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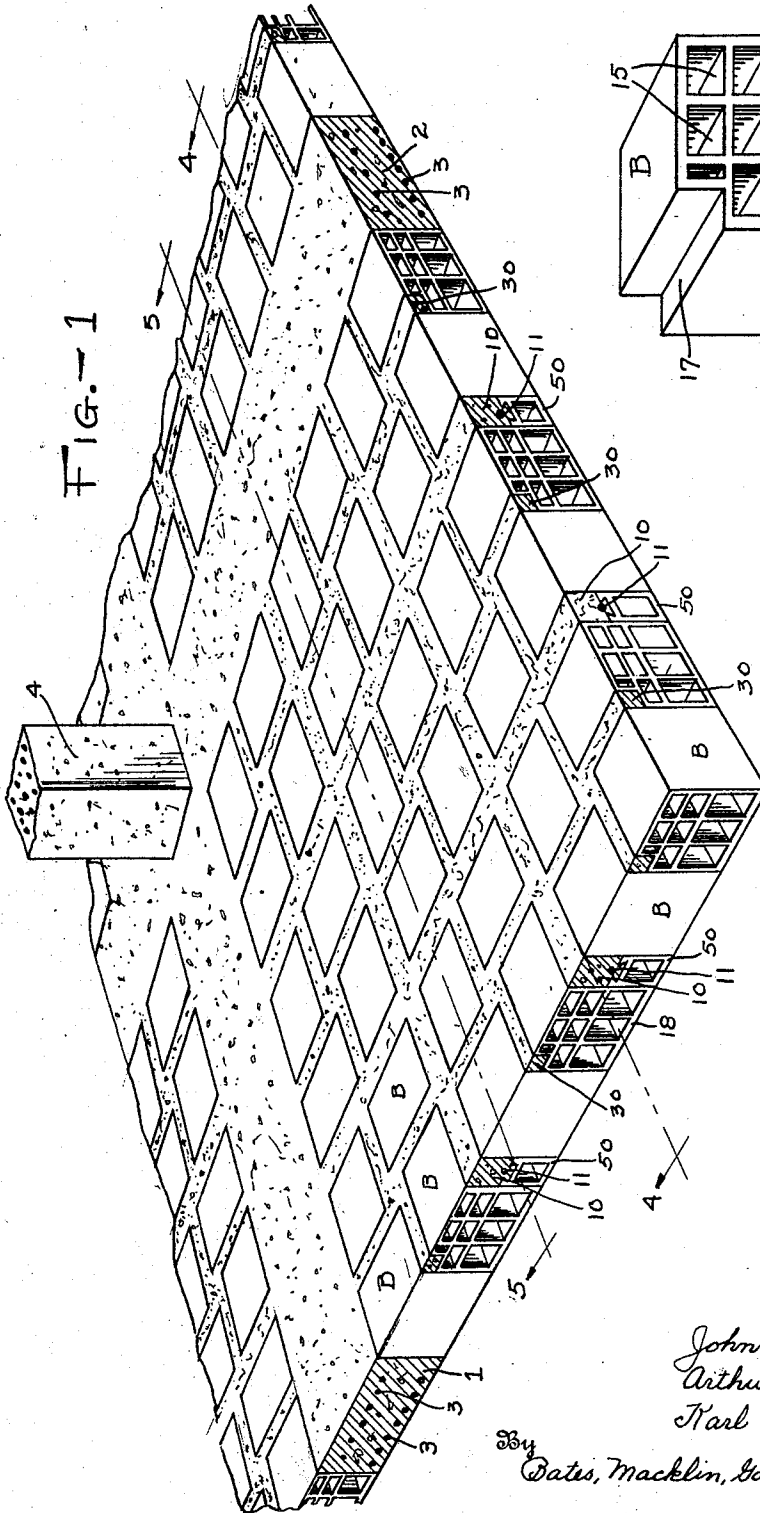
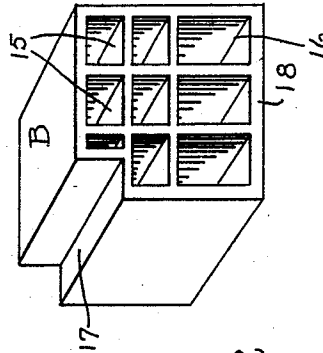
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FLOOR SLAB

Filed June 27, 1927

2 Sheets-Sheet 1



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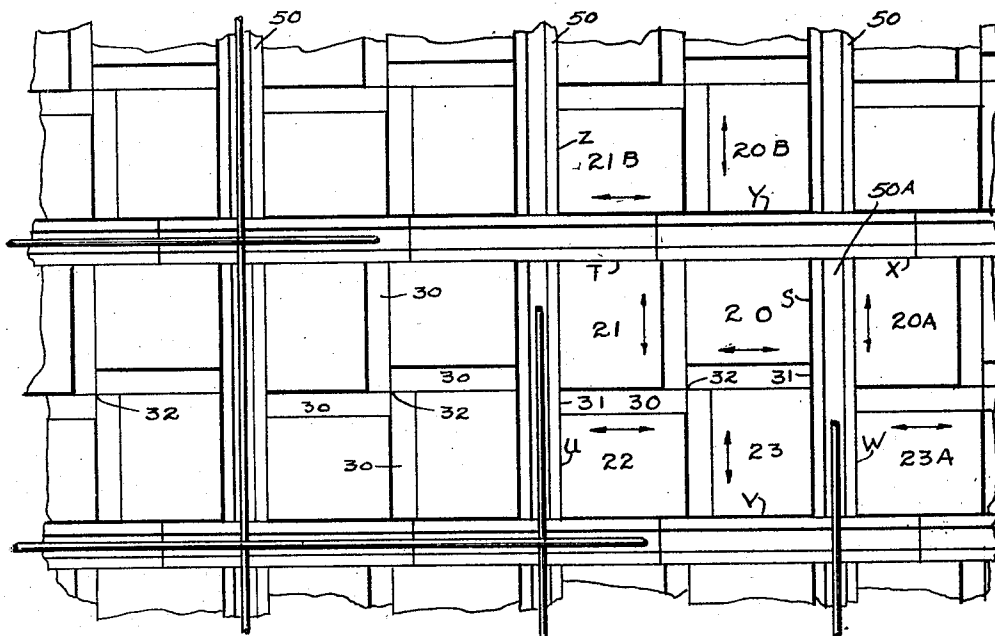


FIG. 3

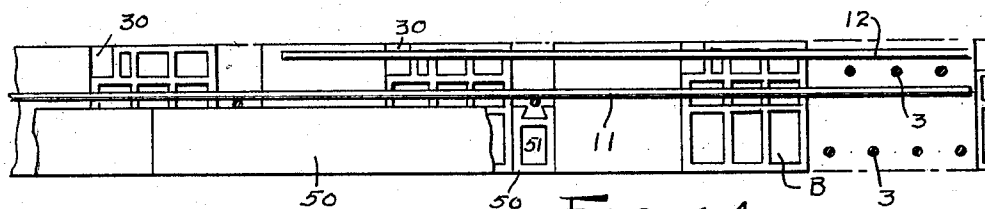


FIG. 4

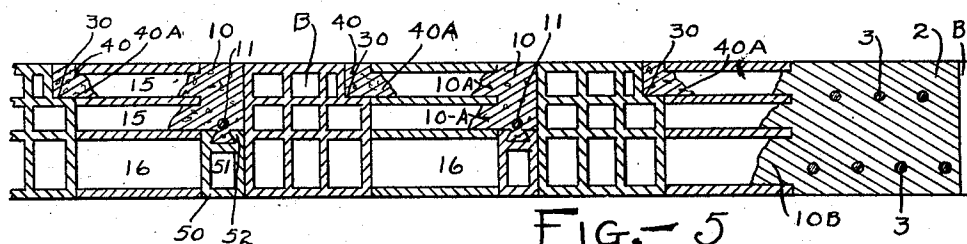


FIG. 5

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UNITED STATES PATENT OFFICE

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FLOOR SLAB

Application filed June 27, 1927. Serial No. 201,631.

This invention relates to a floor or ceiling construction, and more particularly to a floor slab composed in part of hollow tile blocks. It is among the objects of our invention to construct a floor which combines a minimum weight with great strength and which may be rapidly and easily built.

Other objects include making the floor fire-proof. Another object is to provide an ample insulation between the concrete of the floor and the ceiling surface so that the ceiling surface may be plastered and be free from the accumulation or seepage of moisture from concrete.

A further object is to arrange and position the tile in the floor so that the strength of the tile blocks is most efficiently used in carrying the floor load. A further object is to group and arrange the tile so that the tile will be bonded to the floor joists and beams as well as to each other. A further object is to lessen the time and cost of erecting temporary supports on which our slab is laid, by arranging the tile in such manner that the tile comprises the form for the concrete, while the support merely holds the tile.

Other objects will appear from the following description of our invention; the essential characteristics are summarized in the claims.

In the drawing, Fig. 1 is a perspective of a section of a floor slab including portions of intermediate beams or girders; Fig. 2 is a perspective of major or working tile block; Fig. 3 is a plan of the tile and reinforcing steel, as laid before the concrete is poured; Fig. 4 is a partially broken section (with concrete removed) taken along the lines 4—4 of Fig. 1; Fig. 5 is a section taken along the lines 5—5 of Fig. 1.

In carrying out the objects of our invention and referring to the preferred form illustrated in the drawings, we show particularly in Fig. 1 a portion of a floor slab which, for the purpose of illustration may be square or rectangular and is shown lying between beams or girders 1 and 2. The beams 1 and 2 are shown as composed of reinforced concrete having suitable reinforcing bars 3. The beams are arranged to intersect in the

usual way and be supported by suitable columns such as the column 4. We show in Fig. 1 a preferred form of our invention wherein the slab has the same depth as the beams. While we contemplate building slabs with greater or less depth than the beam, still we find that the principles of our invention readily lend themselves to this construction which has the very apparent advantage of eliminating ceiling beams.

The slab proper is composed of intersecting concrete joists 10, the tops of which lie flush with the tops of the beams and with the tops of the tile blocks. Suitable reinforcing rods 11 are laid in the joists as shown. The rods are shown to lie in two directions as shown in Fig. 3. Referring to Fig. 4, we have shown in addition to the rods 11, the rods 12, which extend across the upper portion of the beam and lie above the neutral axis of the slab in the usual way. The particular arrangement of the reinforcing rods of the slab is a matter of choice consistent with the teaching of our invention; we have shown the conventional use of such rods by way of illustration to more clearly set out the other novel features.

The joists 10, as appear, are not as deep as the beams 2 and for the sake of illustration. I have shown the joists to be about one-half the depth of the beams. It follows that in the form of our invention shown herewith, that the upper half of the slab does the work of carrying the load and that the lower half may be regarded as being idle at least in the portions remote from the beams.

In the slab, we use major tile blocks B as illustrated, for example, in Fig. 2, which blocks may be substantially cubical in form and are extruded to have a plurality of voids 15 and 16 extending the length of the block in the usual manner. In the preferred form, the tile blocks have a step or off-set portion at one of the upper edges of the block as at 17; the step lying parallel with the voids. We do not care to be limited however, to the relation of step or steps to the direction or size of the voids in the block. The voids 15 in the upper portion of the block are shown to be smaller than the voids 16 below and in

placing the block in the floor, the smaller voids along with the step portion are placed upwardly so that the lower voids 16 lie immediately above the ceiling which is composed in part of the bottom shells 18 of the blocks B.

5 Referring to Figs. 1, 2 and 3, the blocks B are laid on temporary supports, not shown, in groups of four blocks B, with the voids and step portion of each block lying normal to the voids and step portion in the adjacent blocks. Thus, in Fig. 3, we show blocks 10 20, 21, 22 and 23 constituting a group with the voids and steps of the blocks 20 and 22 extending as indicated by the arrows in the face of the drawing, and the voids and steps of the blocks 21 and 23 extending at right angles as indicated by the arrows. The step portions of the blocks face inwardly of the group and form a continuous channel or groove across the upper face of the group as at 30. These channels or grooves extend to the outer edge of the group as at 31.

Referring to Figs. 4 and 5, the channel or grooves 30 appear between the steps 17 and the ends of the uppermost voids 15 of the adjacent and abutting blocks. Concrete keys 25 40 are poured to fill up the channels as shown in Figs. 1 and 5. The concrete keys 40 in these channels lie in the step portion 17 of each block and flow into the voided ends of adjacent blocks forming lugs 40A. The keys 30 40 extend across the face of the floor and not only avoid dry joints between tile, but also bond the tile in each group together.

35 If we consider that each group of tile constitutes in itself, an isolated dome or arch, the compression stress will reach a maximum in the top portion of the center of the group as at 32 in Fig. 3, where the keys 40 intersect. Further considering each group as a pair of 40 intersecting arches, it will appear that the concrete keys 40 with lugs 40A, form, in effect, an extended keystone for each arch. The concrete keys 40 in the channels 30 thus serve to distribute the load across the top of 45 the group and distribute the load from the side of the step 17 to the top shell and to the upper webs of the adjacent tile. The lugs 40A extending into the voids lying between the top shell and the upper horizontal web 50 serve to mechanically lock the tile in engagement and to take the direct shear between abutting tile.

Referring back to Figs. 1 and 3, I provide 55 soffit tiles 50 which lie below the joists 10 and space the groups from each other and space the joists away from the ceiling surface. The soffit tiles may be of convenient length to conform with the size of the blocks B. In 60 Fig. 3, we show, particularly, the soffit tile 50^a to be equal in length to a side dimension of the group of tile 20, 21, 22 and 23, that is, the soffit tile 50^a is shown to be as long as the combined length of the tiles 20 and 23. 65 The soffit tiles are laid in all of the spaces be-

tween groups of tile, and with bottom shells of the blocks B, form a continuous tile ceiling.

As shown, particularly in Figs. 4 and 5, each soffit tile 50 has a large void 51 extending longitudinally of the tile and has a chan- 70 nel formed in the top which is adapted to be keyed into the joists and suspended thereby as at 52. Any suitable keying means between the soffit tile and the joist can be used.

The soffits are of such height as to close the 75 lower voids 16 of the major tile as shown in Fig. 5, so that substantially all of the concrete in the slab is maintained substantially in the upper section thereof. The cells or voids of the soffit tile 51 may be substantially 80 of the same cross sectional area as the major voids 16 in the blocks B, so that a complete and uniform cellular layer is provided between the ceiling surface and the working portion or upper section of the slab. Plaster 85 may be applied to the lower shells of all the tile. These shells are well insulated from any moisture that may accumulate in or through the concrete joists or keys. In this manner, the plaster is always dry and insu- 90 lated from the concrete. The fireproofing value of this slab is greatly enhanced by reason of the fact that the reinforcing rods 11 for instance, are insulated from the nearest surface by the air space in the lower voids 95 and are of course insulated from above by the concrete in the joists.

In laying the tile, as shown in Fig. 3, all of the temporary supporting surface is covered with tile so that there is no shifting of 100 tile when the concrete is poured. In addition to the advantage of centering and locating the tile on the supports, it will be seen that a complete tile form is provided for the concrete which is poured in the slab. The 105 temporary supports may comprise loose planks which need only be spaced closely enough to provide a safe flooring for the workmen. Such temporary supports may of course be more economically erected and removed than those which must constitute in 110 part a form for concrete.

The reinforcing rods 11, see Fig. 3, are laid directly over the soffit tile, the lowermost of the rods are laid to extend transversely of the 115 channels of some of the soffits. The rods which extend parallel with the channel portion of the soffits are laid over intersecting rods.

As appears from Figs. 1, 3 and 5, particu- 120 larly Fig. 5, the joists 10 lie between and fill the space between groups of the tile and have lugs 10^a which extend into the open ends of alternate faces of tile. Thus, each tile is firmly bonded into the joists at one end and 125 is bonded at the other end by the concrete key 40 having the lugs 40^a. A group of tile such as the group shown in Fig. 3 is bonded to the joists where the voided ends of the particular tile meet the joists. Thus the tile 20 is 130

bonded into the joists by lugs along the edge S, the tile 21 similarly bonded along the edge T, the tile 22 along the edge U, the tile 23 along the edge V. We further provide on the other side of the joists that the tile 23^a is bonded into the joist along the edge W and the tile 20^a is bonded into another joist along the edge X. In this manner, the lugs of the joist extend first into the tile 23^a along the edge W and then into the tile 20 along the edge S. Considering the tile spaced across the joists in the other direction 20^b and 21^b, the tile 20^b is bonded to the joist along the surface Y and the tile 21^b is bonded to the joist along the surface Z, thus the lugs in the transverse joist extend into the tile 20^a at X and then diagonally across the joist into the tile 20^b at Y and then back into the tile 21 at T. With this arrangement the voids of each tile in the floor as well as each tile in the group extend at right angles to the adjacent tile and so that the greatest strength of tile augments the strength of the two-way reinforcement. In other words, the strain in a given tile measured in the direction of its vertical webs is transferred through a medium of concrete with every adjacent tile against the side wall thereof and is both dispersed and carried through the horizontal webs and shells of the adjacent tile. In this manner both in the groups and between groups, we effect a great uniformity of loading each tile, so that all of the tile may most effectively work, or rather so that each tile may work at great efficiency.

Referring particularly to Fig. 5, it will be seen that the groups of tile adjacent the beams present one tile per group with all of its voided end open to the beam. In this manner the lugs of concrete not only extend into the upper voids of the major tile, but also extend into the lower voids as at 10B. This construction fully bonds the tile on the edge of the slab to the beam and aids in taking the direct shear between the edge of the slab and the S beam. It will be further appreciated by one skilled in the art that these lugs in the lower voids adjacent the beam aid in gripping each tile to help take the compressive strain in the lower portion of the slab, which is greatest adjacent the beam.

The foregoing constitutes a description of a preferred form of our invention, but we do not care to be limited to the exact details of construction shown. For instance, we have shown groups constituting four tile blocks, but it can be readily understood that the teaching of our invention is readily applicable to groups composed of different numbers of blocks. The particular shape of the tile block and the size and arrangement of the step and web structure may be varied to suit the needs of a particular case. Other variations may be made without departing from the scope of the claims appended hereto.

We claim:

1. A floor slab having concrete joists and groups of four voided blocks bonded between intersecting joists, each block in the group having one open end abutting the joists and keyed to the joists by means of lugs of concrete extending into the voided ends of the tile and having the other open end facing the shell of an adjacent block in the group, in combination with a continuous concrete key extending between the upper portions of said blocks and distributing compressive load between them in all directions.
2. A floor slab including a group of voided blocks, the blocks in a group being arranged with voids in one block at right angles to the voids in a horizontally adjacent block and presenting alternate open ends to the exterior of the group, concrete joists spaced from each other and laid in two directions in the floor and surrounding each group of tile, each joist having lugs of concrete extending into the open ends of the blocks, the lug portions of the joists alternating from side to side of the joists and spaced longitudinally of the joists a distance equal to at least the length of a block.
3. A floor slab having intersecting concrete joists and groups of hollow tile blocks positioned between the joists, the voided end of each tile in the group abutting a lower portion of the shell of an adjacent tile in the group and spaced from the upper portion thereof and a concrete key disposed between abutting tile in the group to distribute the load throughout the group.
4. A floor slab having reinforced concrete joists and groups of hollow tile blocks bonded between joists, the open ends of tile in the group abutting adjacent tile, a non-reinforced concrete key disposed between abutting ends of the tile in the group and transmitting compressive load between blocks in the group and having lugs extending into the open ends of the abutting tile.
5. A floor slab having concrete joists and groups of voided tile blocks bonded between joists, one voided end of each block in the group abutting the side wall of an adjacent tile and the other voided end facing the joist, and a concrete key disposed between abutting blocks and having lugs extending into the voided ends of the abutting blocks, the joists having lugs extending into the other end of each tile, whereby each tile is locked into the slab by lugs of concrete in both ends, and whereby each group of blocks constitutes a load bearing unit throughout which the load is distributed by said key.
6. A floor slab having concrete joists spaced apart and groups of tile blocks spaced between joists and lying flush with the top of the joists and each group acting as a load bearing dome or arch, each tile of the group abutting adjacent tile and having an

upper reduced portion, the depth of the reduced portion being less than the depth of the joist, and concrete keys formed integral and flush with the top of the joists and lying across the upper face of the group of tile
5 between the said upper reduced portions of the tile and serving to distribute the load from block to block throughout each dome or arch.

10 7. In a floor slab the combination of groups of hollow tile blocks having webs and shells, each group composed of blocks abutting each other and bonded between concrete joists, the blocks in the group being
15 arranged with the vertical webs lying normal to the shells of adjacent tile, each tile in the group having an upper reduced portion whereby grooves are formed in the upper surface of the group with parts of the
20 shells and parts of the open ends of adjacent blocks exposed to the grooves, and concrete keys poured in the grooves and having lugs extending into the exposed open ends of the blocks and lying between the webs thereof,
25 said webs abutting and transmitting the load to the said concrete joists.

8. A floor slab comprising spaced reinforced concrete joists with hollow tile blocks arranged in horizontally adjacent pairs between joists, the blocks having their upper
30 shells flush with the top of the joists so that each pair of blocks constitutes a load carrying arch abutting the joists, at least one block having a plurality of vertical webs, at least one block having one of its upper
35 edges cut away forming a channel with an adjacent block and exposing the upper portion of the said vertical webs of one of the pairs of blocks, concrete keys poured in the channel and having lugs extending around
40 said vertical webs, and lugs extending from said joists into the voided ends of the tile blocks exposed thereto.

9. A floor slab comprising spaced intersecting reinforced concrete joists with hollow tile blocks arranged in horizontally adjacent
45 pairs between joists in both directions, the blocks having their upper shells flush with the top of the joists so that each pair of blocks constitutes a load carrying arch abutting the joists, each block having a plurality
50 of vertical webs and each block having one of its upper edges cut away forming a channel with an adjacent block extending from the mid-portion of one of the joists parallel to joists against which a pair of blocks abut
55 and exposing the upper portion of the said vertical webs of one of the pairs of blocks, concrete keys poured in the channels and forming a cross whose ends join the mid-
60 portions of the joists and having lugs extending around said vertical webs, and lugs extending from said joists into the voided ends of one of the tile blocks of each pair exposed
65 thereto.

10. A floor slab comprising spaced reinforced concrete joists, and groups of hollow tile blocks bonded together between joists and having their upper shells flush with the
70 top of the joists and comprising load carrying arches for which the joists serve as abutments, said blocks being placed in alternate and oppositely arranged pairs extending between joists with the voids in one block of
75 each pair extending at right angles to the voids in the other block of each pair, with the shells of one block of a pair facing the joists and with the voided end of the other block of a pair facing a joist and having lugs of
80 concrete integral with the joists extending into its voided end, each of the blocks having an upper edge cut away parallel to its voids and to a greater depth than the top shell of the block, said cut away edges facing the
85 voided ends of adjacent blocks and providing channels for concrete keys which have lugs extending into the voided ends of adjacent blocks, whereby the blocks are bonded to each other both laterally and longitudinally of
90 the floor, and whereby alternate blocks are bonded to the joists.

11. A floor slab comprising spaced parallel joists, hollow tile blocks extending in rows at right angles to the joists, each row including
95 pairs of blocks between joists, said blocks having their upper shells flush with the top of the joists and having a voided portion comprising a zone generally disposed at a lower level than the bottom of the joists, the
100 blocks in a given row being alternately arranged with their voids normal to the joists and parallel to the joists, blocks with the voids parallel to the joists having an upper edge cut away remote from the joists providing a channel exposing the upper voided
105 ends of adjacent blocks, lugs of concrete integral with the joists extending into the voided ends of the blocks presenting voided ends to the joists, concrete keys poured in the cut-away edges of the blocks whose voids extend
110 parallel with the joists and having lugs extending into the voided ends of adjacent blocks, and cellular soffit tile keyed to the bottom of the joist and closing the lower
115 voids of the blocks whose voided ends face the joists, the bottom shells of the soffit tile forming a ceiling surface with the bottom shells of the other tile which is spaced away from the concrete of the keys and joists by
120 a horizontal cellular zone below the load carrying portions of the floor slab.

12. A floor slab comprising spaced intersecting joists defining the sides of a plurality of squares within which are bonded
125 four hollow tile blocks having all of their upper shells flush with the top of the joists, each of the blocks being disposed in a corner formed by two joists, the blocks in diagonally opposite corners having their voids extending in the same direction and each re- 130

ceiving lugs of concrete in its voided end, from one joist, whereby in a given square each joist has lugs extending into one tile, each tile having an upper edge cut away deeper than its top shell and parallel to its voids remote from the joist against which its shell bears whereby a shallow cross-shaped channel is formed in the top surface of the four blocks which exposes the upper voided ends of each block, and a cross shaped concrete key formed integrally with the joists at substantially the middle of the sides of the squares and poured in the channel and having lugs extending into the said upper voided ends of the blocks.

13. A floor slab comprising spaced intersecting reinforced concrete joists between which groups of hollow tile blocks forming load bearing domes are supported, the blocks in each group having reduced upper portions and arranged to provide a continuous channel for receiving a concrete key in the form of at least a single cross on the upper face of the dome, the blocks of the group engaging the joists to a greater depth than the depth of the key and the key distributing compressive loads from block to block across the upper part of the dome.

14. A floor slab comprising spaced reinforced concrete joists with hollow tile blocks arranged in horizontally adjacent rows between joists, the blocks having their upper shells flush with the top of the joists so that each row of blocks constitutes a load carrying arch abutting the joists, at least one block having a plurality of vertical webs, at least one block having one of its upper edges cut away forming a channel with an adjacent block and exposing the upper portion of the said vertical webs of one of the blocks, concrete keys poured in the channel and having lugs extending around said vertical webs, and lugs extending from said joists into the voided ends of the tile blocks exposed thereto.

15. A floor slab comprising spaced reinforced concrete joists with hollow tile blocks arranged in horizontally adjacent rows between joists, the blocks having their upper shells flush with the top of the joists so that each row of blocks constitutes a load carrying arch abutting the joists, at least one block having a plurality of vertical webs, at least one block having one of its upper edges cut away forming a channel with an adjacent block and exposing the upper portion of the said vertical webs of one of the blocks, concrete keys poured in the channel and having lugs extending around said vertical webs, the end blocks in each row abutting and transmitting thrust to the said reinforced joists.

16. A floor slab having reinforced concrete joists and groups of hollow tile blocks having a reduced upper shell and a full horizontal web defining small upper voids in said blocks,

said blocks being bonded between joists, the open ends of the tile in the group abutting adjacent tile with said upper webs of adjacent tile contacting and said upper shells of adjacent tile spaced apart, a concrete key integrally formed with said joists disposed between abutting ends of the tile and upon said upper web and between said upper shells and transmitting compressive load between blocks in the group and having lugs extending into the open ends of the abutting tile.

17. A floor slab having reinforced concrete joists and groups of horizontally adjacent hollow tile blocks bonded between joists, the open ends of tile blocks in the group abutting adjacent tile, the upper shells of at least certain of the blocks being of smaller area than area of the maximum horizontal cross-section whereby channels are provided between abutting tile, a concrete key of less depth than the joists poured in said channels above abutting parts of said blocks and transmitting compressive load between blocks and having lugs extending into the open ends of the abutting blocks.

In testimony whereof, we hereunto affix our signatures.

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