 or 11-13 or show variations of block 100, 100a, and 100b, respectively, having nominal 6"x6"x24" dimensions, wherein the "small" foam insert has a nominal length of 48" and spans across more than one such concrete block to help insulate the blocks. Where appropriate, the "small" foam insert can be cut to any desired length.

[0065] FIGS. 20-25 are various views of a concrete block 500 similar to the block 100 previously described and shown in FIGS. 5-10, and with similar elements with the same reference numerals, except for having nominal 8"x8"x16" dimensions, with appropriate dimensions of the foam inserts 202a and 204a to accommodate the dimensional differences in the block 500. As the block 500 is substantially shorter than the 6"x6"x24" blocks 100, 100a, and 100b, only two cross-webs 110 can be employed in this embodiment.

[0066] FIGS. 26-29 are perspective, side, top plan, end, and bottom plan views, respectively of a concrete block 500 according to the invention as previously described and shown in FIGS. 20-25 having nominal dimensions of 8"x8"x16". Where appropriate, the block 500 can be cut to any desired length.

[0067] FIGS. 30-33 are perspective, side, plan, and end views, respectively, of an "outside cell" or "smaller" polystyrene foam insert 204a for a concrete block 500 as shown in

FIG. 20 having nominal 8"x8"x16" dimensions, wherein the "outside cell" foam insert 204a has a nominal length of 16", but the insert 204a can be made to span across more than one such concrete block to help insulate between the adjacent heads of the blocks when placed in courses to build a wall. Where appropriate, the "outside cell" foam insert 204a can be cut to any desired length.

[0068] FIGS. 33-37 are perspective, side, plan, and end views, respectively, of an "inside cell" or "larger" polystyrene foam insert 202a for a concrete block 500 as shown in FIG. 20 having nominal 8"x8"x16" dimensions, wherein the "outside cell" foam insert 202a has a nominal length of 16", but the insert 202a can be made to span across more than one such concrete block to help insulate between the adjacent heads of the blocks when placed in courses to build a wall. Where appropriate, the "inside cell" foam insert 202a can be cut to any desired length.

[0069] The Insulated Concrete Masonry Units ("ICMU") and the resulting Insulated Reinforced Masonry Wall System ("IRMWS") consists of expanded polystyrene inserts or spray foam designed for use with the hollow mortared concrete masonry units that comply as Grade N units under Uniform Building Code ("UBC") Standard 21-4. The mortared masonry units are manufactured by concrete block manufacturers.

[0070] One or two curtains of foam inserts are installed in each masonry unit in the field. The ICB foam inserts are expanded, from polystyrene beads, to a density of 1.0 to 2.0 pcf (16 to 32 kg/m³). The inserts have a maximum flame-spread rating of 25 and a smoke-developed rating of less than 450. The inserts comply with ASTM C 578 as Type I. See the description of the figures and the figures for additional details of the ICMU foam inserts.

[0071] Simply stated, the new block is very strong. The strength and durability combination of concrete and steel is unmatched in the construction industry today. All concrete systems are engineered to meet local code requirements and can be made stronger by adding more Portland cement to the concrete mix and/or adding more steel into the system. The difference is always economics.

[0072] In general, the block shares the same process, materials, volumes, and testing used to produce a standard C-90 spec block. But more specifically, the block according to the invention has 12% more mass and 4% greater compression surface area than the standard C-90 spec block, thereby achieving greater strength. At nearly 60 sq. inches using 3,000 psi concrete the block will test at loads in excess of 180,000 pounds, or 90 tons of compression per block.

[0073] Today's coastal environments are also concerned with wind or horizontal loads. Shear loads in earthquake zones. And of course impact resistance due to flying debris.

[0074] As a wall system, the block is reinforced with steel rebar. It is the steel rebar that does a majority of the work. I have been told more than once, by engineers and architects both, that you could jack hammer away the block and the remaining steel and surrounding grout grid would still easily support standard roof and shear loads. Typical engineered placement of 1/2 inch rebar every 4 foot with-in the wall, both horizontally and vertically, produces a 140 mph wall. Increasing size and/or frequency can easily produce a 250 plus mph wall, again, economics. For example: 3/8 inch rebar every 24 inches. A Dallas prison spec requires 3/4 inch rebar every 8 inches. This would be easily done within the block wall according to the invention without cutting. Of course, with

every interior cell filled with rebar and grout “R” performance would drop, however, maximum strength and security can be achieved.

[0075] A non-linear thermal path is created by the onset and restricted pathways, combined with the “thermal mass” of the block itself effect the thermal flywheel and the Adobe principles that heat will not travel from one side of the wall to the other in a twelve hour day, the sun goes down, the air cools down, and the collected heat is released back out into the night and the passive energy efficient solar cycle begins again.

[0076] The aggressive pursuit to design and build not only a survivable but sustaining exterior building envelope for hurricanes began with concrete and steel, incorporates current technology and theory and is combined with new leading edge design features to create a floodable, hurricane resistant, safer home, and more cost effective home.

[0077] The thermal blocks are designed for insulation inserts or spray foam tilled on-site, and can be pre-insulated at the factory. The design preferably includes factory pre-finishes. So the block could be delivered pre-insulated and pre-insulated to the job site, this intern would reduce sub-contractors and labor costs. Pre-insulated foam will also be pre-cored to create a handle for the block, electrical wires, electrical boxes, plumbing, rebar reinforcement, and post-tension systems.

[0078] The block may also incorporate an insulation bed of expanding foam, or weather stripping foam vertical sealant groove **160** just prior to setting the block. Vertical sealant grooves **160** in the middle rib of the head provide support for foam or weather stripping. This provides an additional thermal break for the system, and an air and water infiltration barrier. Preferably, the block **100b** includes such a vertical sealant groove **160** in the middle rib **106** of one end or head of the block. Preferably, such a vertical groove is V-shaped.

[0079] Referring briefly ahead to the plunger head **650** of the mold **600** shown in FIGS. **39a** and **39b**, a horizontal sealant groove **162** is formed in the top of the block **100b** to provide a groove for a sealant, such as a bead of caulk or weather stripping, to be placed between the heads of block in courses of the block **100b**. This provides additional thermal break for the wall system, and an air and water infiltration barrier. Preferably, the sealant groove is formed in the top of a middle rib of the block as shown in FIGS. **39a** and **39b**. Preferably, the sealant groove **162** is V-shaped.

[0080] A groove is formed in the middle rib to provide clearance for the electrical ground screw in the back side of an electrical outlet box, which can be installed as shown in FIG. **4**. This ground-screw clearance groove also advantageously marks the middle, or center, of the block for accurate quick cutting of the block in half.

Installation

[0081] The mortared masonry units are installed in a running-bond or stack-bond pattern. Grout must have a 28-day minimum compressive strength of 2,000 psi (13.8 MPa). Wall construction should also comply with Section 2104 of the 1997 Uniform Building Code (UBC). Construction quality should comply with Section 2105 of the UBC. Anchor bolts and wall anchors should be embedded in fully grouted bond beams without the foam plastic inserts.

Design

[0082] Structures are preferably designed as reinforced masonry in accordance with Sections 2105, 2106, 2107 and 2108, inclusive, of the UBC, with the following provisions:

[0083] Specified compressive strength, f_m , used in design must be between 1,500 psi and 2,000 psi (10.3 MPa and 13.8 MPa).

[0084] Specified compressive strength, f_m , must be verified by prism tests

[0085] described in Section 2105.3.2 of the UBC.

[0086] Lintel beam design width must be the block width minus the foam plastic insert thickness, if used.

[0087] Notations used in this evaluation are set forth in Section 2101.4 of the UBC.

[0088] Allowable Stress Design Method:

[0089] The maximum tensile stress in deformed bars is 20,000 psi (138 MPa).

[0090] The nominal block width may be used as the value “ t ” in the allowable axial stress (F_u) equations.

[0091] Determine allowable axial stress in reinforced walls.

[0092] Strength Design Method:

[0093] Determine design axial load.

[0094] Determine design moment.

[0095] Steel reinforcement must be centered in the grouted section.

[0096] Allowable in-plane shear stress of reinforced walls must be based on the reinforcing steel resisting all shear.

[0097] Anchor bolts are designed and installed in accordance with Section 1701.5.7 of the UBC.

Four-Hour Fire-Resistive Wall Assembly

[0098] The four-hour fire-resistive wall assembly (of a light-weight material) consists of walls constructed in running bond. Horizontal bond grouted beams are required at the top and bottom of the walls and intervals, as required by the code, or 32 inches (813 mm) on center, whichever is less. Vertical cells must be grouted at intervals as required by the code or 48 inches (1219 mm) on center, whichever is less. Both inner and outer cells are grouted and reinforced as required by the code, but with no less than No. 4 deformed steel reinforcement complying with the code. Grouted inner and outer walls must occur in the same course, or staggered one course. Foam inserts occur in all ungrouted cells. The surface-bonding cement must be applied to a minimum 1/4-inch (6.4 mm) thickness. The axial load on the wall is determined in accordance with the code, not to exceed an allowable stress design service load of 5,370 plf (78.4 kN/m).

Special Inspection

[0099] Special inspection is required in accordance with Section 1701.5.7 of the UBC for installations located in Seismic Zones 3 and 4. Unless design stresses are reduced in accordance with Section 2107.1.2 of the UBC, special inspection is also required for installations located in Seismic Zones 1 and 2.

[0100] The special inspector is responsible for verifying compliance of materials, plans and specifications, mortar preparation and use, masonry unit placement, anchor placement, reinforcement placement, grout preparation and use, preparation and handling of prisms, and mortar and grout test sample preparation.

[0101] Verification must be submitted to the building official that the masonry units comply as Grade N units in accordance with UBC Standard 21-4.

[0102] For each project, plans and calculations demonstrating compliance with the code are submitted to the building official for approval.

[0103] Design and construction complies with the manufacturer's instructions. A copy of the manufacturer's instructions and ASTM C 946 must be submitted to the building official for each project.

[0104] Special inspection is provided.

[0105] Foam inserts are manufactured under a quality control program with inspections by Underwriters Laboratories Inc. (AA-668).

[0106] The block foam inserts are installed at the jobsite in accordance with the manufacturer's instructions and approved plans.

[0107] Walls are four-hour fire-resistive assemblies when constructed in accordance with the building specifications for the block. Walls are noncombustible when the foam inserts are covered by at least 1 inch (25.4 mm) of masonry at all points.

Non-Concrete Block

[0108] The thermal block with a non-linear thermal path design is not limited to being made of a concrete mixture alone. Other structural suitable structural material can be used. Today, as always, there are new technologies creating new materials. The constant demand for efficient, renewable, and recyclable materials is ever growing. Currently the block can be manufactured from glass, or an enzyme and clay mixture can be used. The block can be used as an end fill application with no structural properties. There are also injectables, such as expanding foam based composite materials.

Mold For Manufacturing Block

[0109] The vast majority of block today are produced on only two brands of equipment, Columbia and Besser. The standard "3 out" machines use a steel pallet size of 26"×18". The front of the pallet as it comes out of the machine in a forward motion is the 26" inch side while the depth of the machine and the pallet is 18". Three 8"×8"×16" conventional concrete blocks are produced side by side at one time with the head of the blocks, the three 8"×8" dimensions, coming out first with the 16" inch dimensions trailing front to back. Core bars suspend core cans front to back in the mold box, where the core cans define the mold for the cavities of the block. After the concrete material is added to the mold box, a rake bar that is slotted to not interfere with the core bars then moves front to back to evenly distribute and proportion the concrete material within the mold box. Next, the plunger head is lowered and vibrated to compact the concrete material in the mold box. Next, the mold box is lifted and the plunger head pushed or extracts the block onto the pallet around these core bars, however, the presence of the core bars creates slight visual and structural imperfections on the tops of all the blocks being formed in the mold because the pressing of the plunger head cannot be applied where the core bars lie in the field of the mold box.

[0110] A mold 600 adapted for manufacturing the 8"×8"×16" block 500 is shown in FIG. 38. The mold 600 has the two major parts, a mold box 610 and a plunger head 650. The two

major mold parts, the mold box 610 and the plunger head 650 are shown near one another in an aligned position as they would be used in molding block. Usually three of the block 500 in one mold box can fit on a typical pallet in a block molding machine (not shown).

[0111] The mold box 610 has a pair of side walls 612a and a pair of end walls 612b forming a rectangular body that is open at the bottom for molding one or more block 500. A pair of handles 614 is attached to the side walls 612a, whereby the sides of the mold box 610 can be attached to the rest of the molding machine (not shown). The core bars 616 help support the mold cores 618 within the mold box 610 for defining the cavities 117 and 119 of the block 500. The core bars are aligned with the side walls 612a.

[0112] The mold box 610 is lowered by the handles 614 onto a pallet in a block manufacturing machine (not shown) and a cement-based mixture is poured into the mold. A rake (not shown) of the molding machine moving parallel to the side walls 612a scrapes off any excess of the cement based-mixture of which the block 500 is to be made from above the tops of the side walls 612a and end walls 612b of the box 610.

[0113] The plunger head 650 has a plunger head adapter plate 651, which can be used to connect the plunger head 650 to various types of typical block manufacturing machines (not shown). The plunger head 650 supports at least one press plate, and usually a plurality of press plates 652. As will be appreciated by those of skill in the art, the press plates 652 of the plunger head 650 compacts the cement-based mixture and forms the shape of the block in the mold that is oriented upward during molding.

[0114] Referring now to FIG. 38, a mold 600a adapted for manufacturing the 6"×6"×24" block 100b. The mold 600a has the two major parts, a mold box 610a and a plunger head 650a. The two major mold parts, the mold box 610a and the plunger head 650a are shown near one another in an aligned position as they would be used in molding block. One of the innovations is that by orienting the forms inside the box 610a sideways to the conventional orientation, and avoiding the use of core bars, three such larger block 100a can be manufactured simultaneously, i.e., "3-out." Usually three of the block 100b in one mold box can fit on a typical pallet in a block molding machine (not shown). As best shown in FIG. 40, dividers 620 separate the forms for molding three of the block 100b.

[0115] FIGS. 39a and 39b are end and side views, respectively, of the plunger head 650a of the mold 600a for manufacturing block 100a according to the invention. As shown in FIGS. 39a and 39b, the sealant groove 162 to be formed in the top of the middle rib 106 of the block 100b can be formed with the downwardly oriented V-shaped sealant groove forming ridge 654.

[0116] As shown in FIGS. 39-40, the sideways producing a mold box without corebars is unique. This mold box is specifically designed to produce insulated concrete masonry units (ICMU'S) sideways with no core bars. This allows for greater compaction, added block length, and a seamless, zero-flaw, block that is stronger and more stable.

[0117] The new 6"×24" mold according to the present invention is unique in two ways. In order for the 24 inch long block to be produced on an 18 inch deep pallet, the block is set sideways, parallel to the front 26 inch side of the pallet. This complicates the standard core bar configuration because the core bars cannot be placed sideways. The primary reason is due to fact that the rake bar only travels front to back and

requires the core bar to be parallel with the action of the rake bar, seen that having perpendicular core bars would interfere and prevent the rake from raking. Secondly, if the core bars were placed in parallel to the rake bar multiple visual and structural imperfections would be placed on both, interior and exterior, surfaces of the block. The second unique factor is allowed for by the design of the block according to the invention itself. Due to the restricted cross webbing, the voids or cavities are continuous from one head of the block to the other head. This allows the core cans to be welded together and then welded to parallel inside walls of the mold box itself, thereby eliminating the need for suspending the cans by the use of core bars on top of the mold box. So now, a mold box can produce block according to the invention in a direction perpendicular to the direction of standard block production on a pallet with no core bars to interfere with the rake or producing defects in the blocks themselves. The result is a stronger more perfect block.

Post-Tension CMU Wall System

[0118] As shown in FIGS. 41-42, the post-tension CMU wall system 700 includes a series of concrete anchors, tension rods and top wall plates that will increase transverse wind loads. The system 700 includes post-tension roof tie downs tensioning the roof trusses to the tension rods themselves that are anchored to the footers directly.

[0119] FIG. 41 is a side view of the lower part of a block wall 702, preferably made of block according to the invention, especially block 100b, and set on a footing 710. The footing 710 is preferably reinforced with rebar 712. A vertical top-threaded tension rod 714 is attached with a bottom-end "crab claw" 715 to the foundation 710 with a bell-end J-bolt anchor 716.

[0120] FIG. 42 is a side view of the upper part of a block wall 702 made of courses of block 100b. The upwardly extending top-threaded tension rod 714 from the foundation on which the wall is built (as shown in FIG. 41) can be used to apply post-tension to the block wall 702. Preferably, a top plate 720 is positioned on top of the block wall 702. The post-tension is applied with a leaf spring 722, nut 724, and turnbuckle 720. The turnbuckles 726 used in the system are connected to a tie-down cable 730 placed over the tops of the rafters 732.

[0121] The Exterior Building Envelope

[0122] Combined with architectural design the Floodable, Post-tension, CMU and insulated, ICMU construction would have a front line, ocean side rating in excess of 250 mph wind loads effectively saving your single largest cash asset, your home and quite possibly your life and the lives of your family.

Benefits of New Insulated Block and a Wall Built With the Block

[0123] Energy Efficiency

[0124] According to the invention, an 8 inch insulated concrete block having polystyrene foam inserts is provided to achieve high performance "R" value rating in the range of 24. The six inch block "R" rating is 20, and the 12 inch block "R" 38. Such high "R" values, together with the nature of thermal mass reduces heating and cooling energy costs by 40 to 70%. The block is energy efficient due to non-linear thermal pathways and expanded polystyrene foam inserts that are highly resistant to heat flow. The higher mass of this wall system stores a large amount of heat that is slowly released facilitat-

ing moderate indoor temperature changes. The thermal mass maintains a constant and consistent temperature throughout the entire home. These homes are naturally warm in winter and cool in summer. These solid walls also effectively seal out uncomfortable drafts. The economic result is lower monthly operating expense of 40 to 70%.

[0125] Hurricane Resistant Wall

[0126] When reinforced with fiber, steel rebar, and grout, the insulated concrete block becomes a wall system engineered to resist or withstand hurricanes, tornadoes, earthquakes and wind loads in excess of 140 miles per hour. Flying debris during hurricanes and tornadoes cause most of the structural damage to buildings. A wall built with the insulated concrete block according to the invention is capable of resisting damage from flying debris and with no structural damage where a conventional wall system would be easily perforated by such flying debris.

[0127] Capable of Below Grade Installation

[0128] The insulated concrete block can be installed in a wall built below grade.

[0129] Sound Resistant Wall

[0130] A wall made of the 8 inch insulated concrete block according to the invention is nearly sound proof (STC-61).

[0131] Mold, Mildew, and Moisture Resistant

[0132] A wall made with the insulated concrete blocks according to the invention is highly resistant to mold, mildew, and moisture penetration. This is due to the fact that the wall is essentially inorganic and is a waterproof one piece monolithic wall from the footings to the roof with no ground seams or corner seams.

[0133] Insect Resistance

[0134] The Block is not a food for mold, termites or carpenter ants that commonly damage or destroy homes. A wall formed with the block is also insect resistant due to the fact that it is essentially solid waterproof one piece monolithic wall from the footings to the roof with no ground seams or corner seams.

[0135] Hypo Allergenic

[0136] The block is also hypo allergenic and exceeds all government "GREEN" standards. The block is hypoallergenic and "Green" by having no VOC's (volatile organic compounds) and no dust.

[0137] Durability

[0138] Concrete, rebar, and polystyrene foam are non-deteriorating materials. The block is used as part of a very strong inorganic reinforced concrete block system that resists rot and decay. The surface bond or "skin" of the system is a combination of concentrated cement, silica sand, reinforced fiberglass, lime and calcium stearate that greatly assist in making the entire wall system highly resistant to extreme weather, hot or cold, wet or dry, storm damage, wind blown debris, driving rain, flooding, UV rays, cracking, fading, peeling or blistering and insect penetration.

[0139] Fire Resistance

[0140] The block and a wall build with the blocks are capable of being fire tested under ASTM guidelines to achieve the building industries' highest fire rating.

[0141] Security

[0142] The insulated concrete block builds a wall that is resistant to burglary and offers greater overall security. Many homes today are burglarized by simply cutting a large hole in an exterior wall, by passing the alarm system for access. Thermal block makes this far more difficult.

[0143] Traditional Design Finishes

[0144] The block can be in the traditional design look (exterior finish incorporating the molded look of stucco) or manufactured in a number of polished or textured finishes. Any design may be used incorporating the institutive core material.

[0145] Various Sizes

[0146] The block can be manufactured in various sizes. The blocks are preferably of standard dimensions and easy to install. Currently the blocks are 8"x8"x16", 8"x12"x16", and 6"x6"x24".

[0147] Economical Building Cost

[0148] The cost of a fully installed end-to-end wall system is lower than quality conventional construction systems. The wall system requires fewer subcontractors and therefore reduces complexity. The infrastructure for this "new system" is already in place because the improved block is compatible with conventional concrete block manufacturing facilities and the trained experienced installation labor force exists in the form of masons. All of the many benefits of the improved insulated concrete block and building system come at a lower cost compared to a conventionally built home.

[0149] The block cuts cost across the board, from planning all the way through to ownership for generations.

[0150] Planning costs are less. The block is a complete wall system. It is the interior, middle, and exterior wall detail in one. Pre construction costs are less. Fewer materials on the job for an exterior one wall system. Self stores outside in bad weather for years. At 26 to 30 lbs apiece, the block is heavy to steal and not easily damaged.

[0151] Construction costs are less. For example, a 6"x24" face block is a full square foot of wall coverage. Unlike its cousin, the 8"x16" face block, equals only 89% of a square foot. For example, a 10,000 8x16 block wall would spec only 8,900 blocks, 1,100 less blocks to purchase, and 1,100 less blocks to set. The block takes up less square floor footage. The 6x6x24 is two inches thinner, finished, and insulated at the 6 inch depth. The 8x8x16 is 8 inches thick plus a finish and an insulation application can expand the depth to 12 or more inches. The pre-finished block will save 30% over a stucco finish. A true "R"-20, high mass wall will reduce ac tonnage by 20%. A one sub system reduces labor and scheduling miscues, and time is money. Clear span engineered roof trusses can be installed immediately after the exterior walls set, greatly reducing exposure and quickly bringing the building into the "dry" for security and all interior work.

[0152] Post construction costs are less. Block building can be designed with little or no cuts making for very little on-site clean-up. Block is inorganic and is a stable on-site fill material. The pre-finished block needs no on-site finishes or there messes.

[0153] Economical to Maintain

[0154] Additionally, lower costs for maintenance and for pest and termite control will produce maintenance savings compared to a conventionally built home.

[0155] Economical to Insure

[0156] The block is capable of achieving the building industry's highest fire insurance safety rating. Current savings are 2% on insurance for extreme fire ratings with the potential of a 60% savings for 900+ insurance rating.

[0157] Ownership Annual Costs and Risk Are Reduced

[0158] The total economic construct model of an efficient, affordable, energy efficient, storm resistant, floodable, fire proof, mold proof, sound proof, enclosure implicates pro-

found savings. And not just in cash, and not just for the homeowner, but also the financier, the insurance companies, and perhaps even the town itself.

Alternative Embodiments

[0159] Basically there are four forms of concrete: Block ("CMU"), precast, liquid, and sheet goods, half inch thick by 4x8 foot. The block system is as described above form system uses a liquid cement-based mixture, and the "wafer" system uses sheet goods.

[0160] A representative formed-wall system **800** is shown in the cut-away view of FIG. 43. The formed-wall system **800** is made by positioning a structural form made of structural sheets, such a first structural sheet **810** and a second structural sheet **820**, which are spaced apart several inches, for example, about 8". The first and second structural sheets **810** and **820** can be of any convenient structural sheet material, such as plywood or pressed wood.

[0161] A webbing of rebar **830** is positioned between the first and second sheets **810** and **820** and spaced apart from both.

[0162] At least one insulating sheet **840**, such as of a polystyrene foam, is positioned between the first and second sheet materials **810** and **820**. Preferably, an insulating sheet **840** is placed on either side of the webbing of rebar **830** and between the first and second structural sheets **810** and **820**. The insulating sheet preferably has a plurality of openings or bores **842**, which may be of any desired shape, to allow limited fluid communication across the insulating sheet **840**.

[0163] A flowable, cement-based mixture is poured between the first and second structural sheet materials **810** and **820**, which fills up the void spaces between the structural sheets **810** and **820**, flows through the plurality of holes **842** in the insulating sheet **840**, and around the webbing of rebar **830**. (The cement-based mixture is shown only partially filling the voids between the structural sheets **810** and **820**.) The cement-based mixture **850** is allowed to set as it is contained between the structural sheets **810** and **820**. The holes **842** should be relatively sufficient to provide the desired structural rigidity and strength, to the formed wall system **800**. However, the number and size of the holes **842** is preferably minimized to maintain most of the thermal insulating value of the insulating sheet **840** relative to the lower insulating value of the cement-based material, to restrict and limit the thermal paths across the wall system **800**.

[0164] After the cement-based material **850** has set in the form, the structural sheets **810** and **820** can be optionally removed.

Wafer System

[0165] The wafer-wall system **900** is a multi-layered structural insulated panel ("SIP" panel). With a minimum of three layers, two exterior and one middle interior, reinforced concrete sheets **910** sandwich rigid foam insulation sheet **920** in a 4x8 foot sheet as shown in FIG. 44.

Liquid Concrete Formed Wafer

[0166] The liquid concrete form is a break-away form wall system. The entire wall, including footers is pre-formed with electrical conduit, steel rebar and a minimum double curtain foam layers with off set foam cross connecting webbing,

creating a non-linear thermal path thereby dramatically extending and restricting the thermal path of the poured concrete wall.

[0167] After careful consideration of the specific and exemplary embodiments of

[0168] the inventions described herein, a person of ordinary skill in the art will appreciate that certain modifications, substitutions and other changes can be made without substantially deviating from the principles of the inventions. The detailed description is illustrative, the spirit and scope of the inventions being limited only by the appended claims.

What is claimed is:

1. A block for building construction, the block comprising: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) non-linear thermal paths of the body material across the block by offsetting and restricting the cross webbing of the block; and (c) at least two cavities in the block.

2. The block according to claim 1, wherein the block has nominal dimensions of 6"×6"×24".

3. The block according to claim 1, wherein the inorganic material is a cement-based mix.

4. The block according to claim 1, wherein the cavities of the block are open to a face of the block, whereby the cavities can be substantially filled with an insulating material to form an insulated concrete block.

5. The block according to claim 4, further comprising an insulating material positioned in the cavities of the block.

6. The block according to claim 5, wherein the insulating material is an insulating foam material.

7. The block according to claim 6, wherein the insulating foam material is in the form of one or more inserts of a size and shape adapted to fit within the cavities of the block or the foam material is spray filled into the cavities of the block.

8. The block according to claim 7, wherein at least one of the insulating foam inserts spans across more than one block, whereby any small gap between two adjacent blocks in a wall are insulated to help insulate the wall of blocks.

9. The block according to claim 6, wherein the insulating foam comprises an insulating material selected from the group consisting of polystyrene and polyurethane.

10. The block according to claim 1, wherein at least one of the cavities of the block allows for rebar to be positioned through the block, whereby, when a plurality of the blocks are stacked to define a wall, at least one rebar can be positioned through adjacent blocks to reinforce the wall of block.

11. The block according to claim 10, wherein at least one rebar can be positioned through adjacent blocks in the wall of the blocks in a vertical orientation and at least one rebar can be positioned through adjacent blocks in the wall of blocks in a horizontal orientation.

12. The block according to claim 1, wherein at least one of the cavities thereof allows electrical conduit to be positioned through the block, whereby, when a plurality of blocks are stacked to define a wall, at least one electrical conduit can be positioned through adjacent blocks for servicing an electrical junction box or outlet positioned in a cut-out made in a face of the block.

13. The block according to claim 1, further comprising a pre-finish on at least one of the faces of the block.

14. The block according to claim 1, further comprising a pre-insulated foam material in the cavities of the block.

15. The block according to claim 14, wherein the cross webbing of the block is restricted to about one-half of the dimension of one of the shorter nominal dimensions of the block.

16. The block according to claim 1, further comprising a vertical sealant groove in a middle rib of the head of the block.

17. The block according to claim 16, wherein the vertical sealant groove in a middle rib of the head of the block is V-shaped.

18. The block according to claim 1, further comprising a horizontal sealant groove in the top of a middle rib of the block.

19. The block according to claim 18, wherein the horizontal sealant groove in the top of a middle rib of the block is V-shaped.

20. The block according to claim 1, further comprising a vertical ground-screw clearance groove in a middle portion of a middle rib of the block to provide clearance for an electrical ground screw in the back side of an electrical outlet box positioned in the block.

21. A mold for manufacturing a block,

wherein the block comprises: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) non-linear thermal paths of the body material across the block by offsetting and restricting the cross webbing of the block; and (c) at least two cavities in the block; and

wherein the mold comprises:

(a) a mold box adapted for receiving and molding an inorganic material on a manufacturing pallet into the form of at least one of the block; and

(b) a plunger head adapted for compacting and vibrating the inorganic material in the mold box, and after the inorganic material is sufficiently set, pushing the molded inorganic material through the bottom of the mold box as the mold box is raised off the manufacturing pallet.

22. The mold according to claim 21, wherein the block has overall dimensions of about 6"×6"×24" whereby three (3) blocks can be simultaneously molded on a typical manufacturing pallet that is 26"×18".

23. The mold according to claim 21, wherein the mold box does not have core bars across the top, whereby the block can be molded in the mold box sideways to the direction of normal raking across the top of the mold box without interference by any core bars.

24. A wall system for a building construction comprising a plurality of blocks, wherein each of the blocks comprises: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) non-linear thermal paths of the body material across the block by offsetting and restricting the cross webbing of the block; and (c) at least two cavities in the block.

25. The wall system according to claim 24, wherein the blocks have nominal dimensions of about 6"×6"×24".

26. A building comprising a plurality of walls wherein at least one of the walls comprises a plurality of blocks, and wherein each of the blocks comprises: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) non-linear thermal paths of the

body material across the block by offsetting and restricting the cross webbing of the block; and (e) at least two cavities in the block.

27. The building according to claim **26**, wherein the block has nominal dimensions of about 6"×6"×24", whereby three (3) blocks can be simultaneously molded on a typical molding pallet that is 26"×18".

28. A block for building construction, the block comprising: a molded body formed of an inorganic material, wherein the molded body defines (a) a rectangular-box shape; (b) at least two cavities in the block; and wherein the block has nominal dimensions of 6"×6"×24".

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