Feb. 23, 1937. A. ARNN 2,071,378

CONCRETE BUILDING CONSTRUCTION

Filed Nov. 1, 1934 2 Sheets-Sheet 1

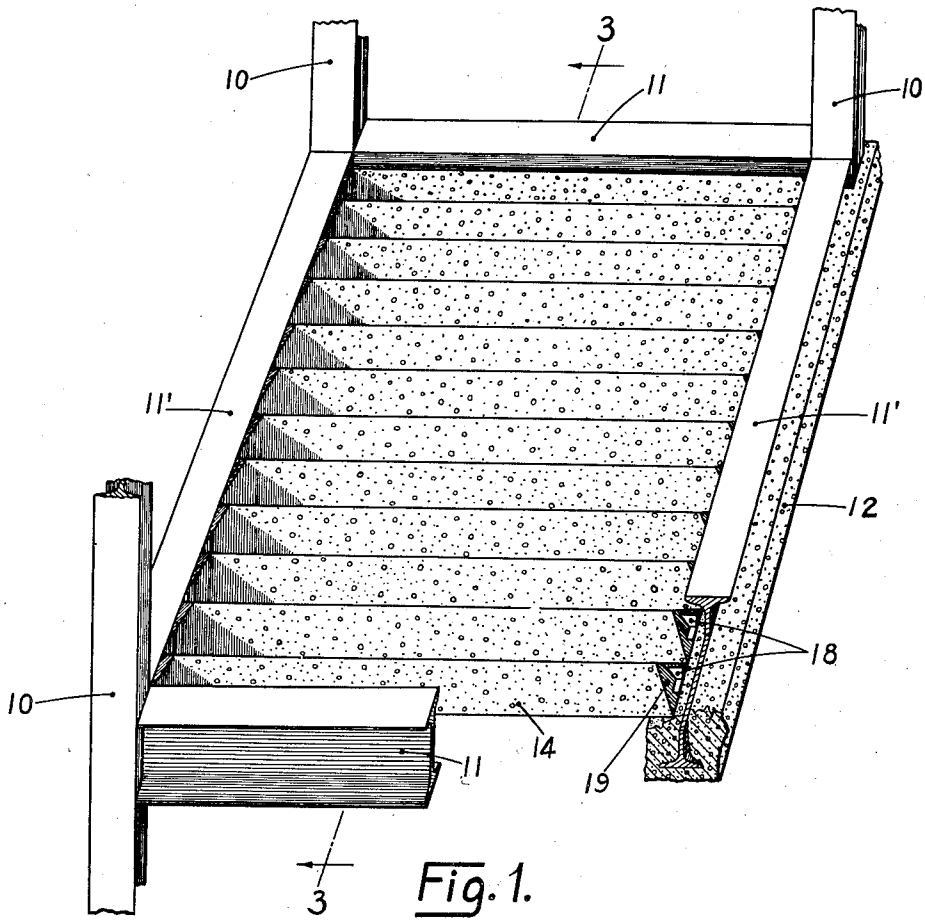


Fig. 1.

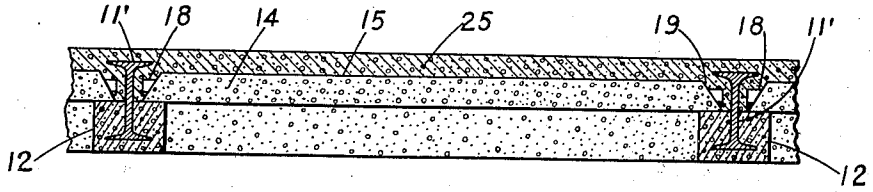


Fig. 2.

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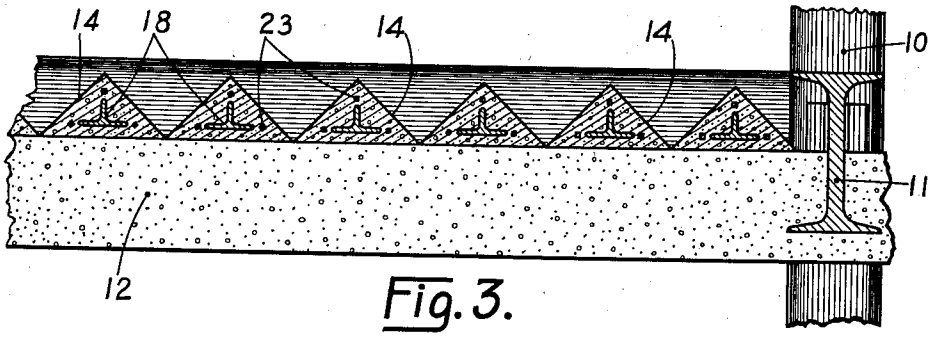


Fig. 3.

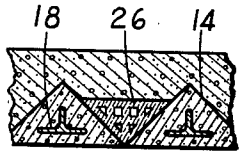


Fig. 4.

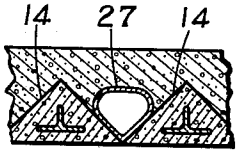


Fig. 5.

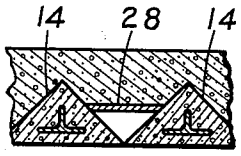


Fig. 6.

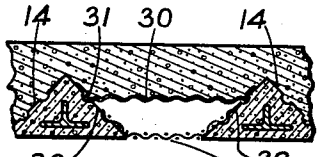


Fig. 7.

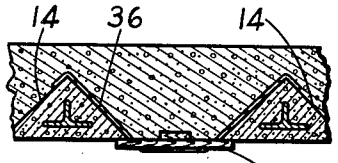


Fig. 8.

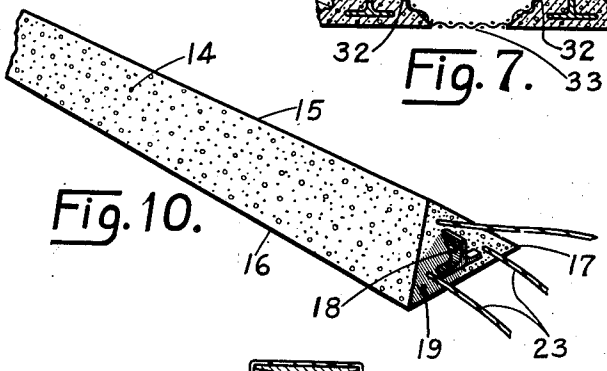


Fig. 10.

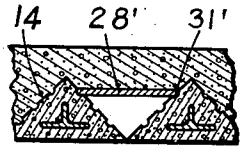


Fig. 9.

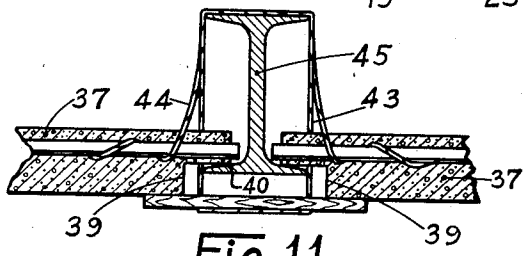


Fig. 11.

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CONCRETE BUILDING CONSTRUCTION

Albert Arnn, Norwood, N. J.

Application November 1, 1934, Serial No. 750,969

6 Claims. (Cl. 72—66)

This invention relates generally to an improved concrete building construction, and more particularly it relates to an arch, floor or roof construction for concrete structures in which the arch, floor or roof is partially composed of pre-cast concrete slabs or beams, and partially of job-poured concrete.

At present in the formation of concrete floors, arches and the like for steel-framed and other types of buildings, it is the practice to erect wooden forms for the concrete throughout the entire floor, arch or roof area of the building, and, after the forms are erected, to pour the concrete into them and allow it to solidify or set. When it has set sufficiently the forms are then torn down and removed, leaving the completed concrete arch or floor. The erection and removal of the wooden forms constitutes an important item of cost in the erection of concrete floors and arches, because of the cost of the lumber involved and the cost of labor in first erecting and later removing the forms.

One object of this invention is to eliminate in great measure the necessity for using wooden forms to support and shape freshly-poured concrete in arch, floor and roof construction, thereby greatly reducing the cost of concrete construction work.

Another object of this invention is to provide a concrete arch, floor or roof construction composed of pre-cast concrete slabs or beams, which will act as a mold or form for an upper layer of job-poured concrete, and which with such job-poured concrete will form a unit-mass concrete arch, floor or roof.

A further object of this invention is to provide a suitable pre-cast concrete slab or beam which is of simple design, easy and cheap to manufacture, which possesses a high degree of strength and rigidity, and which with the job-poured concrete will form a substantially monolithic or unit-mass concrete arch.

Other objects and advantages of the invention will be apparent from the following description when taken in connection with the accompanying drawings, wherein:

Figure 1 is a fragmentary, perspective view of an arch formed with the pre-cast concrete beams provided by my invention, sections of two intersecting I-beams being broken away to reveal underlying structure.

Fig. 2 is a fragmentary sectional view of a concrete arch constructed according to my invention.

Fig. 3 is a sectional view taken on the line 3—3 in Fig. 1.

Figs. 4, 5, 6, 7 and 9 are sectional views showing various methods of forming a light arch, roof or floor construction.

Fig. 8 is a sectional view showing the manner in which electrical boxes or other fixtures may be inserted in the arch.

Fig. 10 is a fragmentary perspective view of a preferred embodiment of the pre-cast concrete beam provided by my invention.

Fig. 11 is a sectional view showing the method of forming a flat ceiling when using a modified form of pre-cast concrete beam.

Referring to the drawings in detail, the reference numeral 10 designates the usual vertical columns of a modern building construction, and 11, 11' designate the usual horizontal I-beams connected to the columns and forming with them one section of the steel frame-work of the structure. In the drawings only one such section is shown, although it is well understood that a building is composed of many such sections on each floor of the building being constructed.

In the erection of a concrete arch or floor according to my invention, a haunch and a soffit 12 is first formed around the lower flanges of a pair of spaced I-beams 11', the haunches and soffits being formed by means of wooden forms or molds erected around the I-beams, and concrete poured into the molds and allowed to set. When the concrete has set sufficiently the forms are then removed.

The next step in the formation of the arch is to span the gap from cast haunch to cast haunch with a plurality of novel pre-cast concrete beams 14 provided by my invention. One of such beams is shown separately in Fig. 10. The beams 14 are pre-cast, preferably being cast away from the job and shipped to it ready for incorporation in the floors or arches of the building. They are preferably made of triangular cross-section, being cast in a V-shape mold. They are also preferably of isosceles-trapezoidal form in longitudinal cross-section, the end faces tapering outwardly, as seen in Figs. 1, 2 and 10, so that the upper edge 15 of the beam is shorter than either of the lower edges 16 and 17, and the faces form an acute angle with the vertical members of the I-beams.

To reinforce the pre-cast beams and provide the strength requisite for some structures, and also to meet the requirements of the existing building codes, I provide an inverted metal T-beam 18 embedded in the concrete beam. This T-beam serves to take up tensile strains engendered in handling, placing and transporting, and

provides both lateral and longitudinal reinforcement for the beam. The T-beam 18 is located interiorly of the concrete beam 14 and extends longitudinally throughout its entire length and preferably has its flanges and web disposed substantially parallel to one face and in the median plane respectively of the triangular concrete beam. In practice I prefer to have the ends of the T-beam protrude beyond the end faces 19 of the concrete beam, the protruding ends serving a purpose which will presently appear.

It is possible to further reinforce the concrete beam by means of tie-rods 23 embedded in the beam (as seen in Figs. 3 and 10), although it will be understood that the tie-rods are provided merely to additionally reinforce the beam and may be dispensed with where the concrete beam with the metal T-beam possesses the requisite strength and rigidity.

When spanning the gap from cast haunch to cast haunch with the pre-cast beams 14, they are preferably placed parallel to each other and edge to edge, to form a complete closure of the opening formed by the intersection of the metal I-beams 11 and 11'. The concrete beams then act as a mold or form for the job-poured concrete which is poured over them, and in addition form a part of the completed arch or floor. The pre-cast beams thus assume the double role of acting as a mold for the job-poured concrete, and also constituting an integral part of the finished arch or floor construction. Also, by means of the inverted T-beams 18 the pre-cast concrete beams provide the necessary metal reinforcement for the arch, although if desired, additional metal reinforcements may be inserted in the V-shaped grooves formed between the adjacent concrete beams. In the usual arch, however, it will be unnecessary to additionally reinforce the concrete, the metal contained in the pre-cast concrete beams providing adequate metal reinforcement.

When forming the haunches and soffits around the flanges of the I-beams, it is preferable to pour only one pair of haunches 12, and these preferably on the long-side I-beams 11' of each section of the metal frame of the structure. Thus as seen in Fig. 1, no haunch has been formed around the bottom flange of I-beams 11. The haunches for this pair of beams are not poured until the concrete for the entire floor is poured over the pre-cast concrete beams 14, and at that time the entire I-beam is encased in a unit-mass of concrete. This unit-mass of concrete extends throughout the entire floor area of the building, completely encasing I-beams 11, the upper flanges of I-beams 11', and the exposed upper surfaces of the pre-cast concrete beams, to form the finished floor or arch. In this way an exceptionally good bond between the freshly poured concrete, the pre-cast concrete beams, and the metal frame of the building is assured, which serves to make the floor theoretically monolithic. Also, I prefer to have the inverted T-beams 18 protrude beyond the end faces of the pre-cast concrete beams, and in this way secure an additional tie between the concrete of the beams 14 and the job-poured concrete 25 of the floor, making a substantially unitary mass. As best seen in Fig. 2, the end faces of the pre-cast beams 14 are outwardly tapered to allow the job-poured concrete to be tamped between the vertical member and upper flange of the I-beams 11', and the end faces 19 of the concrete beams.

As before mentioned, in practice it is preferable to form the haunches 12 on the long-side I-beams of each open section of the floor. In this way the span of the pre-cast beams will be kept to a minimum.

It is apparent that the concrete beams may rest on either the top or bottom flanges of the I-beams or girders, or in small buildings may span from wall to wall, or wall to beam and then to wall.

In Figs. 4, 5, 6, 7 and 9 of the drawings I have shown various methods of forming a light arch, roof or floor construction with the pre-cast concrete beams provided by my invention. Fig. 4 shows an arch constructed with a hollow tile member 26 inserted in the V-shape groove formed by two adjacent pre-cast concrete beams 14. This serves to lighten the weight of the arch, yet avoiding the necessity of varying the size or shape of the pre-cast beams 14. Fig. 5 shows a hollow metal form 27 used in the same manner as the hollow tile. Fig. 6 shows a metal slab 28 having inwardly-tapered edges corresponding in slope with the outwardly-tapered side faces of the beams 14.

It is possible in forming light arch constructions to space the pre-cast concrete beams apart and span the gaps between them with wider tile members, hollow metal forms, metal slabs, or other similar articles. Fig. 7 shows the two pre-cast beams 14 spaced apart and a piece of corrugated metal 30 spanning the small gap between them, the corrugated metal resting on each side in notches 31 formed in the side faces 32 of the pre-cast beams. For the purpose of providing a continuous, smooth surface on the underside of the arch, a wire lath 33 may be used, as shown, and a suitable coating of plaster then applied, which will provide a smooth ceiling for the floor below.

Fig. 9 shows an arch similar to Fig. 6, the metal slab 28' resting in notches 31' formed in the side faces of the pre-cast beams.

In Fig. 8, I have shown the manner in which electrical boxes or other fixtures may be inserted in an arch constructed with the pre-cast concrete beams 14. At any point in the arch where such boxes are to be inserted the pre-cast beams are spaced apart, and the gap between them is suitably closed by a board or plank 35 suspended beneath the opening. As shown in the drawings the board is held in position by means of wire rods 36 which pass under and then up through the board, the ends of the wire rods being hooked over the apices of the beams. The electrical boxes are then located in proper position, and the upper layer of concrete poured. When the concrete has set sufficiently the board 35 is then removed by cutting the wire rods 36.

In Fig. 11, I have shown a method of forming a flat ceiling by using a modified form of pre-cast concrete beam. These beams 37 are formed with notches 39 at each end of their bottom faces. The beams then span the gap between the spaced I-beams and are allowed to rest firmly on the lower flanges 40 of the I-beams. The manner of completing this arch is similar to that described with reference to Fig. 8, except that the wire rods 43 are tied across the top of the I-beam 45. In this figure I also show tie rods 44 embedded in the pre-cast beam which extend upwardly from the beams 37 and are tied above the I-beam 45.

While I have shown and described the preferred embodiments of the invention, I do not wish to be limited thereto, since various changes may be made therein without departing from the spirit of the invention.

What I claim is:

1. A building unit for concrete arch construction comprising a solid pre-cast concrete beam of substantially isosceles triangular lateral cross-section, having metal reinforcements embedded therein, said metal reinforcements comprising a metal T-beam extended longitudinally throughout the concrete beam, the flanges and the web of the T-beam being disposed substantially parallel to the base and in the plane of the altitude, respectively, of the concrete beam.

2. A building unit for concrete arch construction comprising a solid pre-cast concrete beam of substantially triangular lateral cross-section and isosceles-trapezoidal longitudinal cross-section, having a metal reinforcing T-beam embedded therein, said T-beam extending longitudinally throughout the concrete beam and having its flanges and web disposed substantially parallel to the base and in the plane of the altitude respectively of the concrete beam.

3. In a concrete building construction, the combination of a pair of flanged floor beams, spaced apart, concrete supports formed around the lower flanges of said beams, a second pair of flanged floor beams intersecting the first and forming with them an open floor area, a plurality of pre-cast concrete beams spanning the gap between said concrete supports, and a layer of job-poured concrete encasing the exposed upper surfaces of said pre-cast beams and the exposed surfaces of the flanged floor beams, and bonding them together to form a substantially unitary mass.

4. In a concrete building construction, the combination of a pair of flanged floor beams, spaced apart, concrete supports formed around the lower flanges of said floor beams, a plurality of pre-cast concrete beams spanning the gap between said concrete supports, said pre-cast concrete beams having embedded therein longitudinally-extended metal T-beams, the terminals of said T-beams protruding beyond the end faces of said concrete beams, and a layer of job-poured concrete encasing the exposed upper surfaces of said pre-cast beams, the exposed surfaces of the flanged floor beams, and the protruding terminals of the metal T-beams and bonding them together to form a substantially unitary mass.

5. In a concrete building construction, the combination of a pair of flanged floor beams, spaced apart, concrete supports formed around the lower flanges of said beams, a second pair of flanged floor beams intersecting the first and forming with them an open floor area, a plurality of pre-cast concrete beams spanning the gap between said concrete supports, said pre-cast concrete beams having embedded therein longitudinally-extended metal T-beams, the terminals of said T-beams protruding beyond the end faces of said concrete beams, and a layer of job-poured concrete encasing the exposed upper surfaces of said pre-cast beams, the exposed surfaces of the flanged floor beams, and the protruding terminals of the metal T-beams, and bonding them together to form a substantially unitary mass.

6. In a concrete building construction, the combination of a pair of supports, spaced apart, a plurality of pre-cast concrete beams spanning the gap between said supports and laterally spaced apart, spacer means located between and bridging the gaps between said pre-cast beams, metal lathing bridging the gaps between the pre-cast beams at the bases thereof, and a layer of job-poured concrete encasing the exposed upper surfaces of said pre-cast beams and said spacer means and bonding them together.

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