April 21, 1931. H. M. KNIGHT 1,801,631

UNIT CONCRETE CONSTRUCTION

Filed Feb. 17, 1927 3 Sheets-Sheet 1

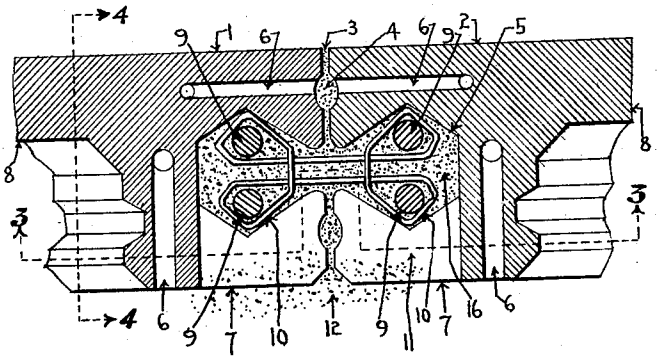


Fig. 1

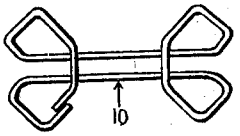


Fig. 2

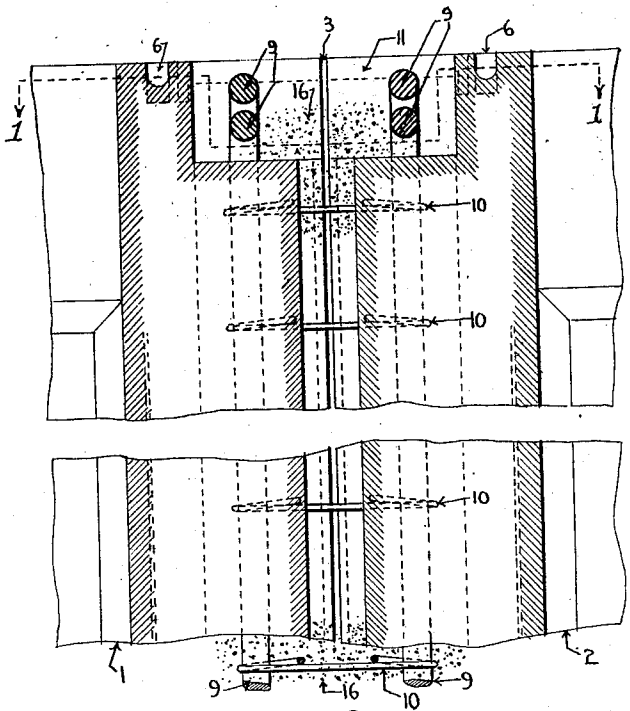


Fig. 3

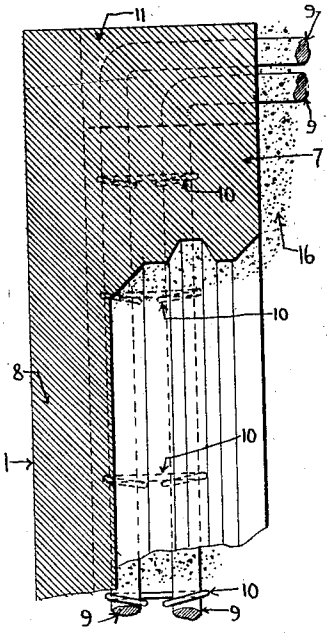


Fig. 4

INVENTOR

Herbert M. Knight

April 21, 1931. H. M. KNIGHT 1,801,631

UNIT CONCRETE CONSTRUCTION

Filed Feb. 17, 1927 3 Sheets-Sheet 2

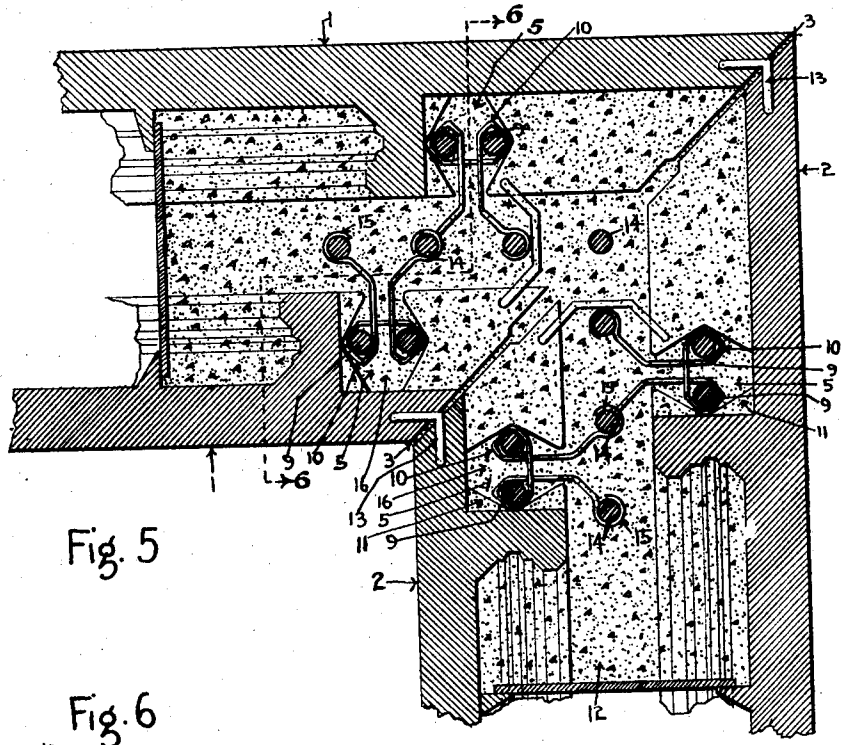
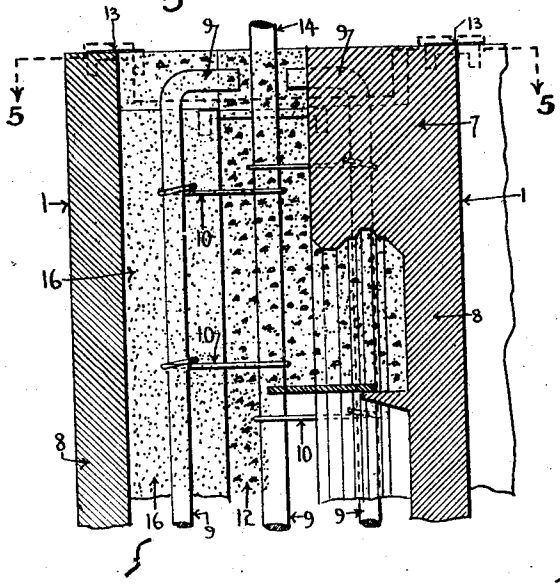


Fig. 5

Fig. 6



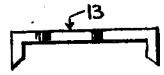


Fig. 7

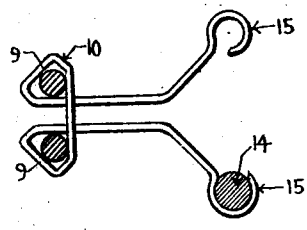


Fig. 8

Herbert M. Knight INVENTOR

April 21, 1931. H. M. KNIGHT 1,801,631

UNIT CONCRETE CONSTRUCTION

Filed Feb. 17, 1927 3 Sheets-Sheet 3

Fig. 9

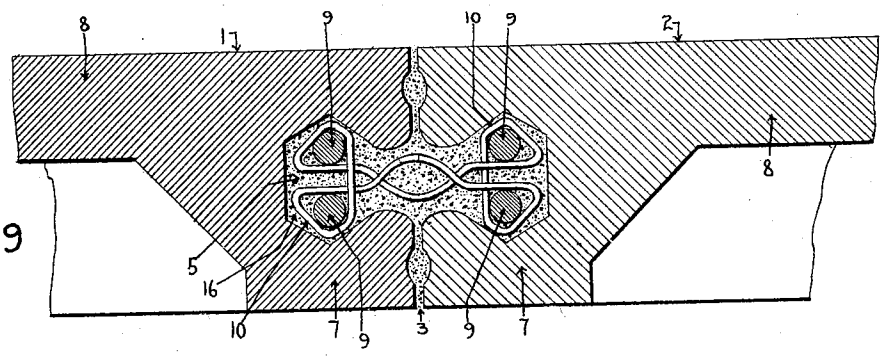


Fig. 10

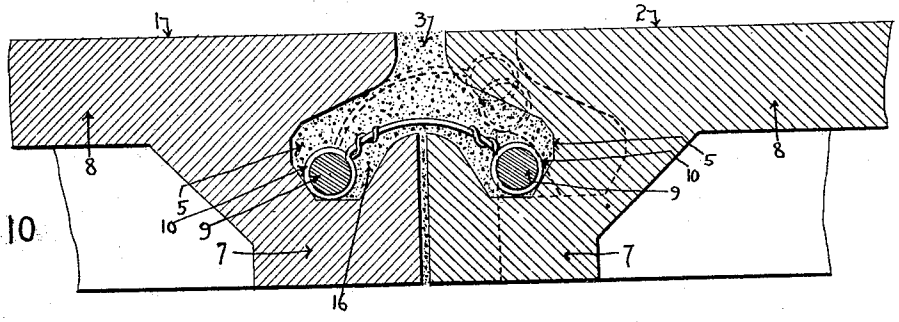


Fig. 11

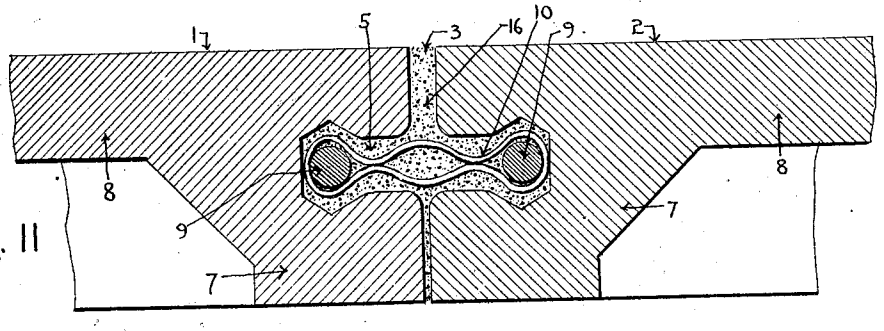
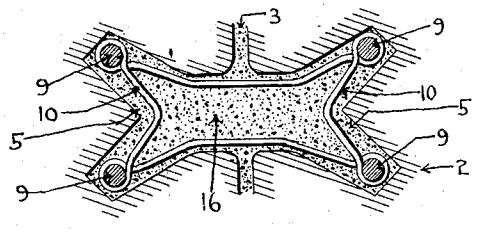


Fig. 12



Herbert M. Knight INVENTOR

Patented Apr. 21, 1931

1,801,631

UNITED STATES PATENT OFFICE

HERBERT M. KNIGHT, OF MONTCLAIR, NEW JERSEY

UNIT CONCRETE CONSTRUCTION

Application filed February 17, 1927. Serial No. 168,972.

This invention relates to unit concrete construction, using pre-cast constructional units, and more specifically to that type of unit construction in which the various elements are connected to each other by the use of keys.

One of the objects of this invention is to unite the various units by means of a flexible key. Another object of the invention is to unite the units by means of a key, which, while flexible of itself, will combine with a cementitious filler, in a key-way, to produce an inflexible and stronger key. Still another object of the invention is to unite the units by means of a key which can be easily inserted in the key-way, but which subsequently to such insertion becomes irremovable. Another object of the invention is to unite the units by means of a key which readily fits within the key-way and which is extended to meet and engage one or more bars of a reinforcing frame. Other objects of the invention will appear from the following description and the accompanying drawings.

The accompanying drawings Figs. 1 to 12, inclusive, are illustrative of the invention and indicate the usual and preferred embodiment thereof. They are however illustrative only and are not to be considered as illustrative of all types in which the invention may be embodied, nor as excluding other types than that indicated.

I illustrate my invention by the accompanying drawings in which, Fig. 1 is a cross-section of a joint between adjacent units on the line 1—1, of Fig. 3. Fig. 2 is a plan of the wire element of such a key. Fig. 3 is a section of such a joint on the line 3—3 of Fig. 1. Fig. 4 is a section of such a joint on the line 4—4 of Fig. 1. Fig. 5 is a cross-section of a wall composed of a multiple of units, said units and the reinforcing members of the said wall being inter-connected by wire keys, said section being taken on the line 5—5 of Fig. 6. Fig. 6 is a section of such a wall on the line 6—6 of Fig. 5. Fig. 7 is a view of the dog employed in connection with said key connected units. Fig. 8 is a plan of the wire element of such an interconnecting key. Fig. 9 is a section of a joint between units, in which the wire element of the key is of the elastic type. Fig. 10 is a section of a joint, illustrating an interlocking type of key. Fig. 11 is a section of a joint, the wire element of which is single and elastic, and which, like Fig. 10, is of the interlocking type, and Fig. 12 is a section of a joint, in which an interlocking type of key is employed, and in which the slot or groove is fanged.

Referring to the drawings in which similar numbers refer to similar parts:—1, is a pre-cast slab, or unit, and 2, another unit, the said units being juxtaposed at the joint 3. Longitudinal chases 4, admit of a mortar body in said joint. Grooves 5, are also longitudinal of said joint. Dog-chases 6, admit of the introduction of dogs, temporarily, or otherwise, binding juxtaposed or opposing units. Thickened edges 7, to said units, extend from the body portions 8, thereof. Bars, or rods, 9, extend longitudinal of said grooves, and wires 10, engage said bars and extend outwardly of said grooves. Depressions 11, are in the thickened edges of the said units and mass concrete 12, engages said thickened edges and enters said depressions. Dogs 13, are positioned in said dog-chases. Reinforcing bars 14, are within said mass concrete and hooked ends 15, engage and partially surround said reinforcing bars. A cementitious filler 16, fills the said grooves and surrounds and engages the said longitudinal bars and the said wires.

In a structure made up of pre-cast units it is necessary that the juxtaposed units be connected by a means which can at once be readily and easily applied, and at the same time permanently secure the said units together. Such connecting means should be one that lends itself easily to the inequalities of the several units and of a sufficiently flexible character to yield to these several inequalities without disturbance or dislodgment of the assembled units. At the same time the connecting means should be such as to rigidly and immovably bind the said units when, and after the assembling is completed.

These desirable features are secured in my invention by the use of a jointing combination, one element of which is a groove, or chase, cast in the thickened edge of the pre-

cast unit, said groove being preferably re-entrant in section. Another element of the jointing combination consists of bars extending longitudinally within said groove, and a further element being wires which engage said bars and extend outwardly from said groove, the outward extending ends or portions of said wire elements engaging either the bars longitudinal within an alined groove of a juxtaposed unit, or the reinforcing bars of a mass concrete frame engaging, or connected to said units. A further element is the cementitious filler or compound, which is introduced into the said groove and the said joint and which surrounds and engages both the bars within the grooves and the wire elements engaging said bars.

The wire elements are so constructed as to engage frictionally the bars longitudinal of the grooves in the units, such friction being sufficient to retain the wire element upon the bars at any pre-determined position. The usual form of the engaging wire element is that of two parallel portions which cross the joint between the adjacent units, the said parallel portions diverging within the groove so as to constitute an open area or areas in which are located the longitudinal bars, the said wire element surrounding, or nearly surrounding the said bars and engaging the superficies of the said bars at predetermined points. The said surrounding wires, however, are rarely of such form, so far as these areas are concerned, as to be in continuous linear contact with the said bars, the contacts being at points rather than linear. As a result of this dissimilarity of form, open portions result between the surfaces of the bars and the wire elements, and these open portions are filled with the cementitious filler of the groove.

In some cases the parallel portions do not remain on the same side of a line medial of the said key, but cross so as to reverse their positions relative to said medial line, thereby acting as a spring, and, by the pressing together of these reversed and parallel portions, result in the bars being more firmly held within and by the enclosing portions of the said wire element.

The key, so far as the longitudinal bars and the wire elements are concerned, is usually assembled exterior to the units desired to connect, and is subsequently inserted longitudinally into the alined grooves of the partially assembled, juxtaposed units. In some cases however it is impossible to insert the said key longitudinally of the said partially assembled grooves. in which event an interlocking key becomes a necessity. Such an interlocking key, and of the wire type, is indicated in Figs. 10 and 12. In Fig. 10, the dotted line indicates an initial position of one unit which is to be brought laterally into final and permanent position, the latter being indicated by full lines. Other dotted lines indicate that of the key, composed of rods and connecting wires, the latter of arched or curvilinear form, one of the rods is located in the grooves of the one of the units which has been definitely positioned, and the free end of the key has been raised until the curvilinear connecting wire element is in contact with the upper lip of the groove of the said definitely positioned unit. As soon as the upper lip of the opposite unit shall have been brought into contact with the rod element of said free end of said key, the said free end is allowed to fall and to rest upon the lower lip of the groove of the unit being positioned. Further movement of said unit results in said rod and its curvilinear connecting wire element dropping automatically into the groove of said moving unit, until, when said unit is finally and permanently located, the said key is embedded within the juxtaposed and opposite grooves of said adjacent units, and is surrounded by the cementitious filler which has been introduced into said grooves before the assembling of the said units. The keys cannot be withdrawn, and the hardening of the said cementitious filler in the said grooves completes the work of binding said units firmly and immovably together.

Fig. 12 illustrates another form of such interlocking key. In this instance the form of the groove is fanged, that is it is composed of two divergent areas, situated on either side of a medial line and connected with a common throat. The key, in this instance, before insertion in the key-way, is practically a straight line key, the portion of the wire element at either end which joins the areas surrounding the longitudinal bars being bent back along the centre line of the key. When the key enters the groove, the throat of which is made of just sufficient width to admit of the passage of the longitudinal rods and their wire elements, it passes into the groove until it strikes the tongue, or fork, of the fang, upon which occurring the longitudinal bars begin to separate and pass each into its own divergent area of the fang. This is occurring at the same time, and in the same manner, in the alined groove of the juxtaposed unit, the pressure or weight, or both of these two units forcing the rods apart and into their said resident areas. The portion of the wire element connecting the said two rods within each groove, is gradually straightened out, until from a position practically parallel with the central wires, it becomes oblique thereto, approaching the normal. The subsequent hardening of the filler, as in the case before, rigidly and permanently keys the joint.

As the assembling of units and keys of these general forms demands a great degree

of accuracy in its performance, it is very necessary that the several units shall register accurately before and during the placing and hardening of the keys. To assure such accuracy of registration, dogs are employed for initially positioning the units, these dogs occupying depressions cast in the units, and, in order that the several units may be placed without interference from the said dogs, these depressions or chases are so cast as to be in all cases beneath the edges, or other surface, of the units, that are depressed beneath said edges or surfaces.

The foregoing description has been largely confined to conditions which would obtain when only two juxtaposed units are to be joined through the agency of keys embedded in alined grooves. In the case of walls in which a multiple of units, oppositely disposed as regards their position in the wall are to be joined, and where a reinforced concrete frame is employed, the conditions may be so modified, as, that, in addition to uniting juxtaposed units together, the entire structure, units, whether adjacent or oppositely disposed, and the reinforced concrete frame can be united in a manner that makes the keys employed, a distinct and effective means of initial and permanent connection. In such cases the wire element of the key is made dissimilar, so far as the inner and outer members thereof are concerned, the inner, or part within the groove, remaining similar in form and purpose to that above set forth, in this description, while the outer portion, or that portion exterior to the groove, is so altered as to open up the wires composing the element, and at the same time the extremities are so formed as to embrace the reinforcing members of the mass concrete frame.

What I claim is:—

1. In a construction, the combination of a multiple of pre-cast units, thickened edges to said units, re-entrant grooves in said edges, and keys in said grooves, one element of said keys being rods within, and longitudinal of said grooves, another element being wires, said wires engaging said rods and spanning said joints and a third element being a cementitious filler within said grooves and surrounding said rods and said wires.

2. In a construction, the combination of a multiple of pre-cast units, re-entrant grooves in said units, a mass concrete frame, re-inforcing members in said concrete and keys connecting said units and said re-inforcing members.

3. A building construction comprising in combination with building units adapted to be assembled in a structure, said units having registering grooves in their abutting edges and which together form a substantially closed pocket longitudinal of the unit and open at one end of said grooves and units upon assembly of said units, and a re-inforcing device entirely within said pocket slidable into position from the open end thereof and extending from one groove into the other of the abutting units.

4. A building construction comprising in combination with building units adapted to be assembled in a structure, said units having registering grooves in their abutting edges and which together form a substantially closed pocket longitudinal of the unit and open at one end of said grooves and units upon assembly of said units, a cementitious key in said pocket filling both said grooves, and a re-inforcing device entirely within said pocket and key slidable into position from the open end of the pocket and extending from one groove into the other of the abutting units for re-inforcing the key.

5. A building construction comprising in combination with building units adapted to be assembled in a structure, said units having registering grooves in their abutting edges and which together form a substantially longitudinally closed pocket upon assembly of said units, a longitudinal re-inforcing bar in each of said grooves thereof, a re-inforcing device entirely within said pocket with a portion thereof surrounding each of said bars and slidable into position from the open end of the pocket on the bars and extending from one groove into the other of the abutting units.

6. A building construction comprising in combination with building units adapted to be assembled in a structure, said units having registering grooves in their abutting edges and which together form a substantially longitudinally closed pocket upon assembly of said units, a longitudinal re-inforcing bar in each of said grooves thereof, a cementitious key in said pocket filling both said grooves, a re-inforcing device entirely within said pocket with a portion thereof surrounding each of said bars and slidable into position from the open end of the pocket on the bars and extending from one groove into the other of the abutting units for re-inforcing the key.

7. A building construction comprising in combination a multiple of pre-cast units, thickened edges to said units, re-entrant grooves in said edges, keys in said grooves, one element of said keys being rods within and longitudinal of said grooves, and another element being wires, a mass concrete frame, and re-inforcing rods in said frame, said wires engaging said rods in the grooves and said rods in the concrete frame.

8. A building construction comprising in combination a multiple of pre-cast units, edges of said units having re-entrant grooves therein, and a key in said grooves comprising a resilient metallic member having a less cross sectional area than said grooves so as to have latitude for resiliently engaging por-

tions of the surfaces of said grooves for positioning said units with respect to each other and constituting a re-inforcing member for the joint between said units.

9. A key for uniting units of building construction having re-entrant grooves, comprising a wire bent to provide enlarged end portions for inclusion in the enlarged portions of the grooves, and said wire providing a narrow connecting portion between said enlarged portions for passing through the restricted portion of said grooves, whereby said units may be held against separation by insertion of said wire key in the opposed re-entrant grooves of said units.

Signed at New York, in the county of New York and State of New York, this 16th day of February, A. D. 1927.

HERBERT M. KNIGHT.