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METHOD OF FORMING COMPOSITE FLOOR CONSTRUCTION.

APPLICATION FILED JULY 29, 1908.

1,183,594. Patented May 16, 1916.

Fig. 1.

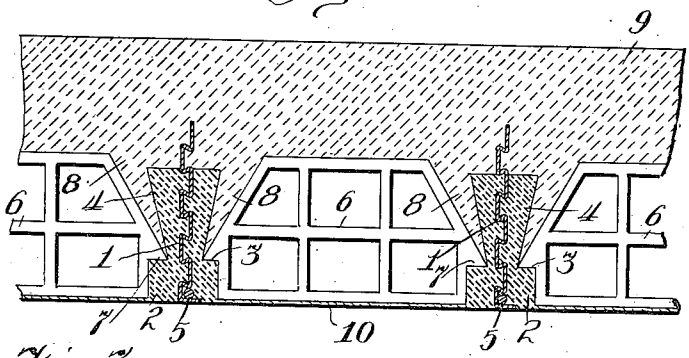


Fig 3.

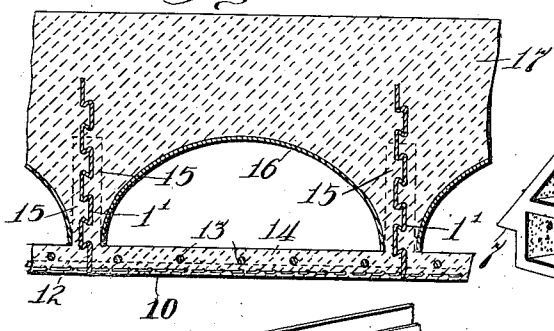


Fig. 2.

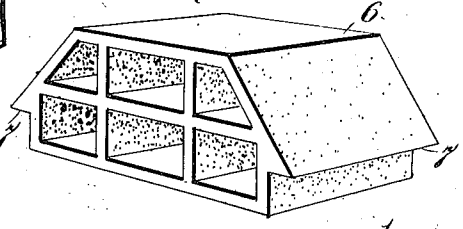


Fig. 4.

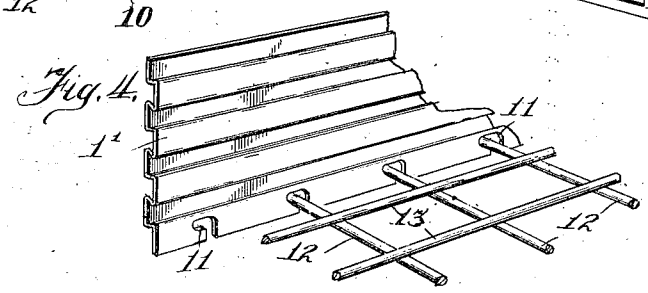
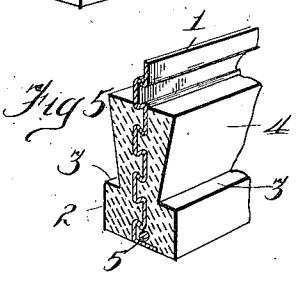


Fig 5



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METHOD OF FORMING COMPOSITE FLOOR CONSTRUCTION.

1,183,594. Specification of Letters Patent. Patented May 16, 1916.

Application filed July 29, 1908. Serial No. 446,016.

To all whom it may concern:

Be it known that I, ROY H. ROBINSON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and Improved Method of Forming Composite Floor Construction, of which the following is a specification.

This invention relates to a new and improved composite floor construction and method of forming the same, and relates more particularly to improvements in reinforced concrete floor constructions.

Among the salient objects of the invention are to provide a method of construction whereby the metal reinforcements are made to serve as supporting nuclei upon which the other component parts of the construction are built up, thus dispensing with the necessity of temporary or specially provided centerings; to provide a construction which when complete is characterized by maximum strength and minimum amount of material, the elements of the structure being so disposed as to best utilize the full efficiency of each of the several components; to provide a method of construction and a construction which may be readily modified to afford more or less strength in accordance with the requirements of given cases, without departing from the spirit of the invention; to provide a construction which may be erected with great expedition and without the employment of special skilled labor; and in general to provide improvements in this art.

The invention consists in the matters hereinafter described, and more particularly pointed out in the appended claims.

In the accompanying drawing—Figure 1 is a transverse vertical sectional view of a floor construction embodying one form of my invention, the lower half or strata of the construction being largely formed of tiles; Fig. 2 is a perspective view of one of the tiles employed in the construction shown in Fig. 1; Fig. 3 is a modification in which the tiles are dispensed with and arch-shaped hollows formed in the stead of the tiles; Fig. 4 is a fragmentary perspective view of the skeleton frame formed of the metallic reinforcements of the construction shown in Fig. 3; Fig. 5 is a fragmentary perspective view of one of the joist nuclei or reinforcements provided with a reinforcing coating of concrete as to its lower portions.

In every floor structure which has to support any considerable weight there are, of course, two classes of stresses, viz: tension stresses in the lower half of the structure and compression stresses in the upper half. Concrete is admirably suited to resist compression stresses but is weak in tensile strength. It is not unusual to supplement the tensile strength of the concrete in a composite floor structure of this character by metal reinforcements. However, in the present invention I not only supplement the concrete by metallic reinforcements but I utilize reinforcements of such character and adopt such a method of procedure in making the floor that these metallic reinforcements become the nuclei of joists or supporting beams which are made strong enough to support the entire added mass of concrete which forms the greater part of the weight of the floor while the chief mass of concrete is plastic and incapable of supporting itself. Moreover, I so organize the structure and proceed in such manner that in the finished structure the metallic reinforcements are as effectually embedded in, and mechanically bonded with, the mass of concrete as though molds had been provided and the concrete poured into these molds and around the reinforcements, and in organizing the structure due regard is had to so positioning the metallic reinforcements that they will occupy most efficient locations and arrangement in the structure.

Describing generally my method of procedure, I first erect a series or set of web or sheet-like metal reinforcements as joist nuclei; arranging these webs vertically in the final positions in which they are to remain in the structure, and connecting them with the cross beams or main frame of the structure in any usual or suitable way. These joist nuclei are of such character that concrete will mechanically bond with both the main surfaces thereof and they may be formed of expanded sheet metal, perforated sheet metal or sheet metal corrugated into inclave form. The last mentioned form of reinforcement is preferred. With a view to economy in the use of metal, I employ for these web-like reinforcements material which is comparatively thin and of a width considerably less than the thickness of the finished floor structure; it being obvious that there is little utility in carrying these reinforcing webs much above a point mid-thickness of the floor structure, since their

function in the finished structure is to afford tensile reinforcement. However, inasmuch as I employ these joist nuclei to support the chief mass of concrete while the latter is plastic, I proceed to augment the strength of the webs by adding to them supplemental reinforcing material which also becomes a component part of the finished structure. Preferably I apply coatings of concrete or cementitious material to both sides of the lower portions of these joist nuclei, and permit this to harden, thereby producing a composite joist composed of concrete with a vertical metallic reinforcing web extending therethrough. Sometimes, however, where very great tensile strength is required in the lower portion of the floor structure, I employ metal structural bars, such for example as T-rails or rods, which I mount directly upon the lower edges of the webs. In either case the joist nuclei are thus made strong enough to support the mass of concrete. If the floor structure is to be cellular or partially hollow as to its lower half, and this is almost invariably desirable, both in order to economize in concrete and avoid excess weight without materially lessening the strength of the structure, I provide either permanent or temporary centerings arranged to extend from joist to joist and then fill in the concrete around the joists and overlying the centerings so as to provide a continuous upper layer of concrete, and beam-like extensions upon the lower side of this upper layer, within which the joists are inclosed to form a monolithic structure. The method will be more exactly understood by a description of the manner in which the several structures herein described are made.

Referring to the drawing, in Fig. 1, 1, 1, designate sheet metal webs of ferro-inclave form arranged with their planes vertical, spaced at suitable intervals apart, and suitably united at their ends to the main stringers or cross beams of the structure. 2, 2, designate concrete coatings applied to both sides of the lower portions of these joist nuclei 1; the concrete coatings being in the construction shown in Fig. 1 so shaped as to provide horizontal shoulders 3 at each side, and upwardly widening or thickening portions 4 above the shoulders. The concrete may be applied to the inclave sheet, so as to produce the cross sectional form shown, by being plastered thereon by a trowel, either before or after the web reinforcement has been erected, or if done before erection it may be applied in this form by passing the web through a suitable molding machine which applies the concrete in plastic condition. If additional metallic reinforcement is desired, I associate reinforcing rods or bars 5 with the lower edges of the webs before the concrete is applied thereto. These joist nuclei having been thus reinforced and allowed to harden, I next arrange sets of hollow tiles 6 in position between the joist nuclei and interlocked with the latter in such manner as to form flat arches. As shown in Fig. 1, each tile is made of a length sufficient to bridge the space from joist to joist, and is provided at its end margin with shoulders 7 which engage the shoulders 3 of the joists hereinbefore described. The end walls of each tile converge upwardly so that spaces 8 are provided between these walls and the proximate sides of the initial concrete coatings of the joists. Having thus arranged the tiles in position, the upper layer 9 of concrete is filled in and spread over the entire area, so as to form an upper layer of considerable thickness of solid concrete and so as to fill into the spaces 8 between the tiles and the joists and thus unite monolithically with the latter. It will be noted that when the chief mass of concrete is filled in, the upper exposed edges of the web reinforcements are also covered and bonded into the mass. Usually a coating of plaster 10 will be applied to the lower surface of the tiles and also edges of the joists to afford a suitable uniform ceiling finish.

In the construction shown in Fig. 3 I dispense with the tiles. In forming this construction I employ reinforcing webs 1′ which are provided in their lower edges with inverted L-shaped notches 11, or other suitable apertures, at suitable spaces apart, and after the web reinforcements have been erected and secured in place, I insert reinforcing bars or rods 12 into these notches 11 so that they extend transversely across the lower edges of the webs and are supported by the latter. If desired I also support a set of longitudinally disposed reinforcing bars 13 upon the set of bars 12, and I then attach metal lathing, or some similar fabric, to the under side of the skeleton structure thus formed, thus providing a continuous skeleton ceiling sufficiently close in mesh to retain concrete or plaster. I next proceed to apply a layer of concrete 14 to the upper side of this skeleton ceiling, and preferably also apply coatings of concrete to both sides of the respective joist nuclei or webs, as indicated in dotted lines at 15, 15, and allow these coatings of concrete to dry and harden. The structure is now strong enough to support any reasonable weight of material, and I may fill in with concrete to any desired thickness between the joist nuclei and above the latter, but preferably before filling in the mass of cement I arrange arch-shaped supporting sheets to extend from one joist to the next, as indicated at 16, so as to leave the arch-shaped hollows shown in Fig. 3. These sheets may be of metal, or even a reasonably thick and stiff quality of cardboard, since

their only function is to support the concrete while plastic and until it hardens, and this in a space which is entirely sealed in. After arranging the arched sheets as described, the main mass of concrete 17 is filled in as in the first described construction, and thereafter the under surface of the ceiling is plastered or otherwise finished.

It will be noted that in making each of the several constructions described, the method of procedure is in general the same; that each construction is characterized by the employment of web or sheet-like metallic joist nuclei which are made to serve as skeletons upon which to build up the main structure; that in each instance the metallic reinforcements are so disposed as to best strengthen the structure against the tensile stresses to which the lower half of the floor structure is subject, and that in each construction the strength incidental to the use of a deep body of concrete is secured while but little more than half of the quantity of concrete necessary to make a solid structure of equal thickness is employed. Those parts of the structure which I have referred to as joists are, of course, in the finished structure more in the nature of integral beam extensions upon the under side of the main layer of concrete and are in each instance monolithic parts of said main layer. It will be obvious that other modifications may be made without departing from the spirit of the invention.

I claim as my invention:

1. The herein described method of forming composite floor constructions, which consists in first erecting in their final positions web-like attenuated metal joist nuclei, each comprising a sheet metal web of ferro-inclave form, each arranged with its plane vertical, or substantially so, then attaching and mechanically interbonding with opposite sides of each joist nucleus a concrete coating and allowing the coating to harden whereby the joist is reinforced in strength and made capable of supporting its share of the full weight of the floor construction, then adjusting supporting arches to extend between the lower portions of the contiguous joist nuclei and then adding a filling of plastic concrete to form an upper layer which bridges the spaces between the joists and embeds and unites monolithically with the joist nuclei.

2. The herein described method of forming composite floor constructions, which consists in first erecting in their final positions web-like attenuated metal joist nuclei each having both surfaces fabricated into projections and cavities adapted to interbond with plastic concrete, each arranged with its plane vertical, or substantially so, then applying and mechanically interbonding with opposite sides of each joist nucleus, a concrete coating, and allowing the same to harden whereby the joist is reinforced in strength and made capable of supporting its share of the full weight of the floor construction, then adjusting supporting arches to extend between the lower portions of the contiguous joist nuclei and then adding a filling of plastic concrete to form an upper layer which bridges the spaces between joists and embeds and unites monolithically with the joist nuclei.

3. The herein described method of forming composite floor construction, which consists in first erecting in their final positions web-like attenuated metal joist nuclei, each comprising a metal web adapted to receive and interbond with plastic concrete, each arranged with its plane vertical, or substantially so, then attaching and mechanically interbonding with opposite sides of each joist nucleus a concrete coating and allowing the coating to harden whereby the joist is reinforced in strength and made capable of supporting its share of the full weight of the floor construction, then adjusting supporting arches to extend between the lower portions of the contiguous joist nuclei and then adding a filling of plastic concrete to form an upper layer which bridges the spaces between the joists and embeds and unites monolithically with the joist nuclei.

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