# United States Patent [19]

**Sandstrom et al.**

[11] **3,846,946**

[45] **Nov. 12, 1974**


[54] **PRECAST CONCRETE BUILDING CONSTRUCTION**


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[52] **U.S. Cl.** ..... **52/221,** 52/223 R, 52/606

[51] **Int. Cl.** ..... **E04b 5/48,** E04c 2/52

[58] **Field of Search** ..... 52/221, 220, 606, 600, 52/251, 250, 223 R



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*Primary Examiner*—Price C. Faw, Jr.

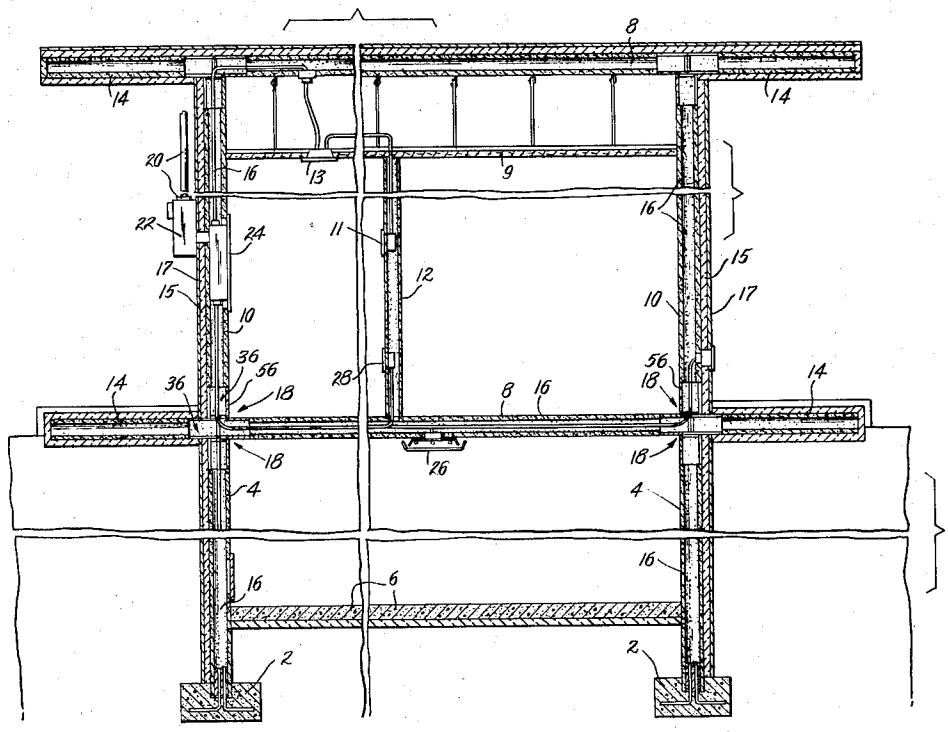
*Attorney, Agent, or Firm*—Bacon & Thomas



[57] **ABSTRACT**

Precast and stressed concrete slabs or panels having parallel openings therethrough are provided with integral spaced short beams extending outwardly from between openings and of a length a little greater than the thickness of the slabs. The slabs are arranged, in the building, with only the extending beams in engagement and secured together so the spaces therebetween provide access to the ends of openings in adjacent slabs, even if arranged at right angles, which facilitates placement, replacement or service of utility service components after the building is erected.


**10 Claims, 9 Drawing Figures**



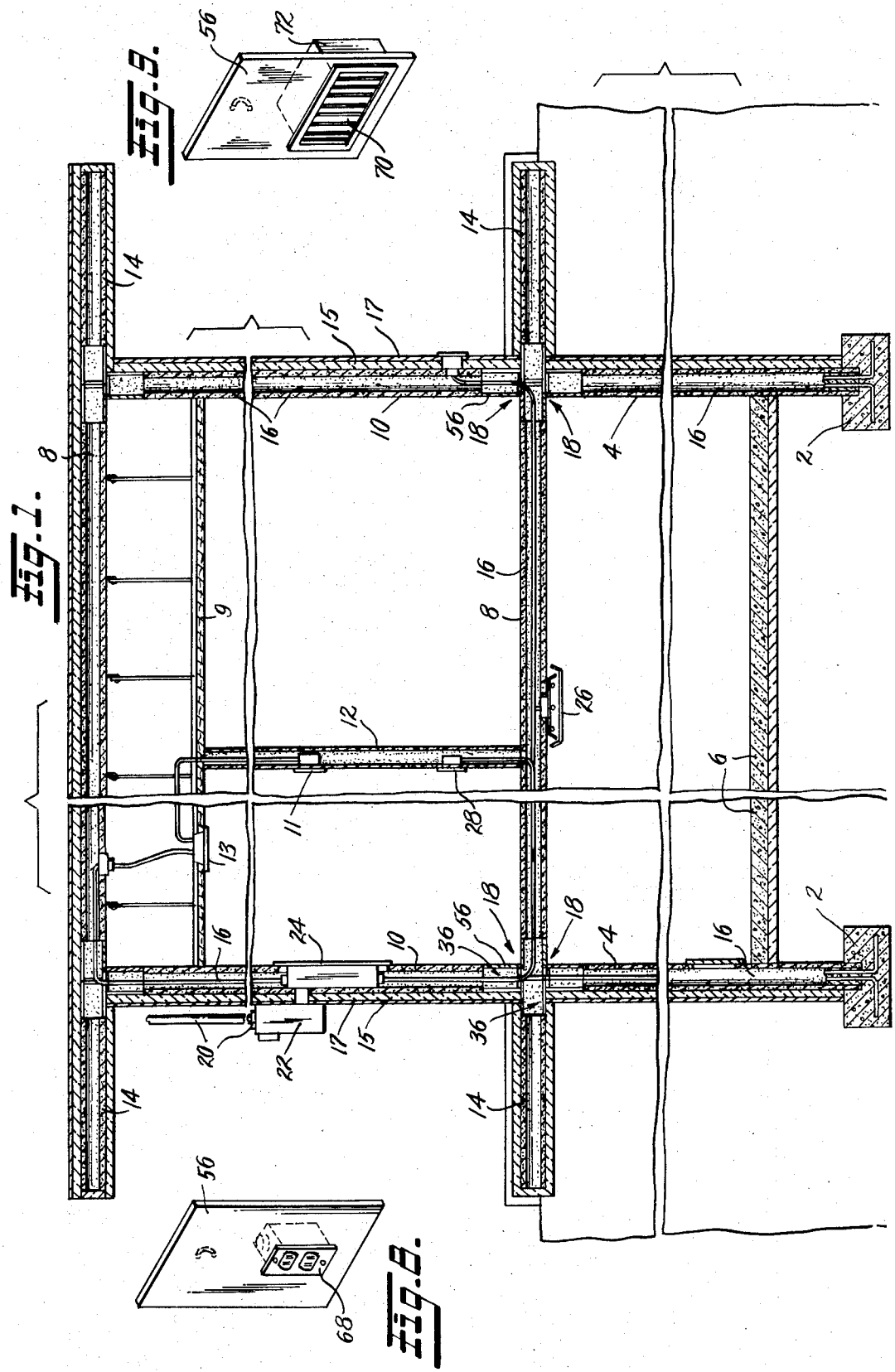



Fig. 1.

Fig. 2.

Fig. 3.

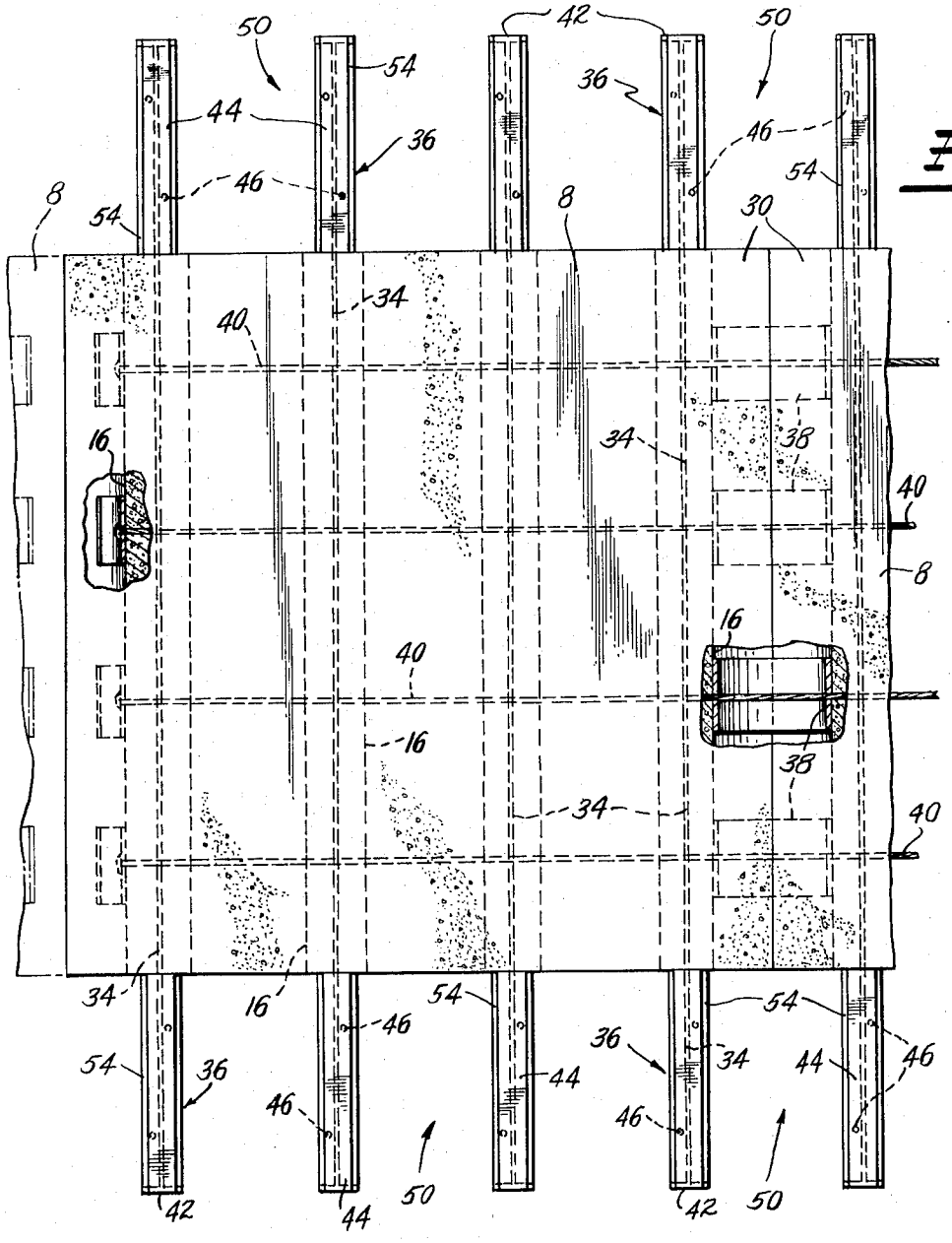

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Fig. 2.

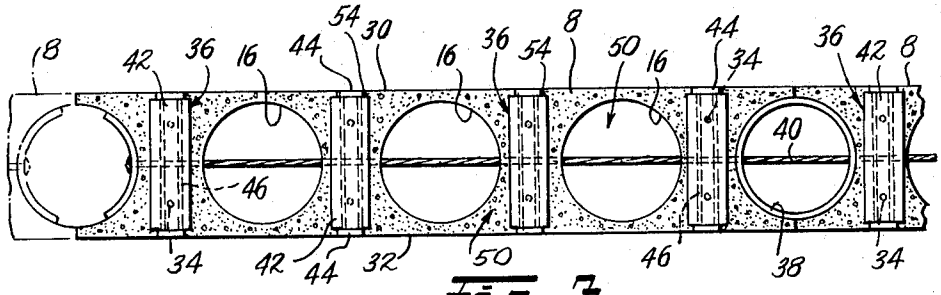

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Fig. 3.

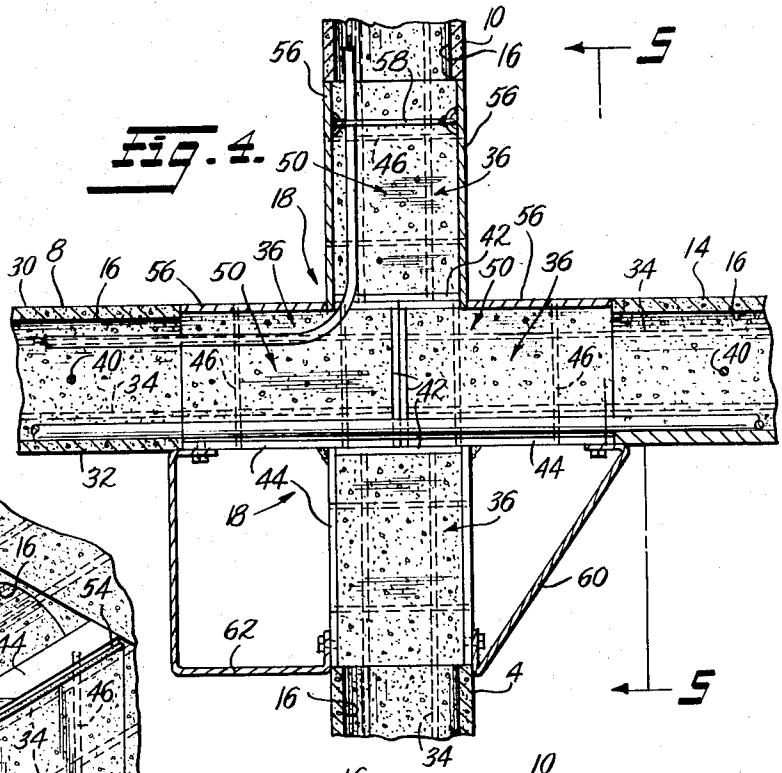



Fig. 4.

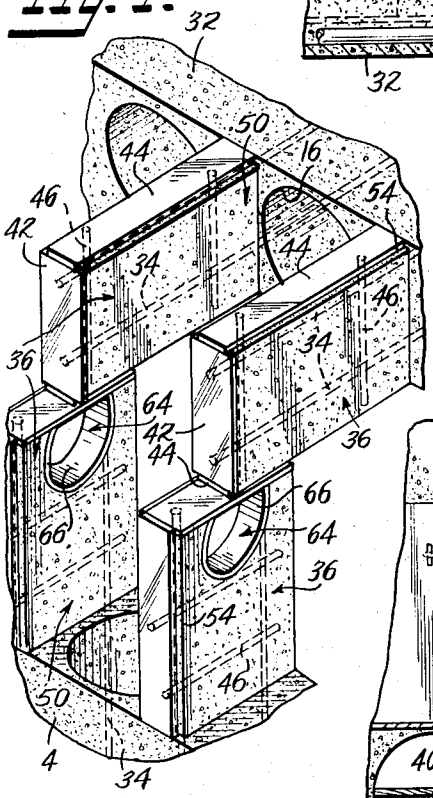



Fig. 7.

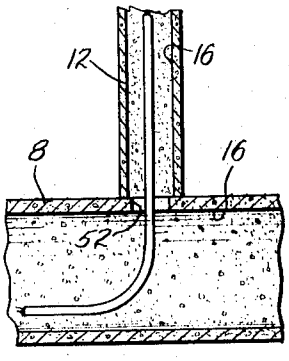



Fig. 6.

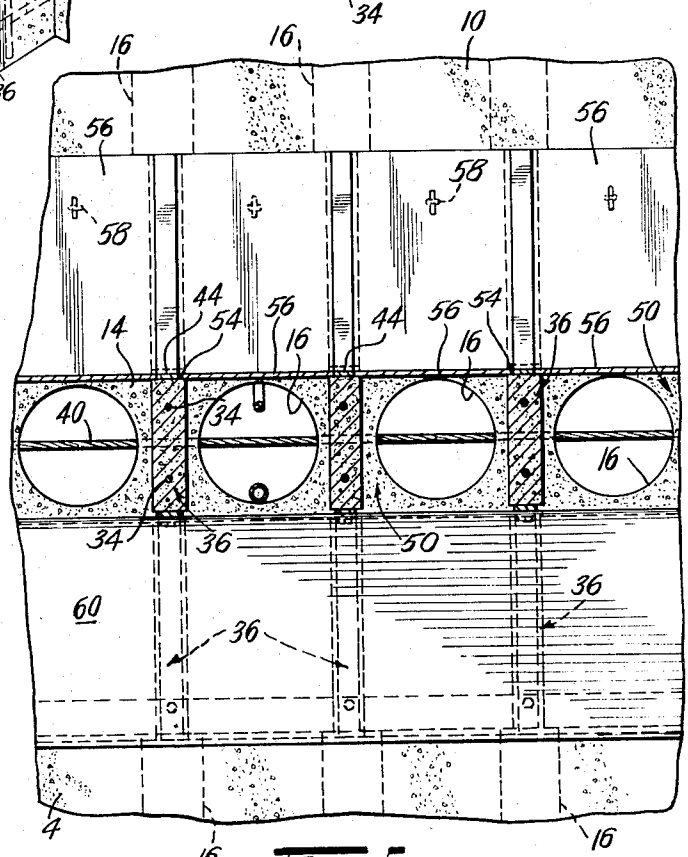



Fig. 5.

# PRECAST CONCRETE BUILDING CONSTRUCTION

## BACKGROUND OF THE INVENTION

This invention is in the field of building construction and components therefor comprising precast and stressed concrete slabs or panels.

Proposals have heretofore been made for assembling buildings or other structures from precast concrete slabs and such proposals have included the provision of passageways in the slabs for the reception of service utility components such as electrical wiring, water pipes or the like. However, in all such proposals known to the applicants, it was necessary to install the utility service components simultaneously with the assembly of the slabs into the building since only at that time were the channels or passageways accessible for making the necessary connections.

## SUMMARY OF THE INVENTION

The present invention comprises a building construction and components therefor comprising precast and stressed concrete slabs having passageways therethrough which passageways are accessible at their ends, even after the building shell has been erected. Thus, service utility components may be installed after the building is erected or at least after a portion thereof has been erected and while construction is proceeding on other parts of the building.

It is, therefore, a principal object of this invention to provide a building construction and components therefor providing for installation of utility service components after the building has been constructed and which components are completely housed within the precast building elements.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic vertical sectional view through a representative building embodying the present invention;

FIG. **2** is a plan view of a complete slab showing the manner of connecting adjacent coplanar slabs together;

FIG. **3** is an end view of the structure of FIG. **2**;

FIG. **4** is a vertical sectional view through a representative joint of a building embodying the present invention;

FIG. **5** is a vertical sectional view taken substantially on the line **5—5** of FIG. **4**;

FIG. **6** is a fragmentary vertical sectional view through another type of joint embodying the present invention;

FIG. **7** is a perspective view of a portion of a building construction illustrating a modification; and

FIGS. **8** and **9** are perspective views of representative closure panels supporting utility outlets.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** is a schematic representation of a building wherein footings **2** below ground level support vertical panels **4** defining basement walls. The floor **6** of the basement is preferably a concrete slab poured in place after placement of the vertical panels **4.** Numerals **8** indicate horizontal panels for defining floor, ceiling or roof, while numerals **10** indicate vertical wall panels, which may be internal load bearing partitions or external walls. Numeral **12** indicates an internal partition



panel that is not load bearing and numeral **14** designates further types of panels defining cantilevered slabs also embodying the present invention.

All of the panels, **4–14,** are provided with generally cylindrical passageways or openings **16** extending therethrough from one edge to an opposed edge thereof and the channels or openings **16** are so arranged that they may receive utility service components such as the electrical wiring illustrated in FIG. **1,** which components may be installed after the building is completely or partially erected.

While the specific description herein will describe electrical wiring, it is to be understood that reference to utility service components is intended to include not only electrical wiring but heat ducts, water pipes, sewer lines, chimneys and/or flues, gas conduits, vacuum lines or any other service components capable of being concealed within building walls or floors.

As shown in FIG. **1,** the passageways **16** of the vertical and horizontal slabs or panels are interconnected and portions thereof are exposed to the interior of the building, as will be more fully described later, so that utility components may be installed. For example, the passageways **16** on vertical panels **10** and floor panel **8** are accessible at the inside corners generally designated **18.** Thus, an electric power line **20** may be connected to a meter or the like **22** and by forming a small opening through vertical panel **10,** the conductors may be directed to a junction box or the like **24.** Power lines may then be directed from the junction box **24** downwardly through a vertical panel **10** to a corner **18** and from there may be directed downwardly through a lower vertical panel or horizontally through a floor panel **8** to a fixture **26,** for example, and may also be directed upwardly through partition wall **12** to a service outlet **28.** They may also be directed through a suspended ceiling **9** between switch **11** and fixture **13.** Since service components are in walls of the building, it is preferred that the structure have outside thermal insulation **15** and a suitable outer sheath **17.**

Referring now to FIGS. **2** and **3,** the floor panel **8** or a wall panel **10,** for example, is shown in greater detail. The panel comprises a precast concrete slab having generally cylindrical openings or passageways **16** extending therethrough from one edge to an opposite edge but spaced inwardly from opposed faces **30** and **32** of the slab. Precast slabs of such construction are known. See, for example, the patents to Bemes U.S. Pat. No. 1,671,462, Sitzman et al U.S. Pat. No. 1,761,848, or LaGue U.S. Pat. No. 3,416,272. It is known that such slabs are of relatively light weight and it can be seen from FIG. **3** that the concrete material between the parallel openings **16** defines, in effect, a series of interconnected I-beam structures. Also, as is more or less conventional, the slab is provided with stressed tendons **34** extending generally parallel to the openings **16** to maintain the I-beam sections in compression and thus provide great strength for the structure.

Applicants improvement resides particularly in providing integral short beam portions **36** extending outwardly from those edges of the slabs through which the openings **16** extend. As shown in FIGS. **2** and **3,** the beam portions **36** extend outwardly from between the openings **16** and are of a length slightly greater than the thickness of the slab, for a purpose to be described. As shown, the beam portions **36** are of generally rectangu-

lar section. As also shown in FIGS. 2 and 3, those edges of the slabs 8 parallel to the openings 16 are provided with half openings or channels so that when two such slabs are placed side-by-side a complete opening is provided at their juncture. Such slabs are "keyed" together by tubular members 38 and transverse tensioned tendons 40. Such joints between slabs, however, are known and do not constitute a part of this invention.

As shown, the tensioned tendons extending parallel to the openings 16, or at least some of them, extend longitudinally through the beam portions 36 and are anchored to weldable metal end plates 42 overlying the end faces of the beam portions 36. They may be anchored by welding or in any other suitable manner and the end plates 42 thus transmit tension from the tendons 34 to the concrete of the beam portions. Preferably, the upper and lower edge faces of the beam portions 36 are also provided with weldable metal plates 44 shown to be of less width than the upper and lower faces themselves, for a purpose to be described later. The upper and lower plates 44 are preferably tied together and secured to the beam portions 36 by means of suitable tie rods 46 extending therebetween and which may be secured to the plates 44 by welding or otherwise.

FIG. 2 shows a slab 8 wherein beam portions 36 extend from both of opposite edges thereof. Referring again to FIG. 1, however, it is to be noted that the vertical panels 4, for example, will be provided with the extending beam portions only at their upper edges and are devoid of such beam portions at their lower edges wherein they rest upon and are secured to the footings 2. Also, the panels designated 14 are provided with the beam portions extending from only one edge thereof while the partition panel 12 has no such beam portions at either end.

Referring now to FIGS. 4 and 5, illustrating a representative junction between panels 4, 10, 8 and 14, for example, it will be seen that the panel 4 is arranged with its beam portions 36 extending upwardly from its upper edge. The end portions of the beams 36 of panels 8 and 14 lie upon the upper end of the beams 36 of panel 4 to be supported thereby. The end plates 42 of the beams 36 of panels 8 and 14 are fixedly secured together such as by welding the same at their adjacent edges to thus unite the slabs 8 and 14 into a unitary horizontal building component. Likewise, the lower plates 44 of the beams 36 of panels 8 and 14 are preferably welded to the corresponding plates 44 of the vertical slab 4, thus uniting the structure into a rigid building unit at the joint illustrated. Vertical panel 10 is arranged with its lower beam portions 36 resting upon and spanning the juncture between the panels 8 and 14, in alignment with the lower panel 4 and its plates 42 and 44 are likewise welded to the upper plates 44 on the beams 36 of slabs 8 and 14 to thus fixedly unite the four panels together at a rigid joint defining the inside corner 18 previously referred to.

As previously stated, the beam portions 36 are of a length greater than the thickness of the slabs to which they are attached and since they extend only from spaces between the openings 16, there are access spaces between those beam portions, generally designated 50, and it will be apparent from FIG. 4 that the spaces 50 open into and are accessible at the inside corner 18 even after the building is constructed. In some instances, a joint somewhat like that shown in FIG. 4 will be constructed but wherein the slab or panel 14 is omitted and in which case the outer end of the beam portions 36 of slab 8 will be positioned to be flush with the outer surfaces of the slabs 4 and 10 but since those beam portions are of a length greater than the thickness of slabs 4 and 10, the spaces 50 will still be accessible at the inside corner 18. It will be readily apparent that since the spaces 50 are accessible at the corner defined by the joints even after the building components have been assembled and fixedly secured together, workmen may easily effect placement of the desired utility service components in selected openings 16 in any slab and then direct them through an adjacent opening 16 in an adjacent slab, whether it be coplanar therewith or at right angles thereto. Obviously, an opening such as the opening 52 of FIG. 6 may be made wherever desired in a slab to provide access to utility components in an opening 16 therein and in alignment with a vertical opening 16 in the partition panel 12, for example.

Obviously, a finished building should not have the spaces 50 exposed after the building is completed. For this purpose, applicants provide closure devices to close the exposed portions of spaces 50 after all service lines have been installed. As previously noted, the plates 44 fixed to the opposite side faces and rabbets or seats 54 are thus provided (see FIGS. 5 and 7). Suitable cover plates 56 may then be positioned between the plates 44, with their edges resting on the seats 54 whereupon the plates 56 are flush with the wall or floor surfaces of the building. It is to be noted that the outer surfaces of the plates 44 are preferably flush with the surfaces 30 and/or 32 of the slabs. As shown in FIG. 4, opposed cover plates 56 may be joined and held in place by a resilient band 58 or the like whereupon the cover plates 58 may be readily pulled outwardly and/or removed to expose the spaces 50 for service or repair of the utility lines therein. The cover plates 56 as described herein are merely illustrative of a contemplated manner of covering the exposed spaces and it will be apparent that any other arrangements may be resorted to.

As also shown in FIG. 4, rather than employing the flush cover plates 56 just described, the exposed portions of the spaces 50 may be concealed by such means as an oblique cover plate 60 extending along but spaced from the inside corner formed at the joint and thus define a conduit extending along that corner whereby utility lines may be directed from one space then along the corner and enter another panel through a different space 50. Such cover plate may extend diagonally across the corner as shown at 60 or may be in a form to define a rectangular conduit, as shown at 62 in FIG. 4.

FIG. 7 illustrates, in perspective, the manner in which panels 14 and 4 are assembled and clearly illustrates the spaces 50 between beam portions 36 but it further illustrates a modification wherein openings 64 are formed in at least certain of the beam portions 36 whereby utility lines may extend from one space 50 through an opening 64 into an adjacent space 50 without resorting to the type of cover plates shown at 60 and 62 in FIG. 4. Preferably, openings 64 would be bounded by a metal lining 66 to maintain the strength of the structure.

FIGS. 8 and 9 illustrate a suggested manner of providing access to the utility service components referred to by providing suitable outlets therefor in selected

ones of the cover plates **56**. In FIG. **8**, an electrical outlet **68** is illustrated whereas in FIG. **9** the cover panel **56** is provided with a hot air outlet **70** which may be connected to a heat duct by an adapter **72**. Obviously, any suitable service outlet may be mounted on the cover plates **56**. Also, rather than employing a multiplicity of cover plates **56**, a single elongated cover structure may extend throughout the length of the corner referred to.

As will also be apparent, rather than directing heat ducts or the like along the opening **16**, the openings themselves may be employed as the duct by providing suitable transition fixtures at the corner joints of the building, which may be readily installed through the openings **50**. It is also to be remembered that openings through the surfaces of any of the panels or slabs may be made at any time after the building is constructed to provide access to utility lines in an opening **16** therein.

While a limited number of specific embodiments have been shown and described herein with specific reference to a "building," it is to be understood that the same are merely illustrative of the principles involved and the the term "building" is intended to include other embodiments, such as sidewalks, bridges, airport runways, docks, or the like.

We claim:

**1.** In a construction wherein precast and stressed concrete slabs are assembled to define a structure, the improvement comprising:

at least one horizontal slab having a plurality of spaced, parallel, generally cylindrical openings extending therethrough from one edge thereof to an opposed edge and generally rectangular integral beam members extending from at least one of said edges between said openings and being of a length greater than the thickness of said slab; and

a vertical slab, of the same construction as said horizontal slab, arranged with the ends of the beams on said one edge thereof abutting edge portions of the corresponding beams of said horizontal slab to define an inside corner of said structure, the spaces between said beams, adjacent said edges, thereby being accessible from said inside corner for connecting a utility service component in an opening in one of said slabs to a corresponding utility service component in an opening of the other slab, after said structure is erected.

**2.** A construction as defined in claim **1** wherein said beams are provided with metal plates overlying and fixedly secured to their end and edge faces, abutting plates of adjacent slabs being welded together at their lateral edge portions.

**3.** A construction as defined in claim **1** including removable cover means closing the exposed portions of said spaces at said inside cover.

**4.** A construction as defined in claim **3** wherein said cover means is flush with the surfaces of said slabs.

**5.** A construction as defined in claim **3** wherein said cover means defines a conduit extending along said corner whereby a utility line or the like may extend from one of said spaces, along said conduit to another of said spaces.

**6.** A construction as defined in claim **1** wherein at least one of said beams is provided with a lateral opening therethrough, providing communication between adjacent spaces between beams.

**7.** A construction as defined in claim **1** including a second horizontal slab of the same construction as said first-named slab arranged with the beams from said one of its edges aligned with and in end abutting relation to the beams of said first named slab;

means fixedly securing the abutting ends of said beams together; and

the ends of the beams of said vertical slab spanning the juncture between the abutting ends of said aligned beams.

**8.** A precast concrete component comprising:

a concrete slab having opposed faces and opposed edges;

a plurality of spaced, parallel, generally cylindrical openings extending through said slab from one edge thereof to an opposed edge and spaced inwardly from both said opposed faces, said openings being of a size to freely accommodate utility service components;

short, generally rectangular beams, integral with said slab extending outwardly from at least said one edge between said openings, said beams each being of a width substantially equal to the thickness of said slab and a length greater than said thickness; and

tensioned stressing tendons extending through said slab and beams generally parallel to said openings.

**9.** A component as defined in claim **8** including a weldable metal plate overlying the end face of each beam and certain of said tendons being anchored to said plate.

**10.** A component as defined in claim **8** including weldable metal plates overlying opposite edge surfaces of said beams, substantially flush with said opposed faces of said slab, and being fixedly secured thereto.

* * * * *