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Stout

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[54] **METHOD FOR MAKING CAST-IN-PLACE CONCRETE STRUCTURES**

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[51] **Int. Cl.** **B23p 19/04**

[58] **Field of Search** 29/433; 249/83, 84; 52/105, 99, 100, 220, 607, 221, 309, 381, 383, 576, 577; 264/35, 263, 273

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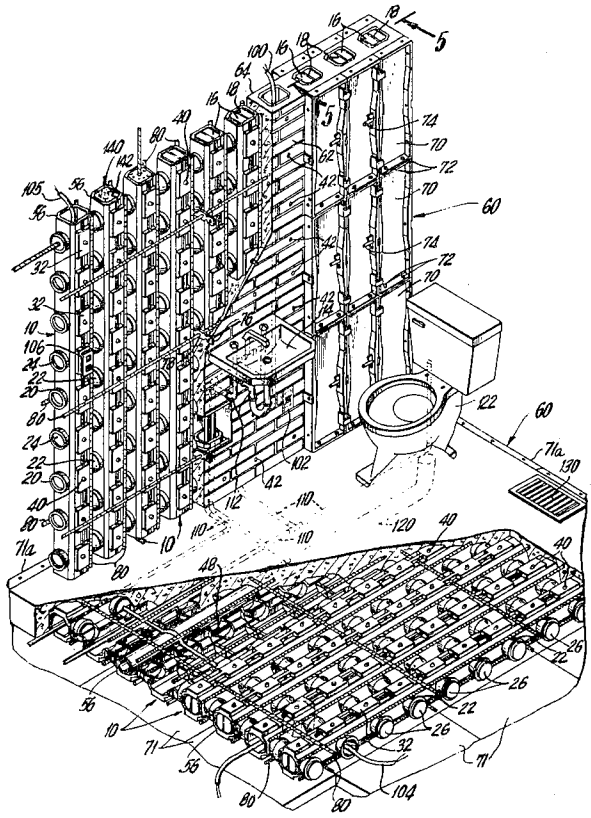
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Assistant Examiner—Victor A. DiPalma
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[57] **ABSTRACT**

A method for making a cast-in-place concrete structure comprises the steps of forming an arrangement of concrete forms; placing a plurality of void creating 09181990 within the confines of and spaced from the concrete forms, each of the void creating devices being an elongated hollow member made of frangible material, and having at least one opposed pair of projections, with the respective projections of adjacent devices within the confines of and spaced from the nal communication between said devices, and with the ends of the devices and the non-abutting projections thereof extending to the periphery of the concrete forms; and pouring uncured concrete into the spaces in and around and in intimate contact with the void creating devices, and allowing the concrete to cure. Subsequently, the frangible ends and exposed projections of the void creating devices may be knocked out in order to provide access into the labyrinth of passageways defined by the hollow devices within the interior of the composite concrete structure. The void creating devices are preferably made of an insulating material, thereby resulting in a one-process system for achieving a one layer, composite, self-insulated concrete construction unit, and which enables the unit to be integrally finished on both sides.

17 Claims, 6 Drawing Figures



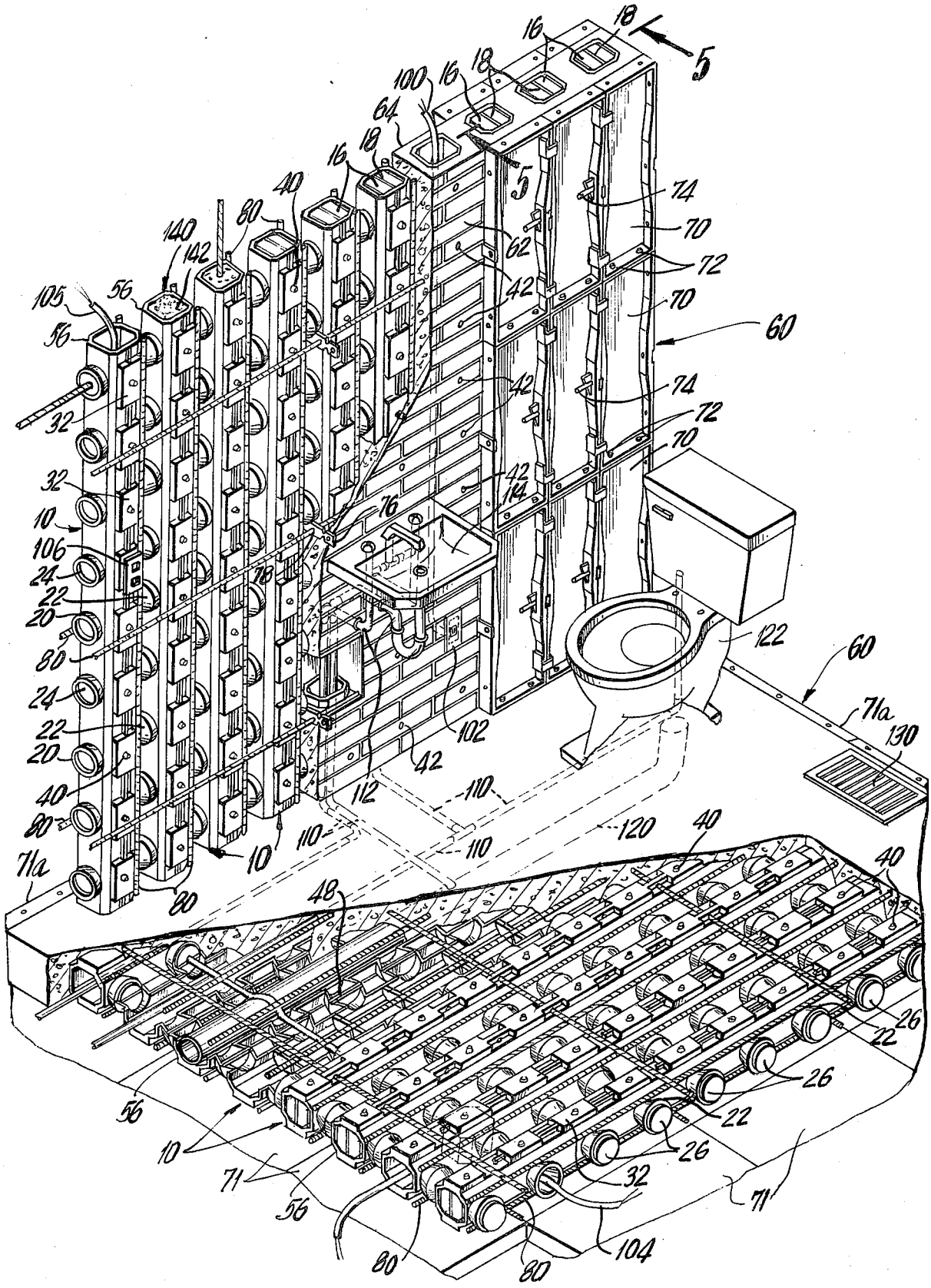

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FIG. 1

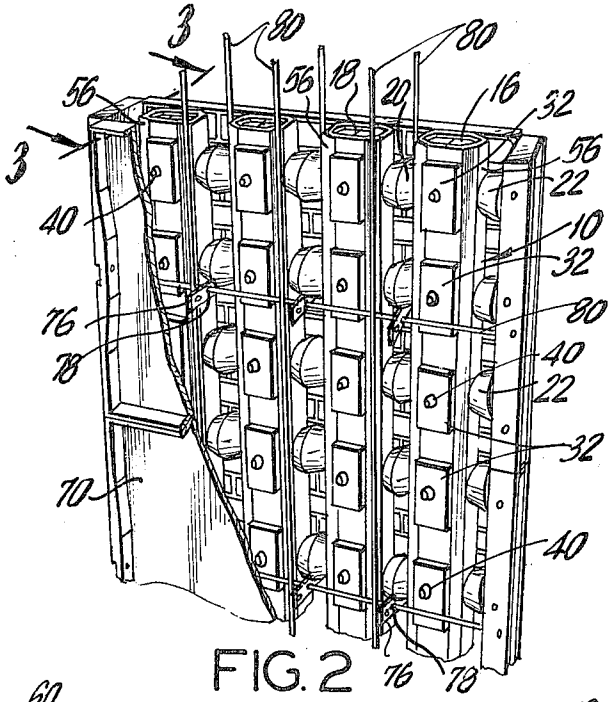


FIG. 2

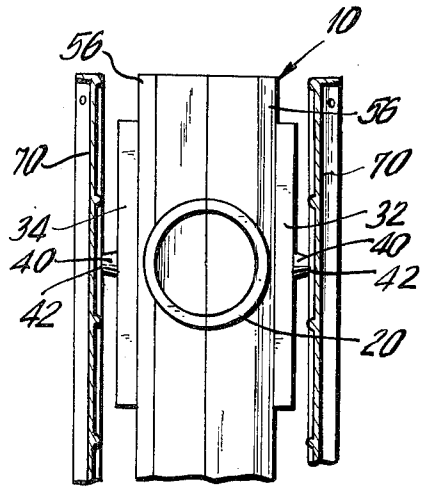


FIG. 3

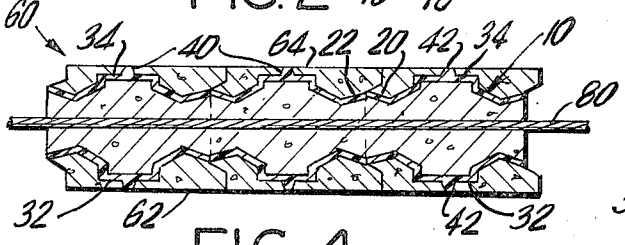


FIG. 4

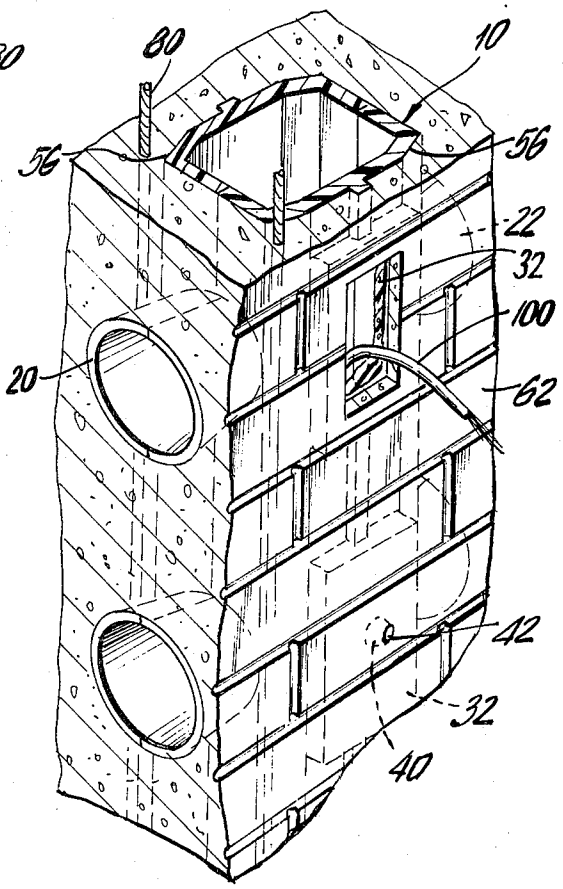


FIG. 6

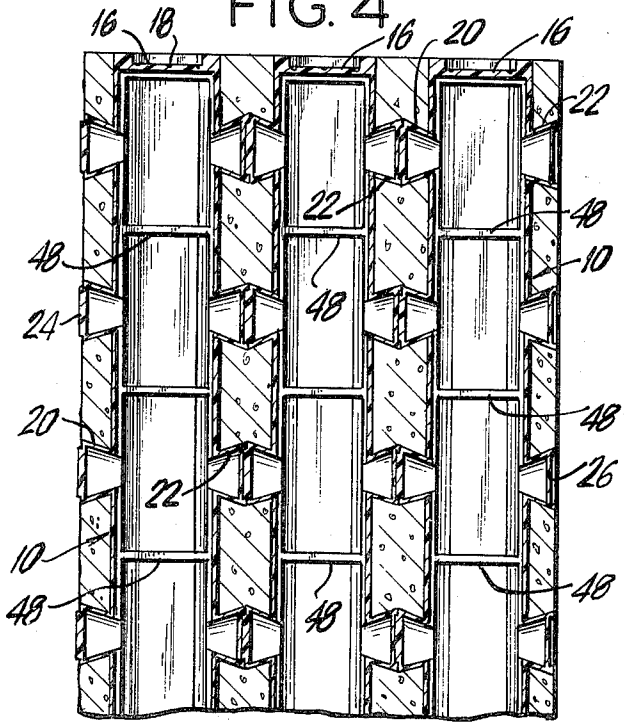


FIG. 5

METHOD FOR MAKING CAST-IN-PLACE CONCRETE STRUCTURES

CROSS-REFERENCES TO RELATED APPLICATIONS

The subject invention is related to the following corresponding applications of the applicant: 1. U.S. application Ser. No. 399,087, filed Sept. 20, 1973 and entitled "CONCRETE STRUCTURE INCLUDING MODULAR CONCRETE BEAM AND METHOD OF MAKING SAME"; and 2. U.S. application Ser. No. 487,604 filed 7/11/74 and entitled "VOID CREATING DEVICE TO BE EMBEDDED IN A CONCRETE STRUCTURE"; the disclosures of which are incorporated herein by reference.

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates to a new and useful process for making a cast-in-place concrete structure which is made of a single layer, self-insulating, of composite construction, and which may be finished on both surfaces thereof, and which is specifically characterized by an internal labyrinth of passageways, extending in three mutually orthagonal directions in order to accomodate utility service lines and the like, as well as to accomplish a multitude of basic uses and functions, as more specifically set forth below.

It is well known that voids in a concrete construction unit such as cored floor slabs, for example, have been known in the construction industry, and provide the benefits of improved weight-strength ratio by reducing unnecessary concrete in the construction unit, and simultaneously reducing the weight of the concrete unit. Other benefits which may be obtained to some degree is the limited insulation value of the simple core unit, as well as the ability to duct utility service lines through the single core units which usually extend in one direction and are of basic shape such as round, square or rectangular.

Prior art attempts to make a concrete structure having voids therein utilizing a cast-in-place process have employed complicated apparatus, including heavy construction equipment, and inefficient methods of construction which make such systems uneconomically feasible. Processes to achieve a two directional void system have involved even more complicated apparatus, skilled labor, inefficient techniques, and have been generally commercially unacceptable.

The present invention overcomes the shortcomings of the prior art techniques and provides a simple, efficient, and low cost method of creating a cast-in-place concrete construction that is of composite construction, self-insulated, finished on both sides, and includes an internal labyrinth of passageways extending in three mutually orthagonal directions for accomodating utility service lines internally of the construction unit. In addition, the method of the subject invention results in a concrete structure having an improved weight-strength ratio, while simultaneously achieving a reduction of unnecessary weight and mass of concrete, to the extent of reducing the mass of concrete by as much as 66⅔ percent, as contrasted to a completely solid concrete structure. In addition, utilizing the method of the subject invention the resulting concrete structure inherently achieves effective insulation of the concrete structure to meet the requisite insulating requirements,

increased fire rating, more efficient sound transmission properties, and accomplishes these results with reduced labor requirements, reduced material requirements, and reduced elapsed time for the construction of the concrete structure, all of which result in significant cost reductions in the making of the concrete structure.

These and other advantages and objectives are achieved by the process of the subject invention which basically comprises the steps of forming an arrangement of concrete forms to define the peripheral dimensions of the concrete structure, placing a plurality of hollow void creating devices within the confines of said concrete forms, each void creating device being an elongated hollow member made of frangible material having at least one pair of opposed projections intermediate its length, with the respective projections of adjacent devices abutting one another in order to enable communication between the devices, and with the frangible ends of the devices and the non-abutting projections thereof extending to the peripheral edges of said concrete forms; and the further step of forming the concrete structure by pouring uncured concrete into the spaces between the concrete forms and the void creating devices, and allowing the concrete to cure. After the concrete has cured, the concrete forms may then be removed, and the exposed frangible ends and exposed frangible projections of the embedded void creating devices may then be knocked out or removed thereby providing access to the labyrinth of passageways created within the composite concrete structure. In addition to providing access through the vertical and horizontal edges of the concrete structure, portions of the concrete structure in the facing walls thereof may be removed in the vicinity of other frangible projections of the void creating devices, thereby resulting in three-dimensional access from the exterior of the resulting concrete structure to the interior thereof. Service and utility lines may then be ducted through the concrete structure, and if desired, the passageways defined by the void creating devices may be employed as internal plenums for conducting heating and cooling fluid flows. Furthermore, the void creating devices may be made of an insulating material, whereby the resulting composite concrete structure may thereby be self-insulating, both from the inherent properties achieved by the material of the void creating devices, as well as the "dead air" space disposed within the concrete structure. The concrete forms may be suitably configured so as to result in an aesthetically finished concrete structure. Furthermore, certain passageways within the structure may be filled with concrete in order to define internal concrete beams and columns for meeting the structural requirements of concentrated loads and specific area strength requirements of the structure without the necessity of the entire structure being designed to carry the loads.

The step of employing void creating devices in the subject process provides the beneficial effects of achieving an internal labyrinth of conduits in the resulting concrete structure; provides means by which steel reinforcing rods within the concrete construction can be precisely and exactly located prior to the pouring of the uncured concrete; reduces to a maximum the amount of unnecessary concrete while enabling the precise control of the amount and location of concrete cover around the reinforcing steel; helps maintain the

reinforcing steel in position during the pouring of the uncured concrete; and assists during the curing of the concrete in order to achieve optimum strength in a minimum of time.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view, partially in section, depicting the several stages involved in the method of the subject invention for making a concrete structure;

FIG. **2** is a perspective view of apparatus employed in the subject process preparatory to the step of pouring the uncured concrete;

FIG. **3** is a sectional view of the apparatus taken along line **3—3** in FIG. **2**;

FIG. **4** is a horizontal sectional view through a portion of a concrete wall made according to the subject process wherein an internal reinforcing beam is provided;

FIG. **5** is a vertical sectional view of a concrete wall made according to the subject process and taken along line **5—5** in FIG. **1**; and

FIG. **6** is a vertical perspective view of a portion of a concrete wall made according to the subject process wherein access to the labyrinth of passageways within the concrete wall is effected through a portion of the concrete wall.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Before describing the several embodiments of the subject invention it should be noted that although the detailed description refers to the building structure as a house, any other type of enclosure which may be made utilizing concrete structures as defined by the subject process may be made according to the teaching of the invention. Accordingly, it is contemplated that building structures such as industrial buildings, warehouses, apartment houses, stores, and the like are included within the scope of the invention.

One of the steps in the subject process for making a cast-in-place concrete structure is the placing of void creating devices within the confines of and spaced from concrete forms. Prior to describing in detail the subject process, a brief description follows relative to the construction of such void creating devices. Each device, designated by the numeral **10,** is of an integral, molded construction and made of a frangible material such as polystyrene foam. Each device may be made of two elongated interfitting sections, and is a generally elongated, hollow member of generally rectangular cross section, which is closed at its opposed ends by means of baffles **16, 16.** The latter may have lines **18** of reduced thickness in order to facilitate the removing or knocking out of the end baffles when it is desired to gain access to the interior of the resulting concrete structure for the passage of service lines or the like, as more fully described hereinafter.

Disposed intermediate the length of the device **10** is at least one pair of opposed projections **20, 22** that are hollow and include closure baffles **24** and **26** respectively, that may likewise be knocked out or removed in order to enable passage of service lines into the interior of the void creating device **10.** The opposed projections **20** and **22** are configured in a tongue and groove configuration in order to enable the interconnection and interfitting of adjacent void creating devices **10.**

In addition to the first set of projections **20** and **22,** a second set of opposed projections **32** and **34** may be provided on the other opposed sides of the void creating device **10.** Projections **32** and **34** may be of any suitable configuration, and are illustrated as being generally rectangular, and are usually positioned so as to face the opposed surface walls **62** and **64** of the resulting concrete structure **60.**

In order to maintain the void creating device **10** at the desired location within the concrete forms during the process of the subject invention, the void creating device **10** may be provided with the plurality of spacer elements **40** that are integrally formed with the opposed projections **32** and **34.** Preferably, each spacer element **40** is of a generally truncated conical configuration, having a relatively small, flat end portion **42** which normally abuts against the concrete form **70** (see FIG. **3**) for maintaining the device **10** in proper position during the forming of the resulting concrete structure **60.**

Disposed internally of the void creating device **10** are internal baffles **48** which extends transverse to the longitudinal axis of the device, and which function to compartmentalize the interior of the void creating device. Each baffle **48** may also include reduced thickness lines which define lines of weakness in order to facilitate the knocking out of the internal baffles **48** when it is desired to duct service lines or the like therethrough.

The corners of the cross-section of the void creating device **10** are preferably bevelled, as designated by numeral **56.** Bevelling of the corners facilitates the positioning of reinforcing rods **80** which extend parallel to the longitudinal axis of the void creating device and which are disposed in positions adjacent to the corners **56.** The bevelled corners also ensure the proper amount of concrete covering over the reinforcing rods. Further details of the void creating device **10,** and modifications thereof are fully disclosed in applicant's copending United States application Ser. No. 487,604, filed July 11, 1974 and entitled "Void Creating Device To Be Embedded In A Concrete Structure."

In the process of the subject invention, the first step is to form an arrangement of concrete forms to define the periphery of the concrete structure. Referring to FIGS. **1** and **2,** two-spaced concrete forms may be provided by the interconnection of the plurality of concrete forms **70** that are interconnected by means of bolts **72** and/or bold and wedge means **74,** with the concrete forms being retained in spaced relationship by means of wall ties **76.** The latter may be constructed to include apertures **78** through which reinforcing bars **80** may extend for maintaining the latter in position prior to the pouring of uncured concrete, as more fully described hereinafter.

In order to achieve a completed concrete structure **60** that is finished on both exterior wall surfaces, preferably the concrete forms **70** are of the type which include a finished pattern, illustrated as a brick pattern in FIGS. **1** and **2,** whereby the resulting concrete structure merely requires decorative painting. Other patterns may also be provided on the concrete forms such as adobe patterns, smooth surface, and intaglio patterns.

For the making of a horizontal wall structure, such as the foundation or intermediate floors of a building structure, a plurality of concrete forms **71** may be interconnected to define the base of the form structure, and

the sides of the resulting concrete structure may be defined by upstanding concrete forms, designated **71**a in FIG. **1.** The combination of the forms **71** and 71a define the periphery of the generally horizontal concrete structure **60.**

After the concrete forms are in place, the next step in the subject process is to place a plurality of void creating devices **10** within the confines of the concrete forms, and spaced from the interior wall surfaces thereof. As illustrated in FIG. **3,** the spaced elements **40** of the void creating device **10** abut the interior surfaces of the concrete forms **70,** thereby maintaining the void creating device in an exact and precise position in order to insure the uniform distribution of the uncured concrete about and in intimate contact with the external surfaces of the void creating devices. The plurality of void creating devices are interconnected by means of the respective tongue and groove projections **20** and **22,** as shown in FIGS. **1** and **2.** The baffle ends **16** of the devices extend to the periphery of the concrete form, and the non-abutting projections **20, 22** also extend to the periphery of the concrete form. In other words, the end projections **20, 22** are in contact with the periphery of the concrete form, the end baffles **16** are exposed or in contact with the concrete form, and the ends **42** of the spacer elements **40** are in contact with the concrete forms **70.** The dimensions of the void creating devices, as well as the spacing of the concrete forms, is suitably designed so as to insure sufficient concrete around and intimate contact with each void creating device so as to meet the structural requirements of the resulting concrete structure **60.**

As shown in FIGS. **1** and **3,** suitable reinforcing steel in the form of reinforcing bars **80** may be provided to extend in generally orthagonal directions within the concrete forms **70.** The vertical extending reinforcing bars **80** are preferably positioned and spaced from the bevelled corners **56** of the void creating devices **10** to ensure proper concrete coverage, while the horizontal reinforcing bars may be supported by passage through the apertures **78** in the wall ties **76.** Alternatively the bars **80** may bear against projecting portions of the devices **10,** and in so doing aid in the positioning of the devices **10** within the forms **70.**

The next step in the subject process is the forming of the concrete structure by pouring uncured concrete into the spaces defined between the concrete forms **70** and the void creating devices **10** so as to embed the void creating devices **10** within the concrete except for the end baffles **16,** and the non-abutting projections **20,** 22. As the uncured concrete is poured into the spaces between the concrete form **70** and the void creating devices, it flows in and around the extending projections **20, 22** and is in intimate contact with the void creating devices **10,** thereby resulting in a unitary, continuous concrete structure that has embedded therein the void creating devices **10.** The composite arrangement of the concrete and the void creating devices provides the new and unusual construction of a composite concrete structure, with the insulation properties being provided by the combination of the void creating devices (which are preferably made of an insulating material such as polystyrene), and the "dead air" space which is embedded within the resulting concrete structure **16** by virtue of the hollow interiors of the void creating devices. Those hollow interiors also define the labyrinth of passageways which enable the ducting of utility service lines and the like through the concrete structure, as described below.

The uncured concrete is allowed to cure to a sufficient degree, after which the concrete forms **70** are removed, and since such forms as provided with a patterned form surface, such as brick, the resulting concrete structure is both structurally and aesthetically complete.

Referring particularly to FIG. **1,** numeral **100** designates an electrical cable that may be extended through the hollow interior of a void creating device in order to provide electricity to an outlet, indicated by numeral **102.** After the concrete structure **60** has cured, the end baffle **16** of the void creating device **10** is knocked out or removed, as well as the internal baffles **48** in order to enable the cable **100** to be passed downwardly through the concrete structure **60.** To provide access to the hollow interior of the void creating device in order to connect the cable **100** to the outlet **102,** it is merely necessary for the mechanic to remove that portion of the concrete wall **62** in the vicinity of the projection **32** extending from the void creating device **10.** Reference is made to FIG. **6** which illustrates the opening through the concrete structure **60** created by the mechanic so as to provide access through the face of the concrete wall **62** to the interior of the void creating device. Cable **100** is then pulled through the opening, after which the outlet **102** is connected to the cable and the outlet is then suitably affixed to the wall of the concrete structure **60.** By this arrangement, there is achieved the ducting of electrical service lines internally of the concrete structure.

An electric cable, or for that matter any other utility service line, may also extend transverse to the longitudinal axes of the void creating devices as embedded in the concrete structure. Referring to FIG. **1,** electrical cable **104** is ducted through a plurality of void creating devices by the mechanic merely knocking out the exposed end baffle **26,** and thereafter removing the baffles of the projections **20, 22** of abutting void creating devices in order to extend through the floor of the concrete structure, such as a house. The cable **106** is then ducted upwardly through the floor and through the hollow interior of a vertically disposed void creating device to reach outlet **106** that is provided in the wall structure in the same manner as outlet **102.** From outlet **106,** additional wiring **105** may extend vertically upwardly through the same void creating device.

In like manner, other utility service lines such as water pipes **110** may be ducted transversely and longitudinally within the concrete structure, as illustrated in FIG. **1.** In addition, the water pipes may extend through the wall **62** by the removal of the thinner portions of the concrete in the vicinity of projections **32** and **34.** This is illustrated in FIG. **1** wherein the plumbing pipes **112** for servicing the sink **114** extend through the wall **62** of the concrete structure **60** in order to connect to the vertically extending pipes **110.** The provision of the opposed projections **32** and **34** which are positioned so as to face the opposed walls **62** and **64** of the concrete structure, insures that the concrete coverage is less in the vicinity of said opposed projections **32, 34,** but is still sufficient for structural purposes. The walls **62** and **64** may readily be broken through in order to achieve the desired three-dimensional access to the labyrinth of passageways defined by the void creating devices **10** as embedded in the concrete structure **60.** As also illus-

trated, the sanitary service line **120** for the toilet **122** may likewise be ducted through the labyrinth of conduits defined by the void creating devices within the concrete structure.

Since the void creating devices **10** are made of a frangible, insulating, waterproof, inorganic, and inert material, selected baffles **16, 20, 22** and internal baffles **48** may be removed in order to create ducting which defines a plenum conduit whereby heating or cooling air may be passed, for ultimate distribution to the house structure through registers, such as indicated at **130** in FIG. **1.**

Accordingly, as is readily apparent from FIG. **1,** three dimensional access to the interior of the resulting composite concrete structure is readily achieved by merely knocking out selected portions of the void creating devices. More particularly, with respect to the upstanding wall illustrated in FIG. **1,** vertical access is achieved by knocking out end baffles **16** of the devices **10**; transverse access is achieved by knocking out the respective baffles of projections **20** and **22**; and in the third mutually orthagonal direction by cutting into the face of a wall **62, 64** of the concrete structure, and then through a respective projection **32, 34** to the interior of the void creating device. Because of the interfitting of the abutting projections **20** and **22** of the adjacent devices **10,** a complete three-dimensional labyrinth of passageways within the resulting concrete structure **60** is provided.

FIG. **5** is a cross sectional view through the completed concrete structure **60** to illustrate the internal labyrinth of passageways. As noted above, it is merely necessary to knock out the interfitting tongue and groove baffles of the projections **20** and **22,** and the internal baffles **48** in order to create passageways within the concrete structure **60.**

For certain applications where the concrete structure is to be locally reinforced, such as by means of a vertical post or a horizontal beam, a vertical or transverse passageway within the structure may be created by knocking out the respective frangible portions of the void creating devices, and the passageway then subsequently filled with uncured concrete that is allowed to cure. As illustrated in FIG. **4,** in order to create a horizontal beam, such as header for a doorway, or over a window opening, the respective tongue and groove projections **20, 22** may be knocked out and concrete then forced through the horizontal passageway, and allowed to cure. The internal baffles **48** function to limit the concrete to the desired area of the respective devices **10.** In like manner, in order to form a vertical post, as for example in the void creating device (designated **140**) of the vertical wall illustrated in FIG. **1,** it is merely necessary to knock out baffle **16** and internal baffles **48** within said device, and subsequently filling said device with concrete **142,** and allowing the concrete to cure. Such may be desirable in a case where the vertical wall is to support a second floor or next higher floor of the building.

In summary, the subject invention provides a single process for constructing a concrete structure formed of a composite of concrete and void creating construction devices, which concrete structure is self-insulating, of single layer construction, and may be finished on both surfaces, and is characterized by an internal void system that extends in three mutually orthagonal directions so as to enable the internal ducting of utility service lines therein, and which additionally provides the advantages of increased strength-weight ratio, with significant decreases in the amount and weight of concrete required. The void creating devices remain an integral part of the concrete structure and are made of an insulative material that renders the construction unit self-insulating. Furthermore, the thickness of the devices may be varied to meet any thermal requirement, and the hollow device inherently creates dead air space in the finished constructuon unit which in itself is an important insulator.

The subject process is economical, especially from the standpoints of time, material, and labor, and results in a superior concrete structure that may be employed in any form of building, including houses, commercial buildings, industrial buildings, and the like. The process of the subject invention results in a construction unit that has been the age old dream of the construction industry, and is now provided by means of the subject invention.

What is claimed is:

1. A method for making a cast-in-place concrete structure comprising the steps of:

forming an arrangement of concrete forms to define the periphery of the concrete structure;

placing a plurality of void creating devices within the confines of and spaced from said concrete forms, each device being an elongated hollow member made of frangible material, and having at least one opposed pair of projections intermediate its length, with the respective projections of adjacent devices abutting one another in order to enable communication between said devices, and with the ends of the devices and the non-abutting projections thereof extending to the periphery of said concrete forms; and

forming the concrete structure by pouring uncured concrete into the space defined between said concrete forms and the void creating devices thereby embedding the void creating devices therein except for said ends of the devices and the non-abutting projections thereof, and allowing the concrete to cure.

2. A method for making a cast-in-place concrete structure as in claim **1** further including the step of knocking out an exposed end of a void creating device, and pouring uncured concrete into the hollow void creating device and allowing said concrete to cure in order to define a concrete beam within said concrete structure.

3. A method for making a cast-in-place concrete structure as in claim **1** wherein each void creating device includes two opposed sets of projections extending orthagonal to the longitudinal axis thereof, with one set of opposed projections extending parallel to the plane of the resulting concrete structure, and the second set of projections extending generally orthagonal to the plane thereof, and including the further step of removing a portion of the wall surface of said concrete structure in the vicinity of one of said second set of projections in order to provide access to the labyrinth of passageways within said concrete structure through the wall thereof.

4. A method for making a cast-in-place concrete structure as in claim **1** wherein each set of void creating devices is internally compartmentalized by means of internal baffles, and further including the step of creating a through conduit extending transverse to the axes

of said void creating devices by knocking out an exposed, non-abutting projection thereof, as well as the embedded projections in alignment with said nonabutting projection, and filling said through passageway with uncured concrete, and allowing said concrete to cure in order to form an internal concrete beam within said concrete structure.

5. A method for making a cast-in-place concrete structure as in claim **1** further including the step of placing elongated reinforcing bars along the length of the devices within the concrete forms prior to the step of pouring the uncured concrete.

6. A method for making a cast-in-place concrete structure as in claim **1** further including the step of placing reinforcing bars transverse to the longitudinal axes of said devices within the concrete forms prior to the step of pouring the uncured concrete.

7. A method for making a cast-in-place concrete structure as in claim **1** wherein said arrangement of concrete forms includes two-spaced concrete forms which are maintained in spaced relationship by wall tires having holes therein, and the further step of inserting reinforcing bars through the holes in the wall ties prior to the step of pouring the uncured concrete.

8. A method for making a cast-in-place concrete structure as in claim **1** including the additional step of removing the concrete forms, and knocking out the exposed frangible projections of the void creating devices in order to provide access to the labyrinth of passageways within said concrete structure.

9. A method for making a cast-in-place concrete structure as in claim **8** further including the step of ducting service lines through said labyrinth of passageways.

10. A method for making a cast-in-place concrete structure as in claim **1** wherein each void creating device includes a plurality of projections, disposed parallel to and transverse to the wall of the concrete structure, and including the further step of removing cured concrete in the vicinity of one of said projections in order to provide communication through the wall surface of the concrete structure to the labyrinth of passageways within the concrete structure.

11. A method for making a cast-in-place concrete structure as in claim **10** including the further step of knocking out the exposed ends of the devices and the nonabutting projections thereof thereby providing three dimensional access to the labyrinth of passageways within the concrete structure.

12. A method for making a cast-in-place concrete structure as in claim **11** further including the step of ducting service lines through said labyrinth of passageways.

13. A method for making a cast-in-place concrete structure comprising the steps of:

forming an arrangement of concrete forms to define the periphery of the concrete structure;

placing a plurality of insulating void creating devices within the confines of and spaced from said concrete forms, each device being an elongated hollow member made of an insulative, frangible material, and having at least one opposed pair of projections intermediate its length, with the respective projections of adjacent devices abutting one another in order to enable communication between said devices, and with the ends of the devices and the nonabutting projections thereof extending to the periphery of said concrete forms;

forming the concrete structure by pouring uncured concrete into the space defined between said concrete forms and the void creating devices so as to embed the void creating devices therein except for said ends of the devices and the nonabutting projections thereof, and allowing the concrete to be cured; and

removing the concrete forms, and knocking out the exposed frangible projections of the void creating devices in order to provide access to the labyrinth of the passageways within said concrete structure.

14. A method for making a cast-in-place concrete structure as in claim **13** further including the step of ducting service lines through said labyrinths of passageways.

15. A method for making a cast-in-place concrete structure as in claim **13** wherein each void creating device includes a plurality of projections, disposed parallel to and transverse to the wall of the concrete structure, and including the further step of removing cured concrete in the vicinity of one of said projections in order to provide communication through the wall surface of the concrete structure to the labyrinth of passageways within the concrete structure.

16. A method for making a cast-in-place concrete structure as in claim **15** including the further step of knocking out the exposed ends of the devices and the nonabutting projections thereof thereby providing three dimensional access to the labyrinth of passageways within the concrete structure.

17. A method for making a cast-in-place concrete structure as in claim **16** further including the step of ducting service lines through said labyrinth of passageways.

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