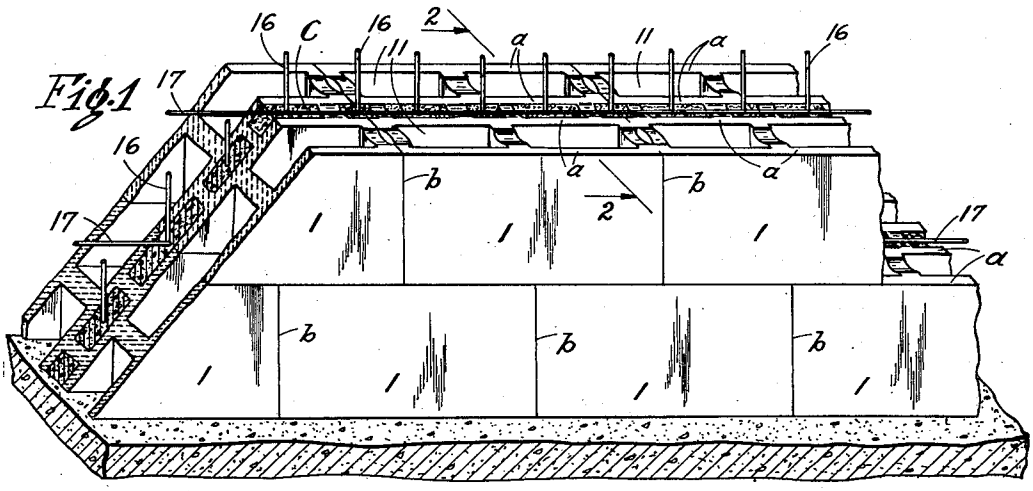
Dec. 14, 1937. D. D. WHITACRE 2,102,447

BUILDING CONSTRUCTION

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Fig. 1



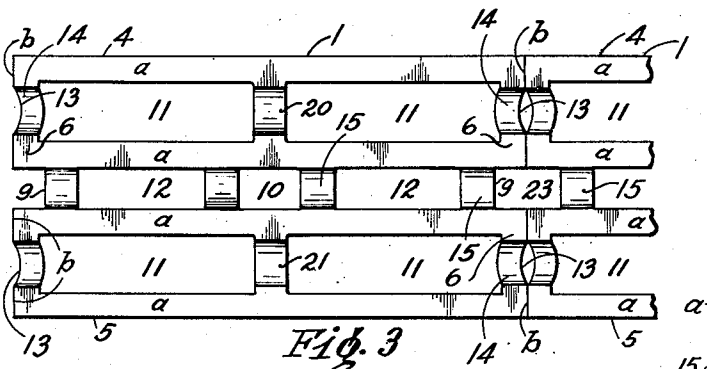


Fig. 3

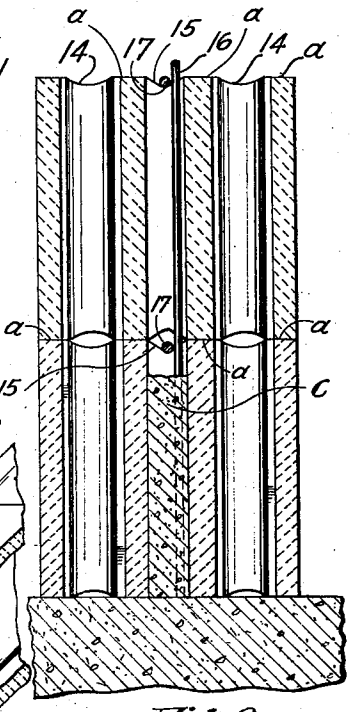
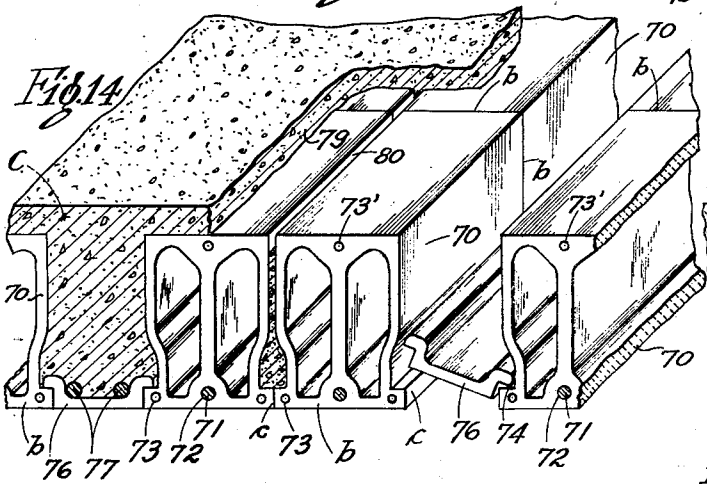


Fig. 2

Fig. 4



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BUILDING CONSTRUCTION

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Fig. 4

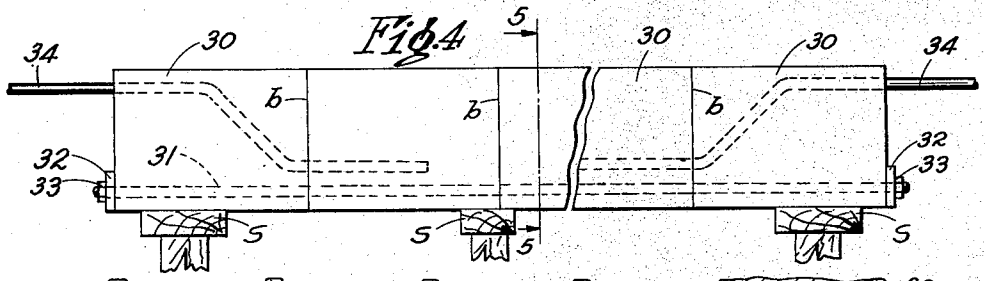


Fig. 6A

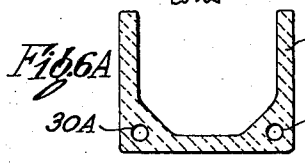


Fig. 6

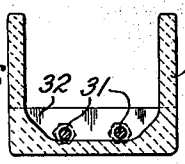
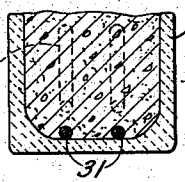


Fig. 5



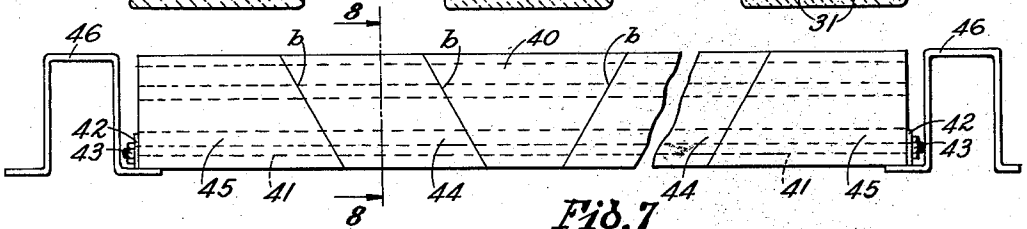


Fig. 7

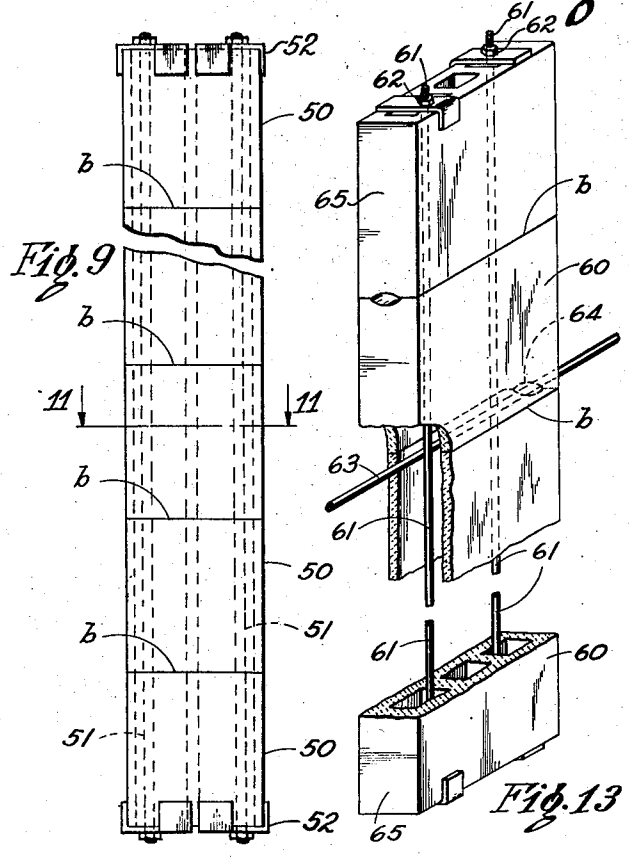


Fig. 9

Fig. 8

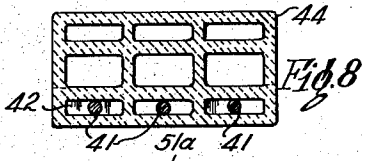


Fig. 10

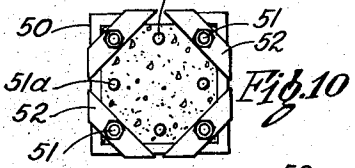


Fig. 12

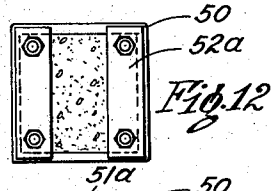


Fig. 11

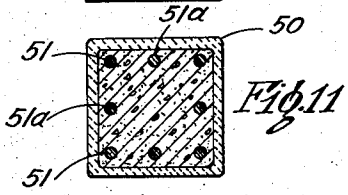


Fig. 13

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Patented Dec. 14, 1937 2,102,447

UNITED STATES PATENT OFFICE

2,102,447

BUILDING CONSTRUCTION

Donald D. Whitacre, Waynesburg, Ohio

Application April 1, 1935, Serial No. 13,994

12 Claims. (Cl. 72—68)

This invention relates to building construction and more particularly to improvements in the construction of and method of assembly of structural units, which preferably include hollow tile blocks prepared and used in the manner hereinafter described.

The structural units which I contemplate making according to the precepts of my invention, include for example, walls formed in situ, pre-assembled wall or floor slabs or units, flat arches, beam and column forms, and the like, all of which, along with other and related units, will become apparent to those skilled in the art from the following description of one or more preferred forms of certain structural units and methods of construction herein set forth.

To show, by way of example, one of the advantages of my invention, one may compare a conventional flat arch construction with a flat arch unit made according to my invention. In making a flat arch tile floor of the conventional type and design, a temporary form or support is necessarily erected or suspended adjacent parallel I-beams and upon that support are laid the skew and key blocks along with mortar and grout for joints and fill. After the mortar and grout have set sufficiently, the forms are removed and are ordinarily carried along to another section of floor where the operation is repeated. When the floor is completed each unit of the conventional flat arch comprises a number of skew blocks and key blocks with mortar joints therebetween for transmitting the strains of the arch to the steel members between which the arches are laid.

According to my invention I have found it economical and otherwise advantageous to form flat arches by grinding the ends of suitably shaped hollow tile blocks preferably of about the same contour as the usual skew and key blocks and assembling a group of such blocks (see for example Figure 7 of the drawings herein), with their ground joints in load bearing abutment and placing tension members preferably through the lower voids of the assembled blocks, which tension members preferably have threaded ends whereby with the addition of suitable plates or washers and nuts the assembly of blocks may be drawn together so snugly that each unit assembly may be handled and will thereafter function as a complete structural load bearing unit. Thus in making the flat arch floor according to my invention, I do away with the necessity of using temporary forms; I do away with mortar joints and the application of grout or other filler between blocks or rows of blocks; and I am able to build up the assembled structural unit with smooth dry load bearing joints at any convenient place and transport it from its point of assembly directly to the point of its ultimate use in the floor, at which point it is then capable and ready to function as a complete load bearing self-contained structural unit.

In this specific example of the application of my invention, it will be appreciated since each unitary assembly is provided with a tension member as well as compression blocks with smooth ground compression transmitting joints therebetween, that the full compressive strength of the blocks is developed and that the strength of each unit is further enhanced by the strength of the tension member whereby the bending moments and the like are developed as in a beam instead of as in a pure arch where the strength depends wholly on the transmission of compressive forces. For the same reason, the beams upon which the ends of units rest are relieved from bearing the end thrust or abutment load of the conventional flat arch construction.

Having in mind, as the following description more clearly shows, that my invention may be practiced in numerous different forms of construction and in various different shapes of structural units, the more salient objects of my invention include the provision of structural units capable of preliminary sub-assembly or assembly in situ wherein hollow tile blocks or the equivalent elements are assembled together in load bearing relation on smooth contacting load bearing areas or faces to which no mortar or other similar bonding material need be added to insure the efficient transmission of load from one block to another and in which assembly, suitable means are provided to hold the load bearing elements in fixed relation to each other either by establishing frictional resistance to movement between blocks by squeezing adjacent blocks upon each other, or by establishing a mechanical key between adjacent blocks to prevent their moving with respect to each other when under load.

Other objects of my invention include the provision of structural units which may be made up in pre-assemblies capable of withstanding structural loads when used as beams, columns, arches, wall or floor slabs and the like, and which may be erected as units in most instances at least, without the use of forms or false work or mortar joints between blocks of the assemblies or between assembled units.

Another object of my invention is to provide permanent structural unit forms such as beam,

wall or column forms which lend themselves to the several functions of forming and initially sustaining such concrete and reinforcing material as may be placed therein; contributing to the load bearing ability of the completed unit; providing a durable and desirable exterior finish for the completed beam, wall or column, as for example one capable of receiving a plaster coat without staining; having an insulating and fireproofing value for the completed reinforced beam, wall, or column or the like; and being capable of assembly in situ or by pre-assembly with great facility and economy.

Another object of my invention is to provide a wall or wall construction which preferably may be assembled in situ in which the tile block elements contact and bear upon each other through smooth tight dry mortarless joints and in which the assembled elements are bonded into a unitary whole by suitable means extending from one block to another and holding them relatively immovable with respect to each other. Another object is to provide such a wall unit which will be impervious to water and air, economical in construction, high in heat insulating value, fireproof and of great strength per unit of mass.

Other objects of my invention will appear from the following description of preferred embodiments of my invention, reference being made to the drawings; the essential characteristics are summarized in the claims.

In the accompanying drawings which illustrate preferred embodiments of the invention:

Figure 1 is a perspective view of a portion of a wall constructed according to my invention with parts broken away;

Figure 2 is a vertical sectional view taken on the line 2—2 of Figure 1;

Figure 3 is an enlarged plan view of the wall of Figure 1 with certain materials omitted to illustrate the tile blocks employed in the wall;

Figure 4 is an elevation of a reinforced concrete and tile beam constructed according to my invention;

Figure 5 is a sectional view, taken on line 5—5 of Figure 4;

Figure 6 is a view similar to Figure 5 showing the arrangement of parts prior to the pouring of the concrete and prior to placing the upper reinforcing bars;

Figure 6A shows a modified form of the construction illustrated in Figs. 4, 5 and 6 with respect to the location of the tie rods;

Figure 7 is an elevation of one form of flat arch suitable for floor construction made in accordance with my invention;

Figure 8 is a sectional view taken on line 8—8 of Figure 7;

Figure 9 is an elevation of a reinforced concrete and tile column constructed in accordance with my invention;

Figure 10 is a plan view of the column;

Figure 11 is a sectional view taken on line 11—11 of Figure 9;

Figure 12 is a plan view of a modified column structure;

Figure 13 is a broken isometric view of a wall or other slab unit assembly constructed according to my invention;

Figure 14 is a broken isometric view of a floor or joist form unit assembly.

In carrying out the objects of my invention, I make the abutting load bearing surfaces of adjacent blocks substantially planar and smooth, as for example by grinding such surfaces so that substantially the full compressive strength of each block may be transmitted from one block to another without subjecting any point or area of the surface of contact of one block to another to any load greater than its proportionate share of the whole load transmitted from one block to another. As I have stated, I prefer to form such smooth surfaces by grinding as with a carborundum wheel or other suitable means, although I contemplate that suitable smooth planar load transmitting surfaces may be created by other means with which I am not now specifically familiar.

I have found by experience that such smooth joint surfaces may be successfully formed or made on hollow tile blocks made from the clays found near Waynesburg, Ohio, as made into hollow tile blocks in the conventional manner. I have also found that the advantages of my invention may be more abundantly enjoyed by the practice thereof with "light weight" tile blocks which I have made by mixing finely divided coal with finely divided clay of preferably equal fineness in proportions varying according to the degree of lightness desired up to about equal parts of powdered coal and powdered clay and wetting and extruding such a mixture in the usual way and drying and burning the extruded blocks, having care to control the burning temperatures with regard to carbonaceous content of the material being burned.

These "light weight" blocks, whether made in the precise manner above described or otherwise, are more easily workable than the conventional full weight extruded and burned clay products, particularly in that the grinding of the joint surfaces thereof is more readily carried out and satisfactorily smooth joint surfaces more easily and perfectly attained. Ordinary full clay tile when subjected to grinding has a tendency to "glaze" both the tile surface and the abrading surface. Such "glazing" seriously interferes with and retards the grinding operations and often necessitates cleaning or replacement of the abrasive and discarding the "glazed" tile block. Tile blocks made by the initial admixture of finely divided coal with the clay do not have the objectionable "glazing" tendency during the grinding operation even where only small quantities of coal are added, such as would result in a tile only about five percent lighter than a full clay tile. It has been my experience that, whereas the "light weight" blocks decrease in load bearing strength in about the proportion of their decrease in mass, by employing such blocks in the making of units according to the instant invention, I can so well develop the full load bearing strength of the blocks in each structural unit, and since my constructions are inherently free from failure in mortar joints and haphazard placing or laying of the elements in the units, that my structure is peculiarly adapted to the use of "light weight" blocks with the attendant saving in weight of the finally constructed building and the saving of effort and labor in erecting the same. The facility with which "light weight" blocks may be employed in my invention also permits the extension of the application of my invention to larger structural units than might be employed with the same facility of handling and setting of the heavier conventional blocks. I do not of course limit myself herein to blocks of any specific weight or degree of lightness, but I do point out that my

invention has especial advantages which grow from the practice thereof with "light weight" blocks.

To illustrate specifically the manner in which I prefer to carry out certain illustrative forms of my invention both in structure and in method, reference is hereinafter made to the embodiments thereof depicted in the drawings.

In Figures 1, 2 and 3, I have illustrated a wall construction which also shows the utility of my invention as a permanent form for a reinforced concrete structure. In the construction therein illustrated, the voided blocks 1 are end set with their voids disposed vertically. Each of the blocks 1 has all the exteriorly exposed contacting surfaces of its webs and shells ground to form smooth load bearing, abutting and substantially water tight joints with adjacent blocks. Such horizontal surfaces are indicated at *a*, *a* in Figures 1, 2 and 3, and such vertical surfaces are marked *b*, *b* in the same figures.

The wall illustrated in Figures 1, 2 and 3 preferably comprises a series of end set hollow tile blocks 1, each formed with side walls 4 and 5 spaced from each other by end walls 6 and other webs and voids arranged interiorly of the block. The end walls 6 are each preferably formed with a central vertical channel 9 and vertical grooves 13 on each side of the channel 9. The horizontal bond faces of each block are preferably provided with three grooves; one groove 15 intersecting the vertical end face channels 9 and grooves 14 on opposite sides thereof intersecting the vertical grooves 13.

The grooves which extend parallel to the voids may readily be formed when the blocks are extruded and the grooves lying transverse the voids may be ground out or cut when the blocks are severed from the clay stream.

Interiorly of the blocks 1 and in alignment with the end face channels 9 are a series of voids 12—10—12. The voids or compartments 12—10—12 are preferably spaced from the walls 4 and 5 of the tile block by webs 20—21 and the voided portions 11 adjacent thereto. The compartments 11—11 preferably form continuous vertical dead air chambers on each side of the central voids 12—10—12.

The wall may be laid on a suitable base or foundation as shown in Figure 1 with the block faces 4 and 5 comprising the inner and outer walls of the building subject to such decorative or other treatment as may be desired. The blocks when laid in abutment end to end provide an additional centrally arranged compartment 23 formed by the face to face abutment of the channels 9. The compartment 23 preferably coincides with the compartment 10 in the vertically adjacent course of tile blocks and in conjunction with the compartments 12 provide substantially water-tight forms for a reinforced concrete structure which may be poured in the central voids 10—12—23. Concrete C may be positioned in the compartments by the use of a concrete gun or other suitable means and reinforcing rods 16 and 17 may be placed at appropriate times as the construction proceeds. The central groove 15 of the horizontal bond face in addition to receiving concrete and bonding the blocks to each other may accommodate horizontal reinforcing rods 17.

The bond faces of the block, that is the top, bottom and end faces, being preferably ground or polished to secure a plurality of tight dry joints between the blocks and the conventional mortar bond being dispensed with permits the blocks to develop their full compressive strength by direct transmission of the compressive forces from one block to another. The vertical grooves 13 and the horizontal grooves 14 adjacent the joint surfaces of the blocks break the continuity of all the transverse joints in the wall and aid in the prevention of the passage of moisture therethrough.

In the wall thus constructed, it will be seen that the tile blocks contacting with each other on smooth dry substantially water-tight joints provide a vertically continuous, exclusive and permanent concrete form which permits the placement of both horizontal and vertical reinforcing rods and permits the rapid setting of the blocks and the expeditious pouring of concrete as the blocks are laid. The reinforced concrete fill on the other hand forms a mechanical key holding the tile elements in place and also serves to make the wall impenetrable to water and air after it has been completed. Both the tile, steel and concrete elements combine in bearing the loads to which the wall is subjected and the tile may present a decorative interior and exterior or may in turn be decoratively treated as one may desire. The tile elements of the wall also afford thermal insulating qualities to the whole structure and serve as a fireproofing protective agency particularly to the steel elements therein contained.

While I have herein referred to a preferred form of wall construction, it is to be understood that the essentials thereof do not necessarily depend upon the particular size or shape of blocks or the number or arrangement of the voids therein, or the specific materials employed for locking or keying the blocks together. The wall just described, while preferably assembled or built in situ may also advantageously be assembled in the same or similar manner in sub-units, sections or panels and thereafter erected and brought into association with similarly formed complementary units to form a complete structure.

In the beam construction shown in Figures 4, 5 and 6 the tile blocks 30 may be extruded or otherwise shaped to have a trough-like cross-section as shown in Fig. 6. A number of blocks, 30, determined by the length of beam to be constructed are arranged with smooth or ground end faces *b*, *b*-- in direct abutting contact with each other and joining or assembling means such as a plurality of tension rods 31 may be disposed adjacent the bottom of the trough formed by the blocks. Metal plates 32 apertured to receive the ends of the rods are preferably positioned at each end of the assembly and the blocks are drawn into firm engagement with each other by nuts 33 applied to the projecting ends of the rods 31. The trough-like structure thus formed may be assembled wherever most convenient and then placed in position upon suitable temporary supports where it may then initially serve as the form for the reinforced concrete beam. The negative moment rods 34 may be positioned if desired while the concrete is being poured and the rods 31 which initially serve to hold the form unit together, thereafter serve as reinforcing rods for the concrete beam formed within the trough-like tile block unit, see Figs. 4 and 5. It will be observed that this method of beam construction in addition to eliminating expensive removable false work and form structure provides a tile exterior beam surface adapted to receive plaster,

and insulate and fireproof the finished beam. The tile blocks may be provided with any decorative surface prior to assembly and this finished exterior will remain intact since the ground joints between blocks may be held water-tight by the tension rods 31 to prevent deleterious leakage of fluid concrete to the outer surface.

For the same reason tile blocks, having no decorative surface but scored or otherwise prepared to receive plaster, afford an excellent plaster base.

Among other advantages of my invention, there is this, that wherever such a structural unit of tile blocks is employed to form or support a concrete body or fill, plaster can be applied directly to the exposed continuous tile surface without hazard of staining by contact with the concrete and there is no delay in applying plaster thereto, such as has heretofore been incident to waiting for the concrete to set, stripping forms and the like.

In Fig. 6A I have shown a modified form of beam form construction in which blocks 30', being and arranged otherwise similar to the blocks 30, have small round voids 30A in which tension rods like the rods 31 may be placed for the purpose of drawing the several elements of the form into snug end to end contact as above described. In this construction the tension rods are not expected to be bonded into the concrete of the beam, and where the beam design demands it other reinforcing rods will be placed in the beam as shown, for example in Figs. 4 and 5. The advantage of the construction shown in Fig. 6A is principally realized when the beam form is relatively long and where, if the form sagged, the rods 31 of Fig. 6 might tend to be lifted from the bottom of the form toward the neutral axis of the beam either before or during the pouring of the concrete. By positioning the tension rods in the small voids, no displacement relative to the neutral axis of the form or beam is permitted at any time in the use of the form or beam. In using the construction of Fig. 6A, I prefer to employ lighter tension rods in the voids 30A than would be used at 31 in Figs. 5 and 6, and develop the main strength of the beam by independent reinforcing rods laid in the concrete.

In Fig. 4 I have shown a plurality of supports S for carrying the beam form during the pouring of the concrete. The number and position of such supports will, as those skilled in the art understand, depend largely upon the length, depth, width and mass of the beam to be formed. Thus, if the beam is relatively short (ten (10) feet for example) and reasonably deep (10'' to 12'') no supports other than at the ends of the form need be employed. If the beam were long, shallow and wide, the load of concrete and steel might well exceed the strength of the tile form unless the tile were made of great thickness, in which case it would be more economical to use relatively thin walled tile elements in the form and support at least the mid-portion and the ends thereof while the concrete and steel were poured and set.

In the illustrative form of flat arch floor construction, above referred to, the tile blocks 40, see Figs. 7 and 8, are preferably though not necessarily cut on a bias and may be assembled as shown in Figure 7 subsequent to the grinding of the abutting load bearing ends *b*, *b*--. The keystone block 40 is preferably tapered as shown to cooperate with the abutting ends of the sew blocks 44. The end blocks 45 preferably have one sloping end to cooperate with the adjacent blocks 44 and a right angled end face to cooperate with a suitably shaped supporting stringer or beam 46. I prefer to employ inverted flanged channel beams 46 instead of the conventional I beams in this construction to facilitate placing the structural units on the beam flanges.

The arch unit may be assembled at any convenient place by the insertion of tie rods 41 and application of clamping plates 42 as more fully described above in connection with the description of the beam form. I prefer as shown in Fig. 8 that the rods 41 be positioned in small voids in the lowest part of the block which limit and restrict any vertical movement of the rods with respect to the blocks. When assembled and properly clamped by nuts 43 the arch may be transported bodily as a unit and positioned in the building between the beams 46. This type of flat arch construction is usually employed in conjunction with a concrete floor slab and the concrete mix may be permitted to flow into the space between the ends of the arch units and the beams 46 to firmly anchor the arch to the beams. If desired the voided ends of the units adjacent the supporting beams may be stopped off in any well known manner to exclude concrete fill from the interior thereof.

As noted above I prefer that the tension members 41 be located in the bottoms of the unit as shown, and have imposed upon them an initial tension when the unit is assembled sufficient to hold the tile elements in fixed relation to each other while the unit is being positioned in the floor and throughout its life as a structural unit doing useful work. In this instance I prefer that the tension members be of sufficient strength to develop the full compressive strength of the tile elements when the unit is under load, for example, as a free beam supported at its ends.

On the other hand it is not beyond the purview of my invention when it is carried out in the form of a flat arch construction or in any other comparable construction that the tension members be relatively light, that is, be called upon only for the purpose of holding the unit assembled for the purpose of its transport to its place of ultimate use and/or for holding it assembled until it be bodily incorporated with the other structural elements. For example, the tension rods in the flat arch construction illustrated in Figs. 7 and 8 may, if desired, be made relatively light but of sufficient strength to hold the assembly while it is placed on the beams 46, and while a concrete fill is poured over the units and between the ends of the units and the sides of the beams. Thereafter when the concrete has set and the flat arch units have a direct load bearing arch abutment with the beams at their ends, then it may well be that the unit will thereafter function more truly as an arch carrying its load by internal compression and end thrust on the abutment beams at its ends as distinguished from depending upon tension in the tie rods in its lower portions.

While I have indicated a preference for using blocks cut on the bias as indicated in Fig. 7, I have found it quite satisfactory, particularly in those instances where the slab will ultimately function as a beam, employing the tension strength of the tie rods, to cut and grind the ends of the blocks on the square instead of on the bias. In such instances the blocks are clamped together tight enough by the tension in the rods to hold the blacks relatively immovable under

load by the frictional bond between blocks across the smooth end contacting surfaces, it being understood that load upon the unit also adds to the pressure across the joints *b* and increases the frictional bond between the blocks.

A reinforced concrete and tile column may advantageously be made according to the teaching of my invention as shown in Figs. 9 to 12 inclusive. In the embodiment there illustrated the hollow tile blocks 50 having planar ground end surfaces, *b*, *b*- - are arranged end to end and preferably clamped into tight abutment with each other by tie rods 51, plates 52 and nuts in the manner heretofore described. This assembled unit may be erected as a form prior to the pouring of the concrete therein or the wet concrete may be rammed into the hollow tile column prior to positioning. The plates 52 arranged to hold the rods 51 in position may comprise short flanged straps disposed diagonally of the tile blocks 50. This type of plate permits the insertion of additional column reinforcing members 51*a* during the pouring of the concrete. In the event that the additional reinforcing members 51*a* are deemed unnecessary, flat bars 52*a* may be employed for engaging the tie rods 51. It is to be understood that a column of tile and concrete may be formed progressively in situ by first placing the bottom block 50 in position on the column footing and pouring concrete therein. Reinforcing rods may be inserted in the wet concrete and additional blocks set upon the ground end surfaces *b* of subjacent blocks as the pouring progresses. In any event the hollow tile serves as a form for the concrete structure and eliminates the costly erection and removal of conventional forms and clamps heretofore employed in concrete column construction.

In Figure 13 I have illustrated an adaptation of my invention to a wall or partition unit assembly. Hollow tile blocks 60 having smooth, preferably ground, planar end surfaces *b*, *b*- - are firmly secured together in suitable panel lengths by longitudinal tie rods 61 disposed within the blocks and having plates or washers and nuts 62 engaging the ends of the end blocks in each panel. I contemplate and prefer that panels as shown in Figure 13, being preferably one block wide and as long as the desired height of the wall or partition, or portion thereof, be separately assembled as shown and then erected as units in the finished wall or partition.

Such panels may be secured to similar laterally adjacent panels by means of horizontal tie rods 63, one or more of which may extend through all of the panels in a group through appropriate laterally extending apertures 64, which preferably may be formed by notching the transverse webs and shells of the abutting ends of the blocks 60 as shown.

Where panel units such as shown in Figure 13 are to be laterally associated with similar units in a wall or partition, I prefer to grind or otherwise smooth off the lateral surfaces 65 of the blocks 60 so that tight dry joints may be provided between laterally adjacent panels as they are drawn together by such means as the horizontal tie rods 63.

In erecting the panel units shown in Figure 13, the bottom ends thereof along with the protruding ends of the tie rods, nuts and plates, may be set in grout or wet concrete, and the upper ends may be engaged to suitable beams or joists by means of the upper protruding ends of the vertical tie rods 61. Likewise the ends of groups of panels may be secured to laterally adjacent columns, jambs, window frames, etc., through the agency of the horizontal tie rods 63.

In Figure 14 I have illustrated a reinforced, concrete and tile floor construction in which the principle of my invention may advantageously be employed. The type of floor I intend to illustrate in Figure 14 is that commonly known as a one-way reinforced floor of the kind generally disclosed in my Patent No. 1,989,254 which issued January 29, 1935. Generally speaking this type of floor employs hollow tile members arranged in longitudinally extending groups, between which groups reinforced concrete joists are poured and over which tile groups a finishing top slab of concrete is usually poured with the joists.

In the floor construction herein illustrated, I prefer to make unitary sub-assemblies of hollow tile blocks 70 whose end faces *b*, *b*- - are ground smooth and to secure a row of such blocks in end abutting contact by tie rods 71, preferably extending through small voids 72 or 73 in the lower portion of the blocks (while I have shown no tie rods in the smaller voids 73, I contemplate that a sufficient number of voids 72 and 73 may be formed in the blocks so that additional tie rods may be employed where longer spans are desired, whether in one floor or in a group of floors to be constructed in one job). In this form of construction I prefer to assemble a row or panel of blocks 70 in tight end to end contact as above indicated by the tie rods 71 with appropriate nuts and plates bearing against the end blocks of the rows, as elsewhere herein described, and erect the assembled rows on suitably spaced temporary supports as mentioned in connection with the description of the beam form illustrated in Figs. 4 to 6A hereof, and, depending upon the spacing desired between the joists to lay one or more such rows in lateral abutting contact (two rows being indicated in Fig. 14), and then by providing a suitable space between rows or groups to create a form upon and between which the concrete joists and floor slab may be poured.

As shown in Figure 14 each of the blocks 70 not only has its end faces ground smooth, but is formed with its lower wall slightly wider than the body thereof, so that where a plurality of rows of blocks 70 have lateral contact with each other that contact may be made substantially fluid tight by grinding the lateral edges of the lower walls as at *c*, *c*- -. I also prefer in the construction of these blocks that the outer shells thereof adjacent the lower portions be undercut as at 74 to provide a shelf-like structure 75 upon which suitable soffit tiles 76 may rest. As illustrated in Fig. 14 the undercut portion 74 is so shaped that the soffit tile may be inserted in the space left between rows of the main blocks after those rows have been positioned, and the soffit tile may thereafter be carried by the main blocks without additional form work or supports. After the soffit tile has been positioned, concrete reinforcing bars 77 may be laid thereupon, and concrete C may be poured in the space between rows of blocks as at 78 and over the tops of the rows or groups of blocks as at 79. A limited amount of concrete may find its way between laterally adjacent rows of blocks as at 80, but the concrete is restrained from penetrating the ceiling below by the smooth intimate contact *c* between the lower walls of adjacent blocks.

I contemplate in constructing floors according to this method that it would be advantageous to make the blocks 70 in standard widths, such

for example as 6 inches, and by using any desired multiple of rows between joists to space the joists on various centers as may be desired by simply varying the number of rows of blocks which are laid between the spaces intended for the joists. In a like manner the width of the joists may be varied at will, depending only upon the widths of the soffit tiles employed therein. In this manner a wide variety of designs of floor construction is afforded, it being understood of course that blocks of varying depths may be supplied to meet loads of varying amounts. It will be seen that a floor constructed according to my method may be very quickly erected, will require no forms as such, but may be supported in the first instance by a very few properly spaced supports, that each row of blocks will in the main be self-supporting, and that the rows of blocks as such, when secured together and arranged as above described, will constitute a complete form for the reinforced concrete floor to be poured thereupon and will provide an all-tile ceiling directly capable of receiving a plastic coat. As above indicated such a floor construction has a great advantage in flexibility of design and in convenience and economy of construction.

Since I contemplate that each row of blocks 10 may be separately assembled prior to placement in the floor to be poured and since these rows may be as long as the floor, as for example 20 feet, I also prefer to provide a small void 13' near the top shell of the block, through which an additional tie rod may be drawn, to more firmly secure the block in an assembled row together particularly when the assembled row of blocks or unit is being transported from its place of assembly to its position in the floor.

From the foregoing it will be seen that I have provided a novel and useful method of building construction and a novel and useful structural unit capable of embodiment in various forms and shapes including those specifically illustrated and described herein and while modification and changes all within the spirit of my invention will occur to those skilled in the art, I do not care to be limited to the embodiments specifically disclosed herein or in any manner other than by the claims appended hereto.

I claim:—

1. A structural unit comprising a plurality of tile blocks with ground substantially planar load-bearing faces arranged end to end with said faces in load-bearing contact, and longitudinally disposed tension means extending transversely of said load bearing faces and secured to blocks longitudinally spaced in said unit and holding the blocks of said unit in intimate contact with each other on said contacting faces.

2. A self-sustaining load-bearing structural unit adapted to be loaded transversely of its length comprising a plurality of blocks arranged longitudinally of said unit having load-bearing engagement with each other through dry substantially planar load-bearing joints, whereby to uniformly distribute the load to be transmitted between contacting joint faces, and tension means extending longitudinally of said unit and transversely of said joints and securing said blocks together in load-bearing engagement at said joints, the forces exerted by said means and the friction between the surfaces in said joints holding said blocks substantially immovable with respect to each other in the direction of the joint up to the point where the full strength of the unit is developed by loads imposed transversely thereof.

3. A self-sustaining load-bearing structural unit comprising a plurality of burned clay blocks having load-bearing engagement with each other through dry substantially planar load-bearing joints formed by grinding away the original burned clay surface and exposing on each block substantially planar surfaces engageable with similarly formed surfaces on adjacent blocks whereby to uniformly distribute the load to be transmitted through said joints, and tension means extending transversely of said joints below the neutral axis thereof and securing said blocks in load-bearing engagement at said joints.

4. A self-sustaining load-bearing structural unit adapted to sustain load as a beam comprising a plurality of voided burned clay blocks having end to end load-bearing engagement with each other through dry substantially planar load-bearing joints formed by grinding away the original burned clay surfaces at the ends of the blocks and exposing on each block a substantially planar surface engageable with a similarly formed surface on an adjacent block whereby to uniformly distribute the load to be transmitted between abutting blocks without favoring certain portions of the joint area at the expense of other portions intended to be similarly loaded, tension means extending transversely of said joints in the lower voids of said blocks, and means coacting with said tension means for drawing said blocks together and at least initially establishing a compression load throughout substantially the whole of the planar areas of said joints.

5. A self-sustaining load-bearing structural unit adapted to carry loads transversely of its length comprising a plurality of lightweight porous building blocks having load-bearing engagement with each other in the direction of the length of the unit through dry substantially planar load-bearing joints formed by grinding the surface and exposing on each block substantially planar surfaces engageable with similarly formed surfaces on adjacent blocks whereby to uniformly distribute the load to be transmitted between abutting block surfaces, and tension means extending transversely of said joints below the neutral axis thereof and securing said blocks in load-bearing engagement at said joints.

6. A self-sustaining load-bearing structural unit adapted to sustain load as a beam comprising a plurality of voided burned clay blocks having smooth substantially planar end surfaces in load-bearing engagement with each other whereby to uniformly distribute the load to be transmitted between abutting blocks without favoring certain portions of the joint area at the expense of other portions, tie rods disposed in the lower voids of said blocks extending transversely of said joints, and means engaging said tie rods and the end blocks of said unit and at least initially securing said blocks in full load-bearing engagement at said joints through the planar areas thereof.

7. A self-sustaining load-bearing structural unit adapted to be loaded transversely of its length comprising a plurality of voided tile blocks having a cellular porosity resulting from the mixing of finely divided coal with clay of substantially similar fineness prior to extruding the blocks, each block having end to end load-bearing engagement with each other block through dry substantially planar load-bearing joints formed by grinding away the original burned clay

surface and thereby providing on each block finely pitted substantially planar surfaces engageable with similar surfaces on adjacent blocks whereby to uniformly distribute the load to be transmitted between abutting blocks without favoring certain portions of the joint area at the expense of other portions, tie rods disposed in the lower voids of said blocks extending transversely of said joints, and means coacting between said tie rods and the end faces of the end blocks of said unit for drawing said blocks together in frictional load-bearing engagement with each other at said joints.

8. A roof or floor slab adapted to be supported at its ends comprising a plurality of longitudinally extending self-sustaining and mutually supporting structural units arranged side by side, each unit comprising a plurality of blocks capable of bearing load in compression and arranged in end to end load bearing contact with their contacting faces formed smooth and substantially planar whereby to bring substantially the whole cross-sectional area of solid material of each block into intimate substantially planar contact with each longitudinally adjacent block at least when the slab is under load, and each unit also comprising tension means extending longitudinally thereof and transversely of said contacting faces and securing said blocks together in frictional bond between longitudinally adjacent blocks, said slab also comprising means disposed between adjacent units and bonding said units together and distributing load therebetween.

9. A structural slab according to claim 8 in which the means disposed between at least some of the laterally adjacent units comprises a load bearing reinforced concrete key mechanically bonded to the adjacent units and supporting said units as well as distributing load therebetween.

10. In a load-bearing structure the combination of a plurality of blocks adapted to sustain load in compression having load-bearing engagement with each other through substantially planar surfaces presented by adjacent blocks in load-bearing contact, and longitudinally disposed tension means extending transversely of said contacting surfaces and secured to blocks longitudinally spaced in said structure and positioned in the region of tension of said structure and holding adjacent blocks in load-bearing contact on said contacting surfaces.

11. A self-sustaining load-bearing structural unit adapted to sustain load as a beam supported at its ends comprising a plurality of blocks having smooth end surfaces and arranged longitudinally of said unit in load-bearing relationship to each other through transverse joints between adjacent blocks of said unit, said joints comprising the smooth end surfaces of adjacent blocks lying substantially coextensively therein and uniformly distributing the load to be transmitted between adjacent blocks whereby to prevent overloading of certain joint areas relative to other joint areas intended to be similarly loaded, and tension means extending longitudinally of said unit and transversely of said joints and lying below the neutral axis of said unit and securing said blocks together in load-bearing engagement through said joints, the forces exerted by said tension means transversely of said joints holding said blocks substantially immovable with respect to each other in the direction of the joints up to the point where the full strength of the blocks is developed when the unit is loaded as a beam.

12. A self-sustaining load-bearing structural unit adapted to sustain load as a beam comprising a plurality of voided blocks having smooth substantially planar end surfaces in load-bearing engagement with each other whereby to distribute the load to be transmitted between abutting blocks without favoring certain portions of the joint areas at the expense of other portions intended to be similarly loaded, longitudinally extending tension means disposed in the voided portions of said blocks extending transversely of said joints below the neutral axis of said unit, and a concrete fill in said voided portions of said blocks bonding said tension means to said blocks and securing said blocks in stressed load-bearing engagement at said joints.

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