United States Patent [19]

Muse

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[54] **WALL STRUCTURES**

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[22] Filed: **Jan. 2, 1970**

[21] Appl. No.: **252**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 802,450, Feb. 26, 1969, Pat. No. 3,609,926, which is a continuation-in-part of Ser. Nos. 658,524, Aug. 4, 1967, Pat. No. 3,479,782, which is a continuation-in-part of Ser. No. 730,727, May 21, 1968, abandoned.

[52] **U.S. Cl.** **52/259**, 52/206, 52/306, 52/439, 52/585, 52/DIG. 2

[51] **Int. Cl.** **E04b 2/00**, E04b 5/46, E04c 1/30

[58] **Field of Search** ..... 52/506, 507, 311, 306, 52/303, DIG. 2, 476, 259, 439, 585, 235

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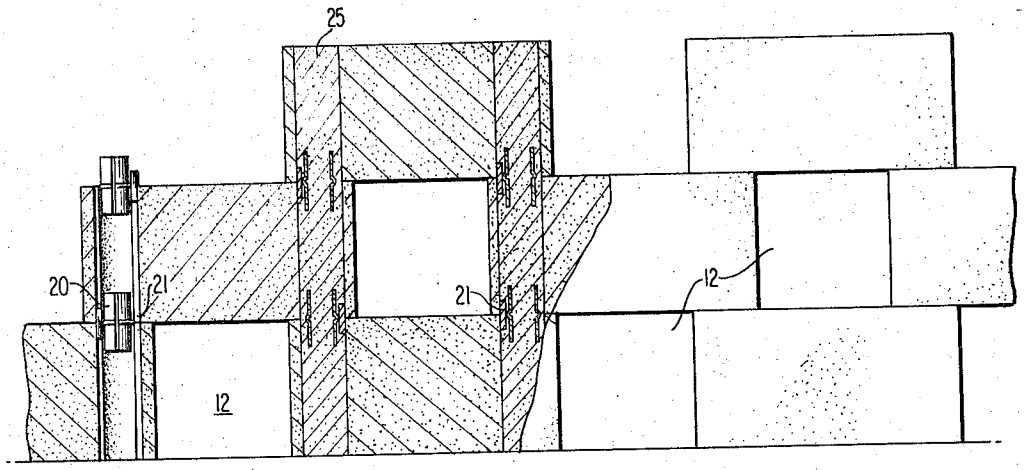
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Attorney, Agent, or Firm—Jones, Thomas & Askew

[57] **ABSTRACT**

A wall structure comprising an apertured wall with various decorations applied to the face of the wall and supported by the openings in the wall. The decorations include rigid and flexible panel accessories positioned adjacent the wall and supported by inserts extending into the openings of the wall, decorative inserts occupying only the openings of the wall, and screens or glass inserts positioned in the openings of the wall. The wall is fabricated of building blocks and includes expandable sleeves positioned in aligned vertical openings in the blocks of adjacent courses of blocks in the wall. Mortar extends through the aligned openings in the blocks which fills and rigidifies the sleeves, which locks the blocks together. An expandable wedge member is inserted into other aligned openings of the blocks and extends between adjacent courses of blocks to assure that blocks maintain an upright attitude.

16 Claims, 11 Drawing Figures



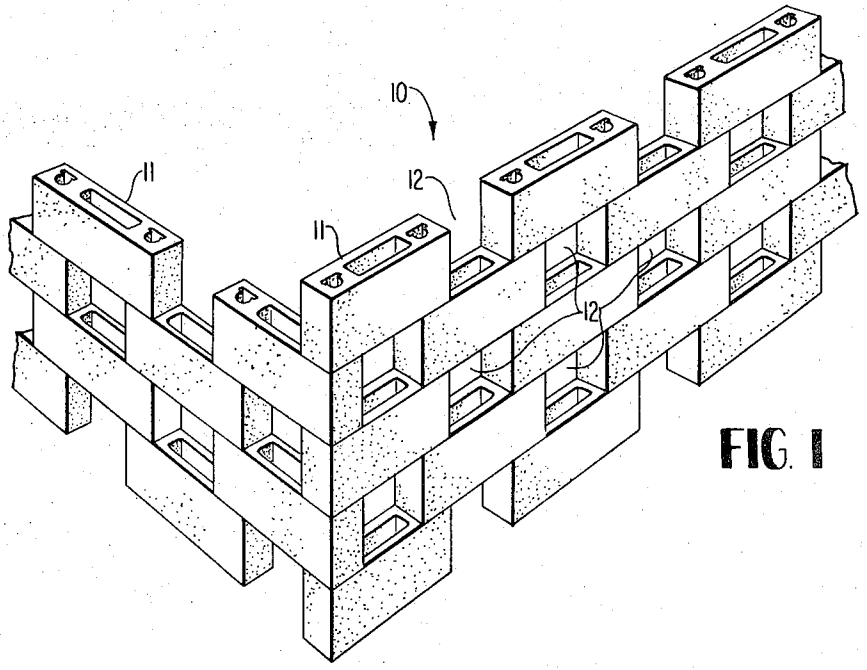


FIG. 1

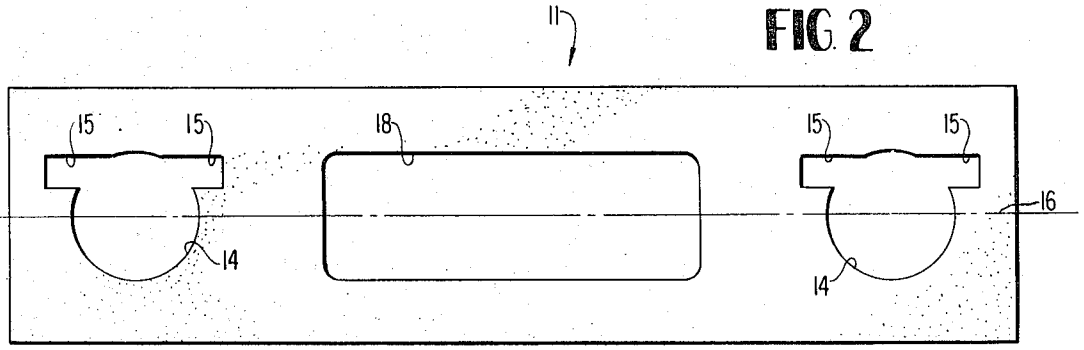


FIG. 2

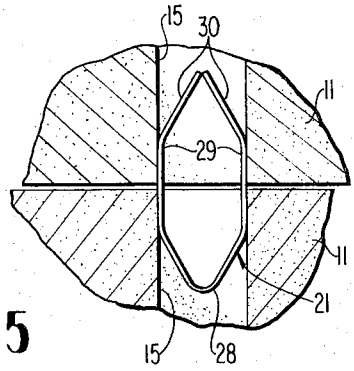


FIG. 5

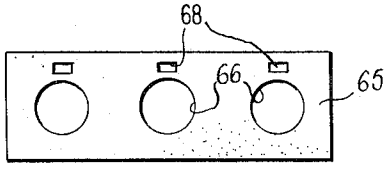


FIG. 4

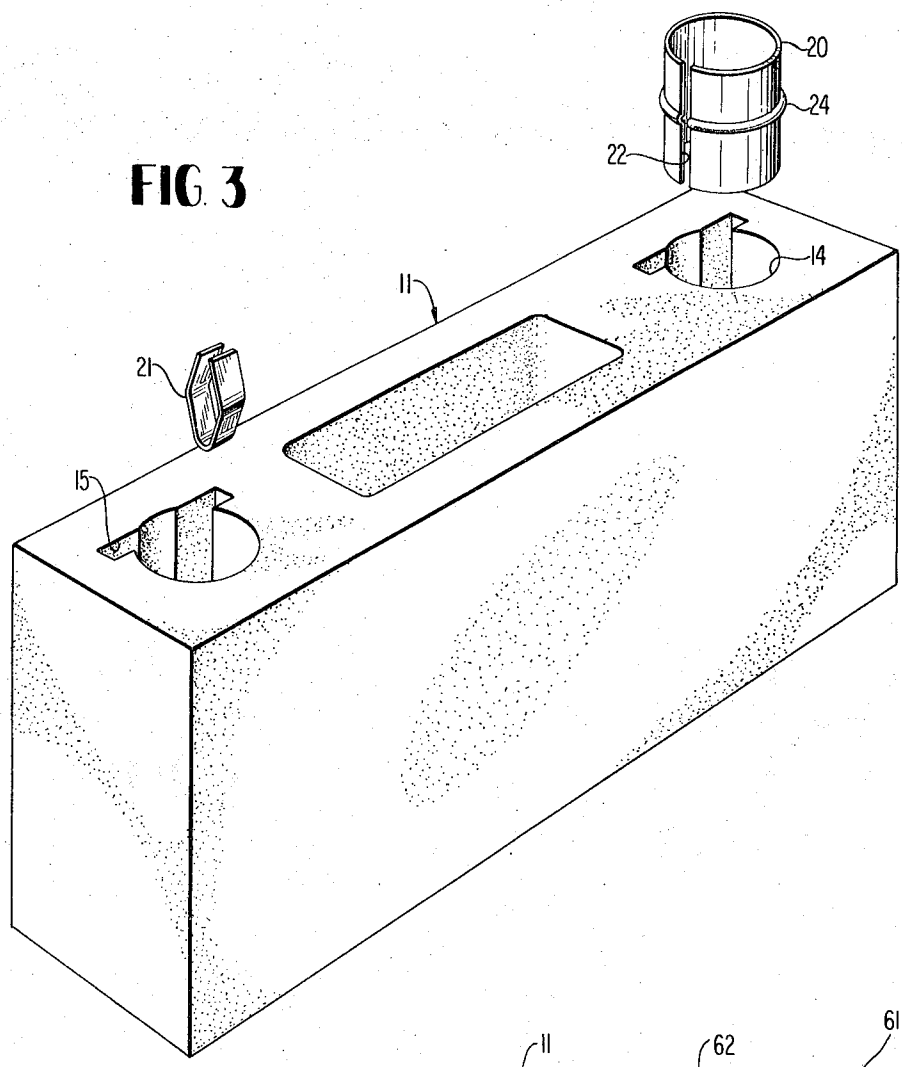
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FIG. 3



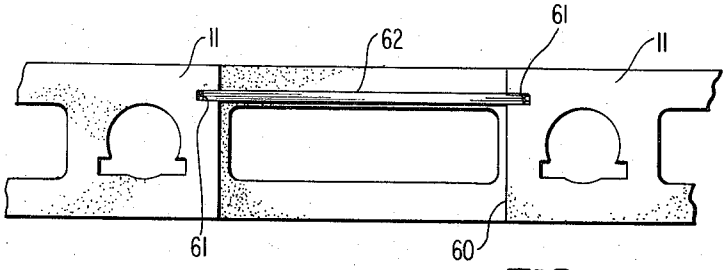
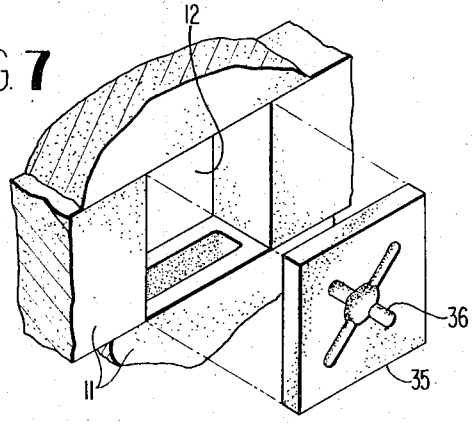


FIG. 11

FIG. 7

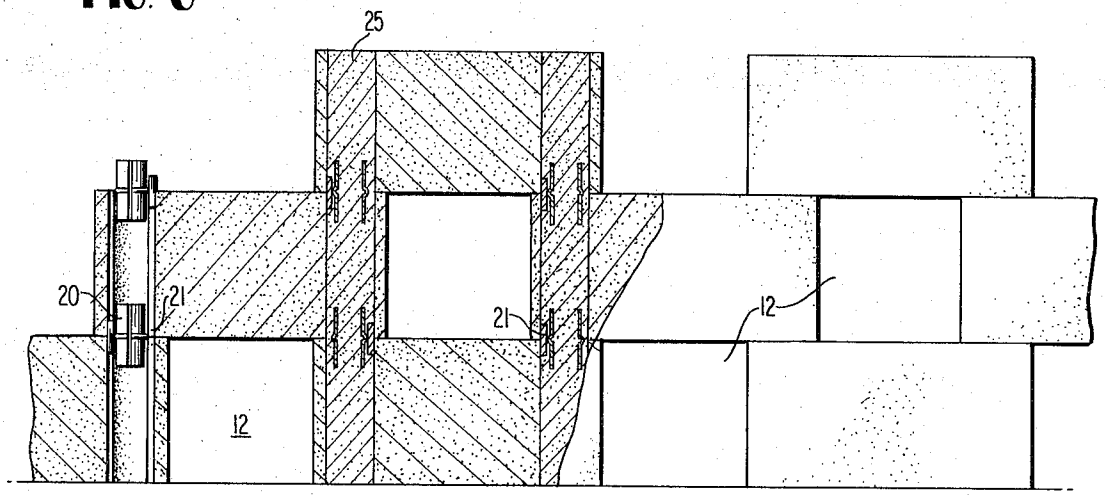


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FIG. 6



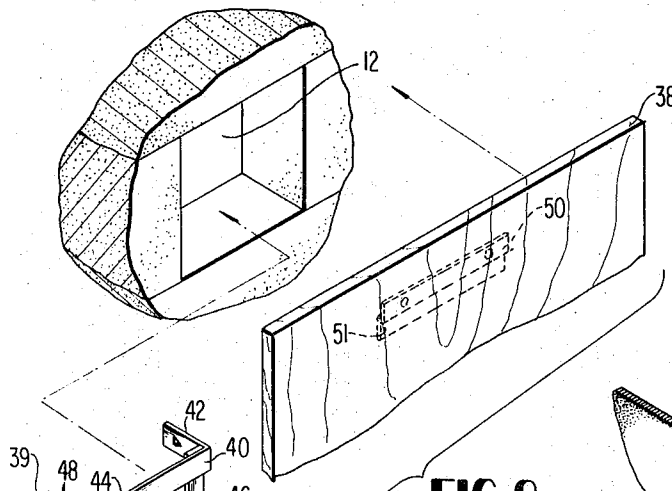


FIG. 8

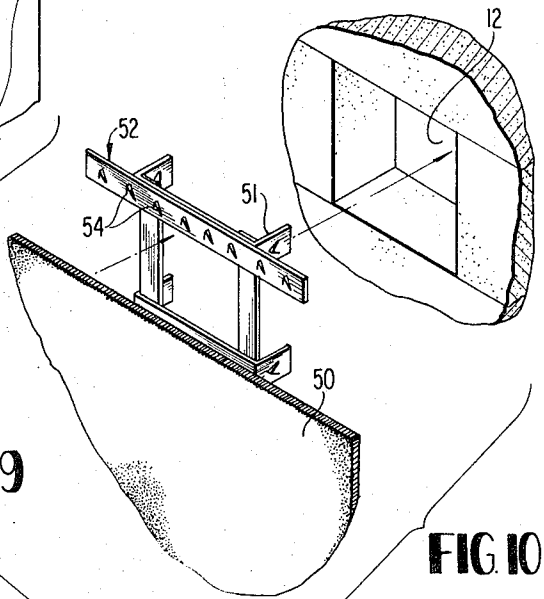
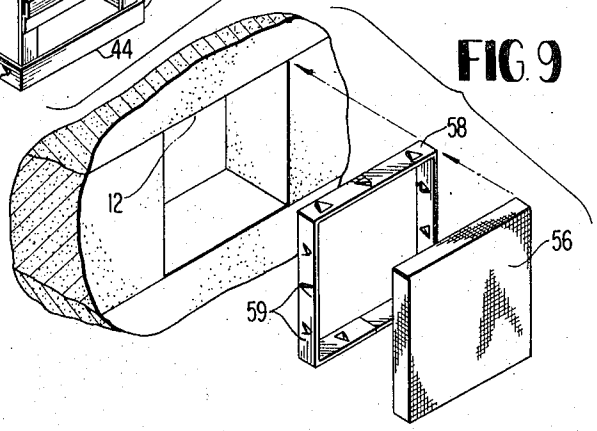


FIG. 10

FIG. 9



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WALL STRUCTURES

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 802,450, filed Feb. 26, 1969, now U.S. Pat. No. 3,609,926 issued Oct. 5, 1971, said application being a continuation-in-part of application Ser. No. 658,524, filed Aug. 4, 1967, now U.S. Pat. No. 3,479,782, and of application Ser. No. 730,727, filed May 21, 1968, now abandoned.

BACKGROUND OF THE INVENTION

In the past apertured wall structures have been relatively weak when compared to solid wall structures since the overlying blocks in the apertured walls are not bonded along their entire lengths to the blocks in the next adjacent courses of blocks and virtually none of the blocks are tied at their end surfaces to the blocks in the same course of blocks. Thus, while an apertured wall structure minimizes the number of building blocks required for a given length and height of the wall, the resulting weak wall structure is not acceptable for most building structures.

As disclosed in my U.S. Pat. No. 3,430,404, apertured wall structures of unusually good strength characteristics have been recently developed. With the advent of the strong apertured wall structure, internal and external building walls can now be safely used. While the apertured wall structure for outdoor partition walls can be constructed without close attention as to whether the wall is plumb, a building wall must be plumb and precisely built.

SUMMARY OF THE INVENTION

Briefly described, the present invention comprises apertured wall structures for use as internal and external building walls and the building blocks and other elements required in the construction of such a wall. A plumb wall can be erected by unskilled labor without locking the blocks of the wall together, the wall subsequently can be surveyed to assure its upright conditions, and mortar can be subsequently applied to the wall to lock the blocks together. The openings in the apertured wall structure are all virtually identical in size and spacing from one another and various prefabricated decorative wall accessories can be applied to the wall structure by inserting the accessories into the openings of the wall or by the use of support elements connected to the accessories and inserted into the openings of the wall.

Thus, it is an object of this invention to provide apertured wall structures that are precisely constructed and which can be rapidly assembled by unskilled labor.

Another object of this invention is to provide an apertured wall structure which defines openings that are virtually identical in size and shape and which are equally spaced from one another.

Another object of this invention is to provide wall structures that comprise a basic apertured wall having various decorative wall accessories inserted in or supported by the openings in the wall.

Another object of this invention is to provide an apertured wall structure and the building blocks for such a structure, wherein the wall structure is of acceptable strength characteristics for use as an internal or external building wall, wherein the wall structure will normally be assembled in a plumb condition, and in which the building blocks are inexpensive to construct and easy to handle.

Other objects, features and advantages of the present invention will become apparent upon reading the following specification when taken into conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a partially assembled apertured wall structure fabricated from the building blocks disclosed herein.

FIG. 2 is a top view of one of the building blocks.

FIG. 3 is a perspective view of one of the building blocks showing the tubular and wedge inserts spaced from their respective openings in the block.

FIG. 4 is a top view of a modified building block.

FIG. 5 is a detail showing of the wedge member shown in FIG. 3 as it is used in the assembled wall structure.

FIG. 6 is a side view, partially in section, of a wall structure fabricated from the building blocks shown in FIG. 3.

FIG. 7 is an expanded perspective showing of one of the openings in an apertured wall structure and a decorative insert spaced from the openings.

FIG. 8 is an expanded perspective showing of one of the openings in an apertured wall structure and the decorative panel applied to the wall.

FIG. 9 is an expanded perspective view of one of the openings in an apertured wall structure and a screen insert applied to the openings.

FIG. 10 is an expanded perspective showing of one of the openings in an apertured wall structure and the manner in which a non-rigid panel is attached thereto.

FIG. 11 is a plan view of one of the openingss in an apertured wall structure, showing the manner in which an insert is applied to the wall openings.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now in more detail to the drawing, in which like numerals indicate like parts at several views, FIG. 1 discloses a wall structure **10** which is partially completed and comprises a plurality of building blocks **11** with their ends spaced from each other to define spaced openings **12**. The particular blocks disclosed in FIG. 1 are substantially identical and each is of a height twice its width and of a length four times its width. The blocks are arranged so that their end 1/4 portions overlap the end 1/4 portions of the blocks next below and next above in the adjacent courses of blocks. This causes the openings **12** between the blocks to be square and of a height equal to the height of the blocks and of a length equal to 1/2 the length of the blocks.

As is best shown in FIGS. **2** and **3**, each block **11** comprises a pair of circular openings **14** which extend vertically therethrough and which have a diameter equal to approximately 1/2 the dimension of the width of the block. Circular openings **14** are located in the center of the end 1/4 portions of the block. Flat sided openings **15** also extend vertically through the block and merge with circular openings **14**. There are two flat sided openings **15** for each circular opening **14**, and the flat sided openings **15** are positioned on one side of center line **16** of the block and on opposite sides of

each circular opening. An elongated, substantially rectangular vertical opening **18** is centrally located in the block and occupies the central two 1/4 sections of the block. While the dimensions of the block and its openings have been chosen with specific proportions for strength and functional characteristics, the block and its openings can be fabricated in virtually any desired dimensions. The common dimensions of the block presently in use is a block 4 inches in width, 8 inches in height, and 16 inches in length. The circular openings **14** are 2 inches in diameter, the flat sided openings **15** are 1/2 inch in width, and the central opening **18** is 6 inches in length and 2 inches in width. This particular combination of specific dimensions has been chosen as suitable for the block to be substantially light in weight and easy to handle, yet the block is large enough so that a relatively large wall structure can be constructed with a small number of blocks and in a short period of time.

As is shown in FIGS. **3, 5** and **6,** tubular inserts **20** are provided for insertion into circular openings **14,** while wedge members **21** are provided for insertion into flat sided openings **15.** Each tubular insert **20** is generally cylindrical in shape and defines open ended slot **22** which extends along its length and allows the tubular insert to be expanded or contracted. Annular bead **24** projects outwardly from the side of tubular insert **20** and is positioned intermediate its ends. Tubular insert **20** can be fabricated from various different sheet materials, and is normally fabricated of cheap metal such as aluminum or tin so that it is substantially resilient and can be contracted and inserted into a circular opening **14** and released so that it expands to substantially fill the circular opening. The bead **24** generally limits the downward movement of the tubular insert **20** as it is inserted into the circular opening **14** of a block.

As is best shown in FIG. **6,** tubular inserts **20** are arranged so that they project into the aligned circular openings **14** of the blocks in adjacent courses of blocks. The tubular insert **20** is inserted in the blocks of the lower course of blocks, and the blocks in the next adjacent course of blocks have their circular openings **14** inserted over the projecting portion of the tubular insert **20.** This precisely locates the blocks in each course of blocks so that each block is spaced from its adjacent blocks in its own course of blocks to form equally spaced and sized openings **12** between the blocks. After the wall structure has been assembled to a desirable height, mortar or other cementitious substance is poured down through the aligned openings and tubular inserts and allowed to harden into a column **25,** which locks the blocks in adjacent courses of blocks together and which fills and makes the tubular insert **20** substantially incompressible. This causes the wall to acquire an unusually strong resistance to shear at the junctions of the blocks, and the elongated column of mortar has a large surface to which it is bonded inside each block, so that the individual blocks are securely bonded to one another.

As an alternative, the outer surfaces of all or some of the tubular inserts can be coated with a bonding material and the tubular inserts placed in the openings of the blocks, as previously described. This functions to bond the blocks together. In addition, mortar can be poured down the aligned openings, if desired.

As blocks **11** are assembled into a wall structure, wedge members **21** are inserted down into the flat sided openings **15.** Wedge members **21** comprise a strap of resilient material, such as spring steel, and each strap is bent intermediate its ends to form a substantially U-shape which comprises rounded lower portion **28** and side legs **29.** The upper ends **30** of side legs **29** are bent inwardly. When wedge member **21** is expanded as shown in FIG. **3,** the side legs **29** slope outwardly. When the wedge member **21** is inserted down into a flat sided opening **15,** the side legs **29** are urged inwardly by the sides of the opening. This causes the upper ends **30** to move toward each other. The upper ends are dimensioned and shaped so that when the side legs **29** are substantially parallel with each other, the upper ends engage each other to restrict any further movement of side legs **29** toward each other. Side legs **29** are substantially flat over a major portion of their lengths so that when the wedge member **21** is contracted, two flat parallel surfaces will engage the flat sides of the flat sided openings **15.**

Wedge members **21** are inserted into flat sided openings **15** to a depth so that they project upwardly out of the flat sided openings. When a block **11** in the next adjacent course is placed over a lower block having a wedge member in its flat sided opening **15,** the tapered end **30** of the wedge member will normally ride into the flat sided opening **15** of the block being placed down onto the lower block, so that wedge member **21** is located at the junction of the blocks in their aligned flat sided openings **15.** As the upper block is moved in a downward direction about a wedge member **21** the tapered ends **30** guide the upper block down into alignment with the lower block, and when the upper block comes to rest on the top surface of the lower block, wedge members **21** tend to cause the aligned flat sided openings **15** to be precisely aligned, even though there might be some irregularity in the bottom surface of the upper block or the top surface of the lower block that might cause the blocks to rock or tilt with respect to each other. The flat outer surfaces of side legs **29** of the wedge members **21,** and the resiliency of the wedge members, and the abutting end portions **30** of the wedge members all function to align the flat sided openings **15,** to nullify the effect of any spurs, lumps, sinks, or other imperfection in the abutting upper and lower surfaces of the blocks.

As is best illustrated in FIGS. **1** and **6,** the openings **12** in the apertured wall structure formed by blocks **11** will be virtually identical in shape and size, and will be equally spaced throughout the wall surface. As is best illustrated in FIG. **7,** the openings **12** can function to support an insert **35.** Insert **35** may take various different forms and can be placed to form a continuous surface with the outer surface of the wall structure, or can form a recess or protrusion with respect to the wall surface. The insert **35** may also carry raised or recessed decorations **36,** as may be desired. Insert **35** can be fabricated of various different materials, including plastic, wood, glass, concrete or any of the other popular building materials. The insert **35** is sized and shaped to fit snugly within opening **12,** and can be grouted into place, or the entire wall surface can be coated with a cementitious substance, if desired. A coating of this sort functions to cover the seams between adjacent blocks and between the blocks and the inserts to form a continuous unbroken surface. Moreover, if inserts **35** are recessed in the openings **12** or allowed to protrude from the openings, or if the inserts **35** carry a protruding or recessed decoration **36,** the decoration, recess or

protrusion will form a corresponding surface texture through the cementitious or similar coating applied to the wall surface.

As is shown in FIG. 8, various panels 38 can be attached to the apertured wall with the use of support brackets 39. The support brackets 39 can take various different configurations, and the example shown comprises a pair of U-shaped straps 40 and 41 having legs 42 and support bars 44, and spacers 45 extend between the support bars and a bracket spans the spaces. V-shaped tabs 48 are punched outwardly from legs 42. When support brackets 39 are inserted into the openings 12 of the wall structure, legs 42 will engage the ends of the blocks in the course of blocks, and the V-shaped tabs will tend to prohibit the support brackets 39 from moving outwardly of the openings 12 by gouging the ends of the blocks.

Panel 38 has an inverted bracket 50 that comprises a downwardly extending flange 51 with mates with bracket 46 of support bracket 39. Thus, panel 38 can be hung from a support bracket 39, which places the panel in juxtaposition with respect to the side of the wall structure.

Panels 38 can be fabricated with virtually any dimensions; however, if a continuous wall surface is to be fabricated by the use of panels 38, the panels most conveniently should be of a width which corresponds to the length of a single building block 11 and opening 12 or to the length of a multiple number of building blocks and spaces. With this arrangement, once the number of building blocks in a course of blocks is determined, the contractor can order a corresponding number of panels 38 and support brackets 39. If there is any misalignment in the wall structure, or if the panels 30 are not properly sized, the arrangement of bracket 50 on the back of each panel 38 and of the bracket 46 of the support brackets 39 is such that the panels 38 can slide with respect to their support brackets 39 to move along the length of the wall structure. This provides a flexibility that may occasionally be needed when connecting the panels to the wall structure.

While only one support bracket 39 is shown in FIG. 8, two or more support brackets can be utilized to support panels 38 that cover more than one opening 12 along the length of the wall structure, and support brackets 39 can be inverted so that their brackets 46 face in a downward direction and the brackets can be inserted in a low opening 12 in the wall structure and attached to a corresponding bracket 50 attached to the panel 38 to connect the panel to the wall structure adjacent both its upper and lower ends. Even with this arrangement, the panels would be moveable along the length of the wall structure.

While panel 38 is illustrated as being a single sheet of wood, it will be understood that the panel can be laminations of various materials, including wood, plastic, fabric, etc. Moreover the arrangement is such that the panels can be readily attached to or detached from the wall so that the decor of the wall can be altered from time to time if desired.

As is shown in FIG. 10, a flexible wall covering 50 can be applied to the wall surface. A support bracket 51 is utilized which is somewhat similar to support bracket 39 of FIG. 8, but includes a horizontal support bar 52 that has a plurality of V-shaped tabs 54 punched from its surface. When support bracket 51 is inserted into an opening 12 in the wall structure, the flexible wall covering 50 is attached to bracket 51 by impaling the inside surface of the fabric on the V-shaped tabs 54. An alternate arrangement would be to attach a rigid support bar directly to the flexible wall covering 50 and hang it on the horizontal support bar 52.

The flexible wall covering 50 can comprise virtually any flexible material, including a tufted fabric such as a carpet, or a woven fabric such as a tapestry.

As is best shown in FIG. 9, the openings 12 of the wall structure can be fitted with screens 56. The screens 56 are mounted about rectangular frames 58 so that they are properly stretched within openings 12. The V-shaped tabs 59 would retain the screen material on the frame and prevent the frame from being removed from the openings of the wall structure.

As is best illustrated in FIG. 11, the end surfaces 60 of each building block 11 can be formed with a vertical slot 61, and a panel 62 inserted down into the slots 61 of adjacent blocks 11. Panels 62 would be inserted into their respective slots 61 as the wall structure was being initially assembled. The panels could comprise an opaque substance, such as wood or plastic, or could comprise a translucent or transparent material, such as glass, or clear plastic.

When the wall structure is decorated in the matter illustrated in FIGS. 7, 8, 9, 10, or 11, the result is that an attractive wall structure is expediently and inexpensively assembled. The basic apertured wall structure forms a versatile and flexible support structure for the attachment of the various inserts and panels disclosed herein and various other devices which would be obvious to one skilled in the art.

As is illustrated in FIG. 4, building block 65 is provided which enables the contractor to provide either an apertured wall structure or a closed wall structure. The end 1/3 portions of the block can be placed in overlying relationship in a manner similar to that shown in FIG. 1 and 6, and the tubular inserts 20 can be inserted into the circular openings 66 of the blocks to form the apertured wall structure. The wedge members 21 can be inserted into the flat sided openings 68 to assure the precise construction of the wall structure. If the contractor decides to form a closed wall structure the blocks 65 can be arranged so that each block abuts the next adjacent block in its own course of blocks. Since circular openings 66 and flat sided openings 68 are located in each 1/3 portion of the block, the circular and flat sided openings of blocks in different courses of blocks will be in alignment with one another. Of course, while only three circular and three flat sided openings are shown in the block of FIG. 4, it should be obvious that the block can be formed with its length four or five more times its width and the same principal of construction can be utilized. This same proportional adjustment is available in the blocks shown in the remaining figures.

While this invention has been described in detail with particular reference to preferred embodiments thereof, it will be understood that variations and modifications can be effected within the spirit and scope of the invention as described hereinbefore and as defined in the appended claims.

I claim:

1. A wall structure comprising a plurality of substantially identical rectangular building blocks each having substantially impervious planar side wall and end wall surfaces and planar top and bottom wall surfaces with

the length of each block being four times its width, said blocks each defining a substantially vertical generally circular opening extending therethrough from its top wall to its bottom wall surfaces centrally in each end one-fourth portion thereof, said blocks being arranged in a series of horizontal courses of blocks with each block in each course of blocks being spaced from the next adjacent blocks in its course and having its planar top wall and bottom wall surfaces overlying and in abutment with the next adjacent blocks in the courses of blocks next above and next below by one-fourth of its length at each of its ends and with the circular openings in each end one-fourth portion thereof being in alignment with the circular openings of its overlying blocks, radially expandable tubular inserts defining a slot from end-to-end positioned internally of said wall structure in at least some of said circular openings and extending between adjacent courses of blocks and expanded outwardly into engagement with the surfaces of said openings, columns of solidified cementitious substance at least partially filling some of said tubular inserts, the openings in the wall structure between the blocks in each course of blocks being substantially equal in size and shape and substantially equally spaced along the length of each course of blocks, and wall opening inserts positioned in at least some of said wall openings defined between the blocks in each course of blocks, said wall opening inserts being sized and shaped to substantially close said wall openings.

2. The wall structure of claim **1** and wherein the blocks are all arranged in a single vertical plane.

3. The wall structure of claim **1** and wherein the blocks are arranged in intersecting wall sections.

4. The invention of claim **1** and wherein said blocks each define vertical slots in their end surfaces, and said inserts are retained in said openings by said slots.

5. The invention of claim **1** and wherein said wall opening inserts comprise substantially impervious block members.

6. The invention of claim **1** and wherein said wall opening inserts comprise a light and air pervious block members.

7. The invention of claim **1** and wherein said wall opening inserts comprise screen members pervious to light and air.

8. The invention of claim **1** and wherein said wall opening inserts comprise transluscent members.

9. The invention of claim **1** and wherein said wall opening inserts comprise a support member, and further including panel members larger than said wall openings connected to said support members and covering a portion of the side of said apertured wall structure.

10. The invention of claim **9** and wherein said panel members comprise substantially rigid planar structures of a width approximately equal to the length of one of said blocks and one of said openings.

11. The invention of claim **9** and wherein said panel members comprise flexible sheets.

12. The invention of claim **9** and wherein said panel members are of a width at least equal to the length of said blocks.

13. The invention of claim **9** and wherein said panel members comprise a lamination of substantially rigid material positioned adjacent the surfaces of the blocks and a soft material positioned adjacent the rigid material.

14. A wall structure comprising a plurality of substantially identical rectangular building blocks each having planar side wall, end wall, top wall and bottom wall surfaces, with the length of each block being at least three times its width, said blocks each defining a substantially vertical generally circular opening extending therethrough from its top wall to its bottom wall surfaces centrally in each end portion thereof, said blocks being arranged in a series of horizontal courses of blocks with each block in each course being spaced from the next adjacent blocks in its course and overlying at each of its ends the adjacent blocks in the courses of blocks next above and next below and with the circular openings in each end portion thereof being in alignment with the circular openings of its overlying blocks, the spaces in the wall structure between the blocks in each course of blocks being substantially equal in size and shape and substantially equally spaced along the length of each course of blocks, radially expandable approximately cylindrical tubular inserts positioned in the circular openings of at least some of said blocks and extending internally within the blocks between adjacent courses of blocks and expanded radially outwardly into contact with the surfaces of the circular openings of said blocks, columns of solidified cementitious substance at least partially filling some of the tubular inserts and locking said tubular inserts in their expanded positions against the surfaces of the circular openings, and wall opening inserts positioned in at least some of said spaces defined between the blocks in the wall structure, said wall opening inserts being sized and shaped to substantially fill said spaces.

15. The wall structure of claim **14** and wherein each of said blocks include flat sided openings merging with its circular openings, the flat sided openings of each block being aligned with a flat sided opening of the adjacent blocks in the courses of blocks above and below in the wall structure, and wedge members extending internally between the courses of blocks and into at least some of the aligned flat sided openings of the blocks.

16. The wall structure of claim **14** and wherein said tubular inserts each define an open ended slot along its length.

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