United States Patent

[11] 3,600,863

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[21] Appl. No. **855,915**
[22] Filed **Sept. 8, 1969**
[45] Patented **Aug. 24, 1971**
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[54] **CONCRETE SLAB WITH IMPROVED FASTENING MEANS**
11 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **52/483,** 52/493, 52/499, 52/583
[51] **Int. Cl.** **E04b 1/41**
[50] **Field of Search** 52/127, 125, 583, 483, 235, 236, 601, 598, 499, 497, 494, 493, 474, 434, 379, 378

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ABSTRACT: A concrete slab having a number of peripheral recesses and fastening means disposed in each recess, respectively. In one embodiment, the fastening means includes an angle member having one portion secured to the slab and a second portion with holes therethrough for receiving mounting studs. A connector plate is provided to interconnect the studs passing through the angle members of adjacent slabs. In a second embodiment, the fastening means includes an angle member rigidly secured to the slab and having an angle element rigidly secured thereto to define a space for receiving a bolt. The slab is adapted for use in a number of different building applications and is particularly suitable for use in forming the floor of a building.

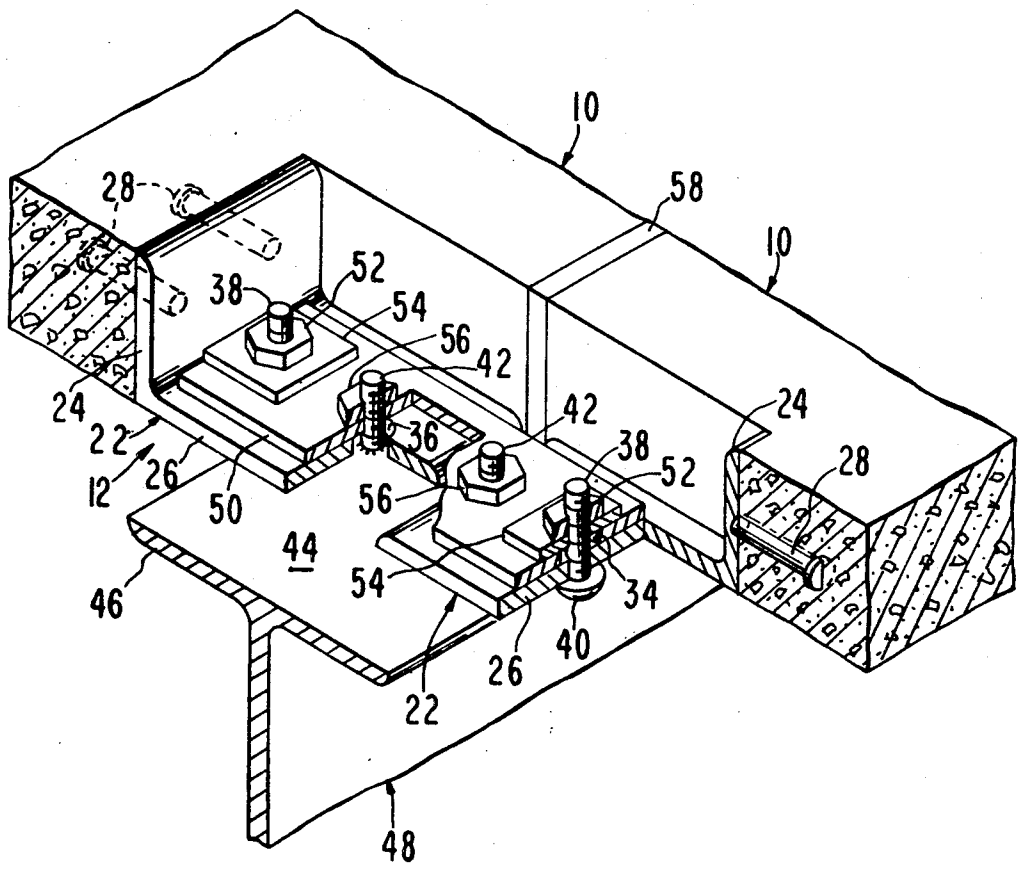


FIG. 1

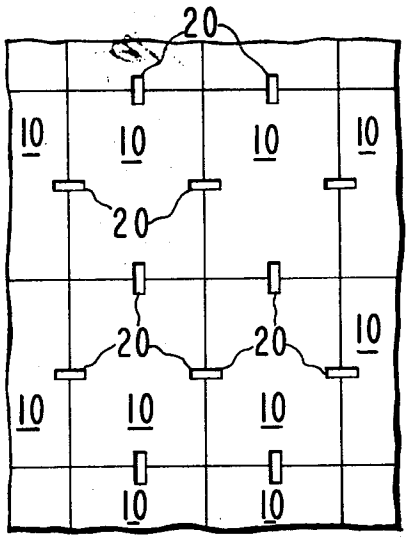


FIG. 2

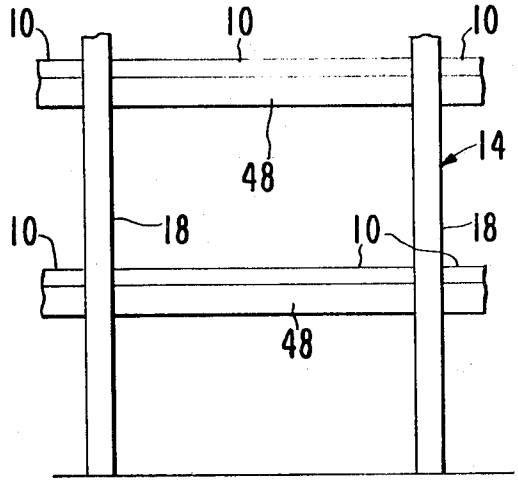


FIG. 3a

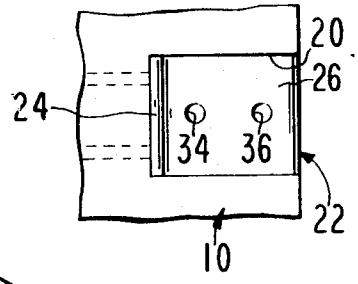


FIG. 3

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FIG.4

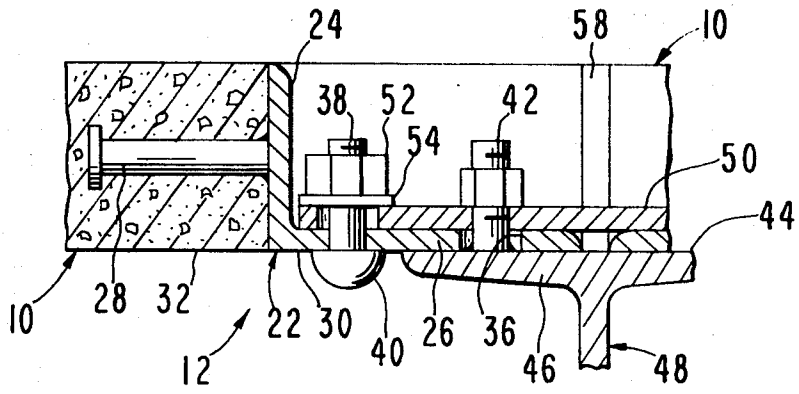


FIG.5

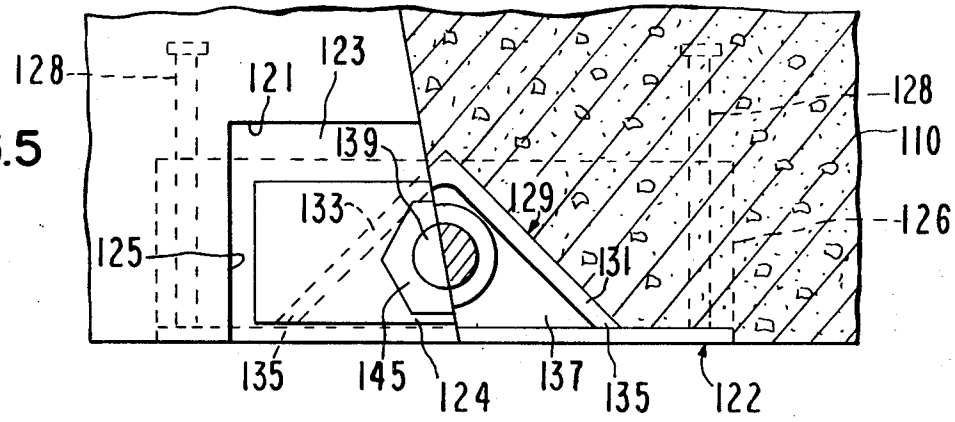


FIG.6

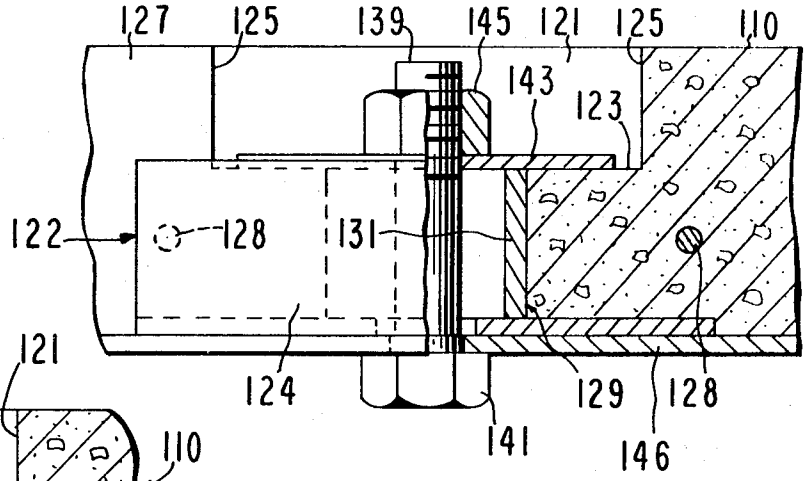
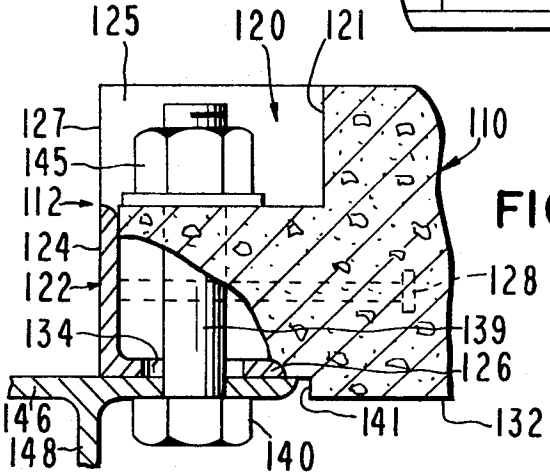


FIG.7



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CONCRETE SLAB WITH IMPROVED FASTENING MEANS

This invention relates to improvements in concrete slabs, and, more particularly, to a concrete slab having improved fastening means on its outer periphery.

The present invention provides a building unit in the form of a precast concrete slab which is capable of being used in any one of a number of different types of buildings. The slab is of the type which is adapted to be secured by attachment or fastening means on its outer periphery to adjacent supporting framework so that a plurality of such slabs secured to the framework will form, for instance, a floor of a building. Thus, the slab of the invention is especially suitable for use in the construction of a multistored parking facility where the facility is to be erected in minimum time and at minimum cost. These advantages can be achieved with the building slab of the present invention since the latter has improved fastening means at each of a number of peripheral locations thereon so that, when the slab is moved into place on a supporting framework, it can be quickly and easily secured to the framework and thereby be rendered rigid. The slab is also constructed in a manner such that the same can be disassembled from its supporting framework when it is desired to move the building to another site or to store the slabs and framework until further need for the same arises.

The fastening means on the slab of this invention can be made when the slab itself is molded. Thus, a large number of such slabs can be made at minimum cost and with the use of conventional forms. Also, the fastening means is simple and rugged in construction and can be attached to the supporting framework without the need for special tools and by workmen who have no special skills.

The primary object of the present invention is to provide a concrete slab having improved fastening means on its outer periphery which permits the slab to be quickly and easily secured to an adjacent supporting framework so that a plurality of such slabs can be used to form a building in minimum time and at minimum expense.

Another object of this invention is to provide a precast concrete slab whose peripheral fastening means is simple and rugged in construction and can be readily attached to adjacent supporting framework without the need for special tools or special skills on the part of workmen using the slab to erect or disassemble a building.

A further object of the invention is to provide a building slab of the type described which has peripheral recess means on one face thereof to present a shoulder adjacent to the fastening means of the slab to provide a guide for the positioning of the slab on a supporting framework to which the slab is to be attached to form a building.

Other objects of this invention will become apparent as the following specification progresses, reference being had to the accompanying drawings for illustrations of several embodiments of the slab.

In the drawings:

FIG. **1** is a fragmentary top plan view of a building construction utilizing slabs made in accordance with this invention

FIG. **2** is a fragmentary, side elevational view of a multistoried building construction using slabs of this invention;

FIG. **3** is an enlarged, fragmentary perspective view of a pair of adjacent slabs utilizing a first embodiment of the fastening means of this invention;

FIG. **3***a* is a top plan view of a portion of one side margin of the slab of FIG. **3**;

FIG. **4** is a fragmentary cross-sectional view of the slab and fastening means of FIG. **3**;

FIG. **5** is a fragmentary, top plan view, partly broken away, of a second embodiment of the fastening means of the invention;

FIG. **6** is a side elevational view, partly broken away, of the fastening means of FIG. **5**; and

FIG. **7** is a cross-sectional view, partly broken away, of the fastening means of FIGS. **5** and **6**.

The first embodiment of the building slab of this invention is illustrated in FIGS. **3** and **4** and is denoted by the numeral **10**. The slab is precast and formed of concrete and has fastening means **12** at each of a number of locations on its outer periphery.

Slab **10** can be utilized in any desired manner, but, for purposes of illustration, it will be described as being usable with other, identical slabs to form a building, such as a multistoried parking facility. Such a building is comprised of a framework **14** (FIG. **2**) and a plurality of slabs **10** coupled to framework **14** and arranged in a generally horizontal plane at each story of the building to define a parking surface therefor. As shown in FIG. **1**, a plurality of slabs **10** are arranged in side-by-side, end-to-end relationship to form the parking surface of a particular story, the slabs **10** at each story being supported by a number of horizontal beams **48** secured together and to a number of vertical columns **18**, beams **48** and columns **18** forming parts of framework **14**. Fastening means **12** of each slab **10** is used to attach the slab to a respective beam **16** so as to render the slab fixed relative to framework **14**. Slab **10** of this invention can be used in building applications other than that illustrated in FIGS. **1** and **2**.

As shown in FIGS. **1** and **3***a*, each slab **10** is provided with a number of spaced, peripheral recesses **20** therein, there being a fastening means **12** at each recess **20**, respectively. For purposes of illustration, one recess **20** is on each side of a slab and one recess **20** is at each end of the slab. The arrangement of the recesses could be different, if desired, FIG. **3***a* shows a top plan view of a portion of the slab looking downwardly onto a recess **20** therein.

In each recess **20** of slab **10**, there is provided an L-shaped connector member **22** made of angle iron, rigidly secured to the slab, and forming a par of fastening means **12**. Each member **22** has a pair of mutually perpendicular plate sections **24** and **26** which are integral with each other. Plate section **24** is in abutment with a flat surface of slab **10** forming the innermost extremity of recess **20**. A pair of elongates studs **28** are rigidly connected to plate section **24** and are embedded in the slab as shown in FIGS. **3** and **4**. These studs hold member **22** rigidly secured to the slab and within the corresponding recess **20**.

The width of plate section **24** is substantially equal to the width of the corresponding recess **20**, as shown in FIG. **3***a*. Plate section **26** has an outer or bottom surface **30** which is substantially flush with the outer or bottom surface **32** of slab **10**. Plate section **26** also has a pair of spaced holes **34** and **36** therethrough (FIG. **3***a*), hole **34** adapted to receive a threaded bolt **38** having a head **40** and hole **36** adapted to receive a threaded stud **42** extending upwardly from the upper surface **44** of the lateral portion **46** of a horizontally disposed I-beam **48** forming a part of a framework for supporting slab **10** in an operative position. While stud **42** is shown as being welded to upper surface **44** of I-beam **48**, it is clear that the stud could comprise a bolt extending through an opening in the I-beam. The size of hole **36** is larger than the diameter of stud **42**, whereby member **22** can accommodate itself to stud **42** even though there is an error in the position of the stud on the I-beam. Plate section **26** extends from plate section **24** to the entrance of the corresponding recess, as shown in FIGS. **3***a* and **4**.

In use, slab **10** is mounted on a framework having I-beam **48** as a part thereof (FIGS. **3** and **4**) with the I-beam having a plurality of upright, threaded studs **42** thereon. To construct a floor of a parking facility, for instance, a plurality of slabs **10** are utilized, each pair of adjacent slabs having mating recesses **20** in the manner shown in FIG. **1**. There is a pair of studs **42** secured to I-beam **48** adjacent to each pair of mating recesses, as shown in FIG. **3**.

At each recess location, each stud **42** is received within a corresponding hole **36**, whereby the corresponding slab **10** is held against lateral movement on the corresponding I-beam

48. To further secure the slab to the I-beam, a connector plate 50 is provided, plate 50 having four longitudinally aligned holes therethrough, the two centrally disposed holes being provided to receive respective studs 42 and the two outer holes being provided to receive respective bolts 38. Nuts 52 are threaded onto bolts 38 so as to clamp connector plate 50 to adjacent members 22. A washer 54 is generally provided between nut 52 and plate 50. A nut 56 is threaded onto each stud 42, respectively, so as to further clamp connector plate 50 to members 22.

The foregoing connection structure is utilized at each of the mating pairs of recesses 20. In this way, a plurality of slabs 10 are releasably secured to respective I-beams 48 for support thereby.

When completely assembled, adjacent slabs 10 will be spaced slightly apart so as to define a space 58 therebetween. This space is provided to allow expansion and contraction of the slabs due to temperature variations and can be filled with a suitable filler material, such as a polysulfide. Concrete grout is preferably used to fill mating recesses 20 and thereby cover the fastening means in the recesses. These materials can be removed from spaces 58 and recesses 20 when it is desired to disassemble the building to permit the slabs and the supporting framework to be moved to another location or to be stored until ready for use again.

A second embodiment of the slab of this invention is illustrated in FIGS. 5–7 and is broadly denoted by the numeral 110. The slab has fastening means 112 thereon at each of a number of locations on the sides and end portions thereof in the same manner as that described above with respect to slab 10. For purposes of illustration only, fastening means corresponding to a single recess is illustrated. Such a recess is broadly denoted by a numeral 120, the latter having an inner surface 121, a bottom surface 123, and a pair of side surfaces 125. Bottom surface 123 is spaced above the bottom surface 132 of slab 110.

An L-shaped member 122 is provided for each recess 120, respectively. Each member 122 is provided with an outer plate section 124 which is substantially flush with the outer side surface 127 of slab 110. Member 122 is further provided with a second plate section 126 which is integral with and substantially perpendicular with plate section 124, as shown in FIG. 7. Plate section 126 is provided with a hole 134 therethrough. An angle member 129 has a pair of mutually perpendicular sides 131 and 133 which are integral with each other and are welded at their outer end edges 135 to the inner surface of plate section 124, as shown in FIG. 5, so as to define with plate section 124 a space 137. This space is open-ended to receive a bolt 139 having a head 140, the bolt also being received within hole 134 in the manner shown in FIG. 7 so that the bolt is used to couple slab 110 to an I-beam 148 having a horizontal portion 146 through which bolt 139 also extends.

The outer surfaces of sides 131 and 133 of element 129 are in abutment with the concrete slab 110 and a pair of studs 128 rigid to plate section 124 are embedded in the concrete so as to hold member 122 in a fixed position with respect to the slab. The upper end edges of sides 131 and 133 are substantially flush with bottom surface 123 of recess 120.

Slab 110 is utilized by placing the same on the horizontal portion 146 of a corresponding I-beam 148. Slab 110 is made so that the bottom surface of plate section 126 is spaced above the bottom surface 132 of slab 110 so as to present an offset shoulder 141 for facilitating the placement of the slab on the I-beam. In this way, shoulder 141 serves as a stop to limit the lateral movement of the slab across the top surface of horizontal portion 146 of the I-beam. Thus, there is no danger of the beam being moved too far laterally so as to slip off the supporting surface of the beam.

When the slab is in the proper location, bolt 139 is inserted through horizontal portion 146, into and through the space 137 so that the bolt projects upwardly from the bottom surface 123 of recess 120. Alternatively, bolt 139 can be secured to the I-beam to permit the slab to be lowered onto the I-beam with the bolt being received within space 137. Hole 134 is oversized to compensate for any error in the placement of bolt 139. After the slab is in place, a connector plate 143 is received over the bolt and engages the upper end edges of sides 131 and 133 in the manner show in FIG. 6. A nut 145 is set then threaded onto the upper end of bolt 139 so as to clamp plate 143 against element 139 and thereby releasably secure the slab to the I-beam.

After the nut has been put on the bolt, the recess 120 can be filled with a concrete grout. The spaces between the side faces of adjacent slabs 110 can be filled with a plastic material, such as a polysulfide or the like. When this has been done, the building is complete and ready for use.

Slabs 10 or 110 can be elevated into position in any conventional manner. If a parking facility is constructed with the slabs, the latter can be moved into position, one-by-one, and secured to the underlying framework in the manner described above. In this way, the facility can be erected in a minimum of time yet be sufficiently rugged in construction to satisfy the requirements of building codes. Moreover, the facility can be disassembled and the slabs and framework moved to another site or stored for subsequent use as a parking facility or as any other type of building. The slab of the present invention provides for the foregoing advantages because its fastening means is simple in construction yet it can be quickly and easily connected and disconnected from the adjacent framework without the need for special skills.

If a number of slabs 10 are used to form the floor of a building, the slabs at the ends and sides of the building will, for purposes of illustration, abut adjacent side and end walls. In such a case, only one-half of each connector plate 50 is required, the half-plates being coupled to respective bolts 38 and studs 42.

What is claimed is:

1. A building unit for attachment to a beam comprising: a concrete slab having a pair of opposed, generally flat faces and an outer periphery provided with a number of spaced recesses extending into the slab, said slab adapted to be mounted in an operative position with one of said faces on said beam and with one of said recesses above the beam; and fastening means in each recess respectively, said means including an angle member having a first section rigidly secured to the slab and a second section adjacent to the lower portion of the corresponding recess, said second section being engageable with the beam and provided with an opening therethrough for receiving an elongated fastening device extending upwardly from the beam, the portion of the recess above said section being sufficient to permit a fastener to be removably received within the recess and to be coupled to said fastening device, whereby the slab can be coupled to a supporting framework by the device.

2. A building unit as set forth in claim 1, wherein the second section is substantially flush with said one face.

3. A building unit as set forth in claim 1, wherein said second section is in a plane substantially parallel with and adjacent to the major portion of said one face.

4. A building unit as set forth in claim 1, wherein the second section has a second opening therethrough spaced from the first opening, and including a connector plate receivable in a recess and having a pair of holes therethrough for alignment with respective openings whereby the connector plate can interconnect the angle member and an adjacent framework.

5. A building unit as set forth in claim 1, wherein each recess has an inner surface and a pair of opposed side surfaces, the first section being in abutment with said inner surface, the second section being flush with said one face and in substantially spanning relationship to said side surfaces, the region of said recess between said second section and the other of said faces being open.

6. A building assembly comprising: a beam having a generally flat surface and adapted to support a mounting stud extending outwardly from said surface; a slab having a pair of opposed faces and an outer periphery having a number of

spaced recesses, the slab being positionable with one of said faces in engagement with the surface of the beam and with at least one of the recesses adjacent to said surface; and fastening means carried by the slab at each recess, respectively, for interconnecting the slab and the beam, said fastening means including an angle member rigidly secured to the slab and having a lower portion provided with an opening therethrough for receiving the mounting stud, said lower portion being flush with said one face of the slab end engageable with said surface of the beam and a connector plate receivable within the corresponding recess and having a hole for receiving said stud, said plate being operable to clamp the angle member to said beam when a nut is threaded onto the stud, said plate extending laterally from the adjacent extremity of said slab, whereby the connector plate can be coupled to a second slab for clamping the latter to said beam.

7. A building assembly comprising: a beam having a generally flat surface and a bolt-receiving opening therethrough; a building slab having a pair of opposed faces and an outer periphery having a number of spaced recesses, the slab being positionable with one of said faces in engagement with the surface of the beam and with at least one recess adjacent to said surface; and fastening means carried by the slab at each recess, respectively, for interconnecting the slab and the beam, said fastening means including an angle member having a first section rigidly secured to the slab and a second section integral with the first section and extending laterally therefrom, said second section being disposed substantially flush with said one face and having a hole therethrough alignable with said opening of the beam, an angle element having a pair of opposed sides with each side having an outer marginal edge, the marginal edges of said sides being rigidly secured to said first section, said sides defining a space aligned with said hole in the second section, each of said sides having a side marginal edge, and a plate spanning the side marginal edges of said sides for use in clamping said slab to the beam when a bolt extends through the opening, the hole and the space and when a nut is threaded onto the bolt.

8. A building unit comprising: a concrete slab having a pair of opposed faces and an outer periphery provided with a number of spaced recesses extending into the slab; and fastening means in each recess respectively, said means including an angle member having a first section rigidly secured to the slab and a second section provided with an opening therethrough for receiving a fastening device, and an angle element having a pair of sides with each side having an outermost marginal edge, the marginal edge of said sides being rigidly secured to the first section to present a space between said sides and aligned with the opening in the second section whereby the slab can be coupled to a supporting framework by the device, the second section being adjacent to one of the faces.

9. A building unit as set forth in claim 8, wherein each side of said element has an end marginal edge, and including a plate for spanning said end marginal edges and having a hole therethrough alignable with said space.

10. A building unit as set forth in claim 9, wherein the end marginal edges of said element are disposed between said opposed faces.

11. A building unit as set forth in claim 8, wherein said slab has a peripheral end face adjacent to each recess, respectively, the first section being substantially flush with said end face.