Dec. 25, 1934. J. V. KOHLHAAS 1,985,786

ROOF AND FLOOR CONSTRUCTION

Filed Sept. 28, 1932 2 Sheets-Sheet 1

Fig. 1.

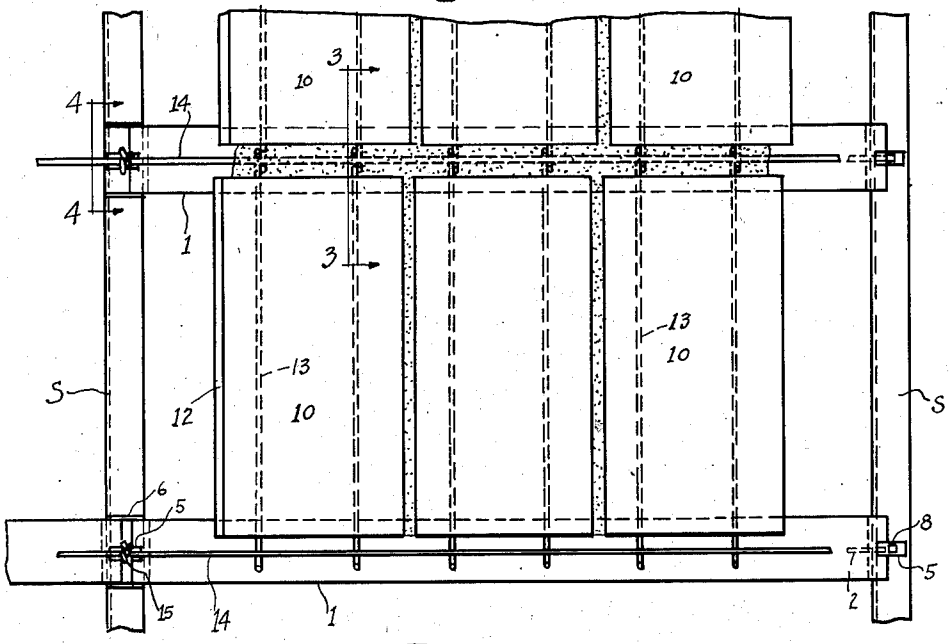


Fig. 2.

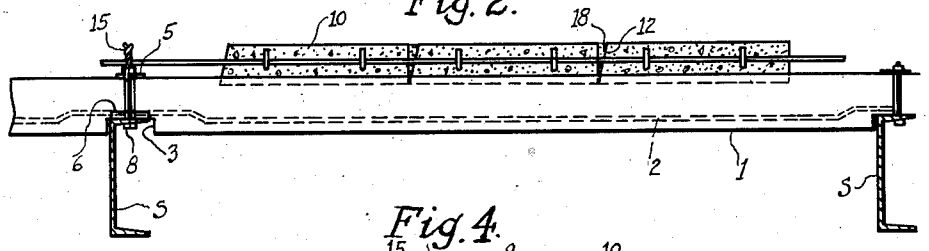


Fig. 3.

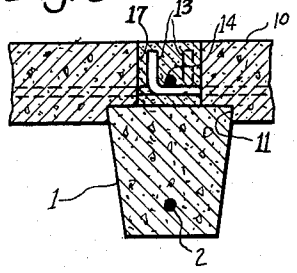
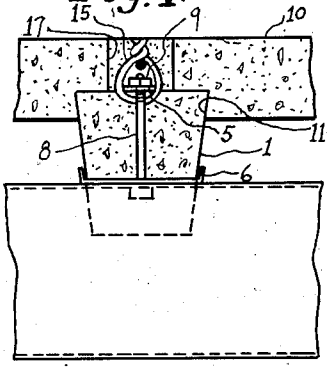


Fig. 4.



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Filed Sept. 28, 1932 2 Sheets-Sheet 2

Fig. 5.

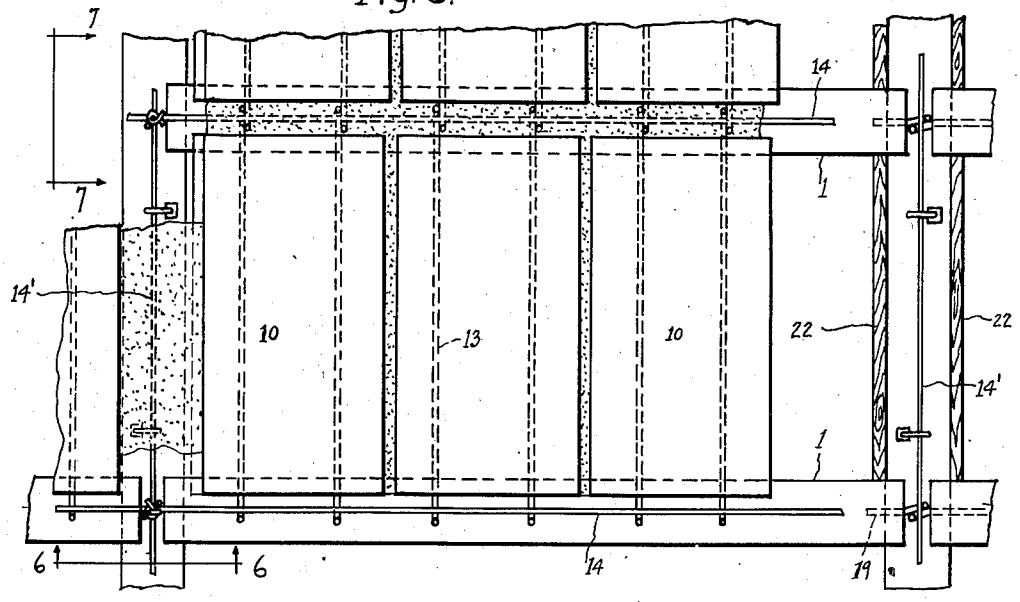


Fig. 6.

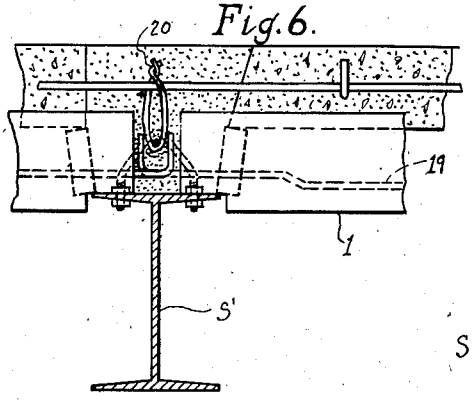


Fig. 7.

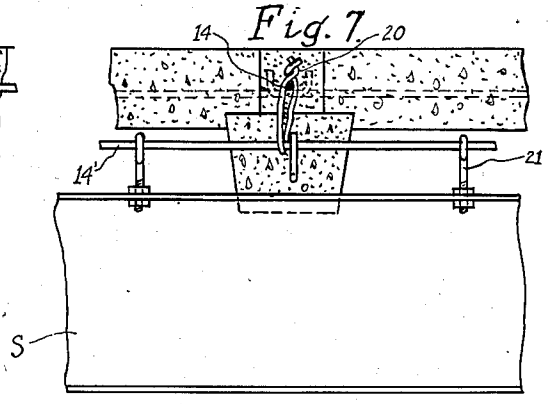
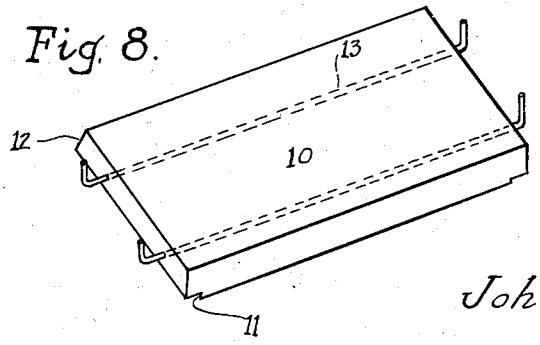


Fig. 8.



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UNITED STATES PATENT OFFICE

1,985,786

ROOF AND FLOOR CONSTRUCTION

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Application September 28, 1932, Serial No. 635,139

2 Claims. (Cl. 72—66)

My invention relates particularly to a building construction, as a floor, roof or the like, comprising a plurality of pre-cast slabs formed of concrete, gypsum, or other suitable material, and provided with interlocking and reinforcing means whereby the several slabs may be firmly secured to their supporting structures and to adjacent slabs, thereby forming a substantially monolithic surface to which roofing material, flooring or the like may be applied, although it will be understood that my invention is also applicable to walls, partitions and other structures in which a continuous reinforced monolithic surface is desired.

In roof or floor structures of this character it has heretofore been the practice to provide relatively thick reinforced slabs capable of withstanding the stresses to which the roof or floor is likely to be subjected and sometimes having integral reinforcing ribs at their edges in order to afford the requisite strength. Such slabs are ordinarily disposed directly upon the roof supporting structure, and span the spaces between pairs of adjacent steel or other joists therein.

Certain disadvantages, however, are met in such structures, for it is apparent that the size of the slabs which may conveniently be handled in erection of the roof is necessarily limited for many reasons, and the supporting joists must therefore be positioned at distances from center to center only slightly greater than the greatest dimension of the individual slabs; thus when, for example, the slabs are approximately three feet in length, the supporting joists must be disposed about three feet apart, even though stress and safety factors and the like might require only that similar joists be spaced at intervals of six feet, and the number of joists required might be reduced by approximately one half were it not for the limitations imposed by the size of the slabs. Furthermore, when slabs provided with integral ribs are employed, it is frequently necessary to manufacture certain of the slabs in special sizes in order that the particular dimensions of the roof may be conformed with in covering the latter, due principally to the fact that any appreciable cutting of a slab in order to fit it properly to the area to be covered thereby necessarily removes all, or a large portion, of one or more of the reinforcing ribs ordinarily disposed adjacent the edges of the slab, and thus so greatly weakens it as to frequently render it unsuitable for its intended use.

In accordance with my invention, however, I provide strong but relatively light slabs of substantially uniform thickness of a size conveniently handled and adapted to rapid and inexpensive erection in a roof and which, when erected in accordance with the present invention, do not require that the roof or floor supporting joists or beams be arranged close together so as to support each slab directly, or that they be spaced at shorter intervals than are required by stress and safety factors usually relied upon for determination of such intervals in building construction; thus, as a result of my invention, the architect, engineer or other designer of buildings is not restricted to the necessity of spacing the floor or roof joists in accordance with the length of the slabs to be employed.

A principal object of my invention, therefore, is to provide a roof or floor structure comprising pre-cast slabs of light weight but of maximum strength and having novel reinforcing means whereby relatively wide spans may be covered by precast reinforced structural elements, and thus a maximum load carrying capacity provided with but a minimum number of steel beams, joists or other main supporting members.

Another object of my invention is to provide convenient means whereby adjacent slabs and other elements may be easily, quickly and cheaply secured in their desired positions in the roof or floor, and thereafter firmly retained in such positions against movement in any direction.

A further object of my invention is to provide a precast structural rib of novel form adapted for employment in the erection of monolithic roofs, floors and the like and operative to support the surface slabs.

A still further object of my invention in one of its forms is to provide means whereby a monolithic structure of the class aforesaid may be easily and cheaply erected without the necessity of providing molds, forms or the like for the pouring of joints between adjacent slabs.

Other purposes, objects and advantages of the invention will hereinafter be more specifically mentioned or will be apparent from the following description of certain embodiments thereof, in which reference will be had to the accompanying drawings.

In said drawings, Fig. 1 is a fragmentary top plan view of a portion of a roof embodying my novel elements and constructed in accordance with my preferred manner of erection, certain elements being omitted for the sake of clearness; Fig. 2 is a fragmentary side elevation of the structure shown in Fig. 1; Fig. 3 is an enlarged fragmentary section on the lines 3—3 in Fig. 1; Fig.

4 is an enlarged fragmentary end elevation of a portion of the incomplete structure shown in Fig. 1; Fig. 5 is a fragmentary top plan view of an incompleted roof portion erected in accordance with a modified embodiment of my invention; Fig. 6 is an enlarged fragmentary end section of a portion of the structure shown in Fig. 5 on the lines 6—6 in said figure; Fig. 7 is an enlarged fragmentary section on the lines 7—7 in Fig. 5; and Fig. 8 is a perspective view of a pre-cast slab made in accordance with my invention and which I prefer to employ in the erection of the composite structures comprehended thereby. In the several figures like characters are employed to designate the same parts, and the several sections are taken in the direction of the arrows in the section lines.

Referring now more particularly to Fig. 1, showing an incompleted portion of a roof structure in the course of erection on a building in which steel beams S form the roof supports, I provide in accordance with my invention pre-cast ribs 1 of novel character which may be formed of concrete, or any other suitable material, and desirably have one or more steel reinforcing rods 2 embedded therein and extending longitudinally thereof; these ribs are employed to support the roof slabs and are disposed at suitable distances apart with their ends resting on the beams S. The ribs are preferably rabbetted at each end as at 3 to fit partly over and partly between adjacent beams, whereby the ribs 1 are held against longitudinal movement, even before they are permanently secured to the beams. For this purpose any convenient means may be employed, such, for example, as the steel plates 5, 6 held together by means of a bolt 8, passing through the beam flange, and nut 9. The lower plate 6 is desirably flanged at two of its edges as shown in Fig. 4, the flanges being effective to restrain any tendency of the ribs to move or creep transversely, that is, longitudinally of the steel beams.

After the ribs 1 have been secured to the beams at the proper distances as determined by the length of the slabs to be employed, suitable concrete surface slabs may then be laid in place, resting on the ribs, and for this purpose I prefer to employ my improved slabs 10 the respective ends of which are suitably rabbetted as at 11 to permit them to be fitted to the ribs, as is clearly shown In Figs. 3 and 4. One or both of the longitudinal edges of each slab 10 are desirably slightly beveled as at 12 for a purpose which will hereinafter appear, and embedded in each slab and extending longitudinally thereof are a plurality of reinforcing rods 13. While I have shown in the drawings two rods 13 in each slab, it will be understood that one only or any greater number of such rods may be employed as desired, usually depending on the width of the slab. The projecting ends of each rod 13 are bent approximately at right angles a short distance from the ends of the slabs, and thus when the latter are in place on the ribs, the rod ends 13 extend partially over and then upwardly from the ribs, the rods from the slabs on opposite sides of any rib overlapping to provide a plurality of small spaced cradles into which a tie rod 14 may be lowered to lock the slabs together. The tie rods 14 may thereafter be secured in place by wires 15, extending under the plates 5 and twisted together above the tie rods. As will be understood from reference to Fig. 3, the ends of adjacent slabs 10 and the top of their common supporting rib 1 cooperate to form a trough or groove 17 into which the slab reinforcing rods project to receive the tie rod, and as at least one of the longitudinal edges of each slab is preferably beveled, it is desirable that the slabs be so placed that additional grooves or troughs 18 will be formed by the abutting longitudinal edges of adjacent slabs, as between two beveled edges or between one beveled edge and an adjacent square edge.

The slabs having been laid in position and the tie rods 14 properly placed and secured to the plates 5, a cement or concrete mix, or any other suitably impermeable grouting material, is then introduced into the grooves 17, 18 in accordance with the usual practice, and allowed to harden, thus binding the slabs together in a continuous layer of concrete, if that be the material employed, while the interlocking of the reinforcing rods adjacent the ribs provides in effect a continuous reinforcing chain between each row of slabs and the adjacent rows, while the reinforced ribs 1, firmly secured to the steel beams, are effective to provide adequate support for the slabs. Thus, in accordance with my invention, I provide a monolithic surface structure of adequate strength to withstand excessive stresses which may be relatively easily and quickly erected at a minimum expense and in which the supporting beams S may be spaced at intervals greater than the length of the superposed slabs.

In the form of my invention shown in Figs. 5, 6 and 7 I provide in the ribs reinforcing rods 19 having upturned ends similar to those of the slab reinforcing rods 13 already described so that the ends of the rods in adjacent ribs overlap to form a cradle adapted to receive a tie rod 14′ and thus the ribs are locked securely in place, while the tie rods 14 may be secured to the tie rods 14′ by any suitable means, such as a wire 20; threaded eyes 21 are also desirably provided at suitable spaced points along the steel beams S′ for securing the tie rods 14′ thereto whereby a continuous interlocked network of reinforcing rods extends throughout the roof area and is firmly held in place at spaced points through connection with the supporting structure formed by the subjacent beams S′.

To complete the monolithic character of the roof in this form of the invention, I prefer to place temporary side forms 22 along each steel beam to provide, as shown in Fig. 6, a trough through which the adjacent tie rod 14′ extends and into which grouting may be poured to thereby enclose all metal parts above the steel beam within the concrete or other grouting material and securely hold them in place in the roof structure. After the grouting in the trough has set and hardened, the side forms 22 may, and usually will, be removed.

It is apparent that when the dimensions of the roof or floor are such that certain slabs smaller than standard sizes are required, they may readily be obtained by suitably cutting standard slabs to the required dimensions and bending the reinforcing rods, the uniform thickness of the standard slabs permitting such cutting without the sacrifice of strength.

While I have herein shown and particularly described certain specific forms of my invention as comprised in roof structures, it will be understood that I do not desire or intend thereby to limit myself thereto, as the same may with equal facility be employed for floors, while changes in the size and proportions of the various elements employed, and in the form and arrangement thereof may be made if desired without

departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described my invention, I claim and desire to protect by Letters Patent of the United States:

1. A building construction of the character described comprising spaced joists, spaced precast monolithic ribs supported thereby, each rib having a reinforcing rod extending therethrough and projecting beyond its extremity, said rods overlapping the projecting ends of the rods in adjacent ribs, means extending transversely to said rods operative to tie said projecting ends together, a plurality of precast slabs supported on the ribs, a reinforcing rod in each slab projecting beyond the extremities thereof and overlapping the projecting ends of the rods in adjacent slabs, and means extending transversely of said last mentioned rods operative to tie said rods together.

2. A building construction of the character described comprising spaced joists, spaced precast monolithic ribs supported thereby, each rib having a reinforcing rod extending therethrough and projecting beyond its extremity, the projecting ends of the rods extending substantially normal to the main portion thereof, said rods overlapping the projecting ends of the rods in adjacent ribs, means extending transversely to said rods operative to tie said projecting ends together, means operative to tie said first mentioned means to the adjacent joists, a plurality of precast slabs supported on the ribs, a reinforcing rod in each slab projecting beyond the extremities thereof, the projecting ends of the rods being normal to the main portions thereof and overlapping the projecting ends of the rods in adjacent slabs, means extending transversely of said last mentioned rods operative to tie said rods together, means operative to secure said last mentioned means to said first mentioned means, and grouting material substantially imbedding all of said means and presenting an uninterrupted monolithic surface continuous with the upper surfaces of the adjacent slabs.

JOHN V. KOHLHAAS.