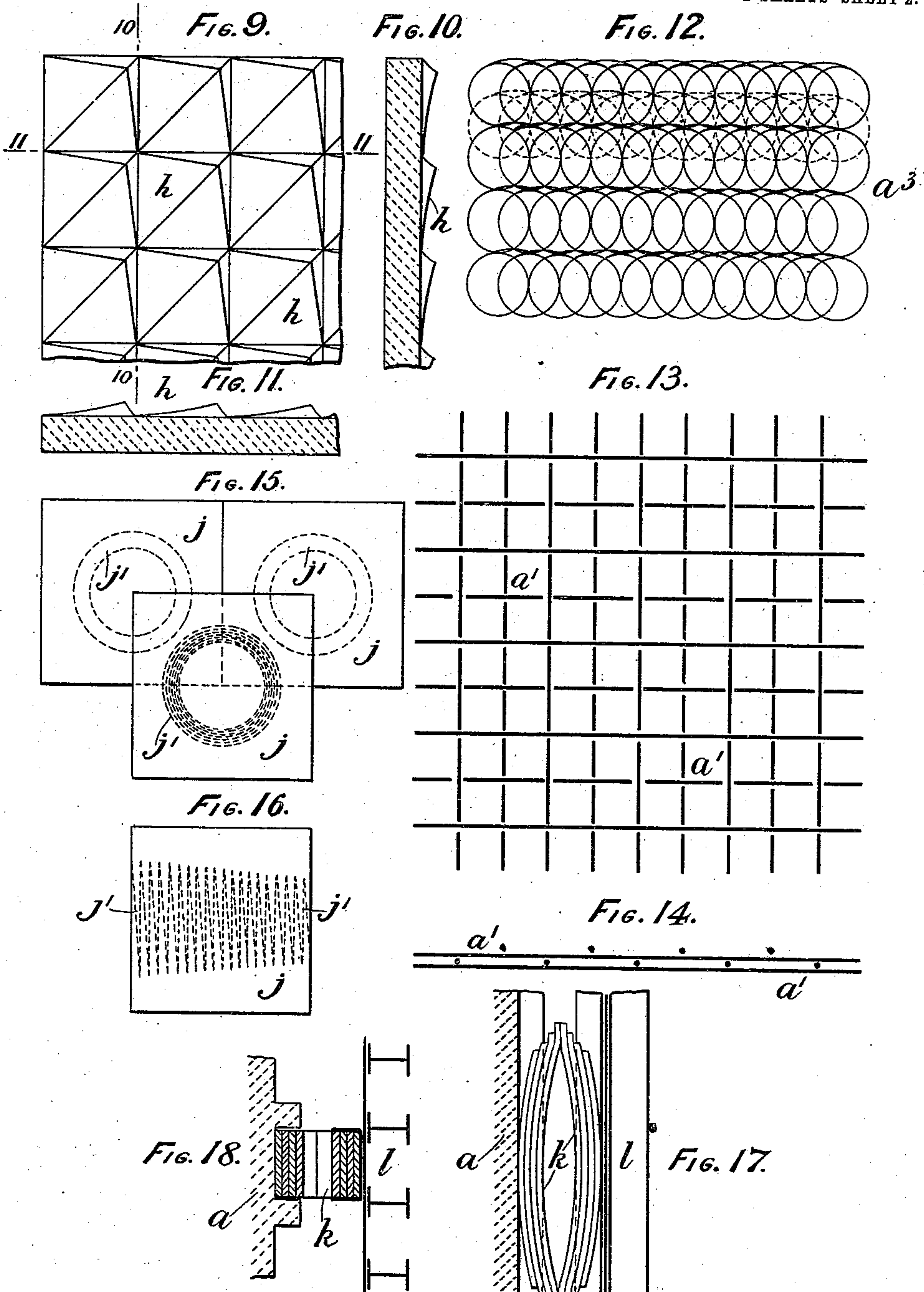


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REINFORCED CONCRETE STRUCTURE.
APPLICATION FILED MAR. 2, 1909.

985,640.

Patented Feb. 28, 1911

2 SHEETS—SHEET 2.



Witnesses.—

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REINFORCED CONCRETE STRUCTURE.

Specification of Letters Patent. Patented Feb. 28, 1911.

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To all whom it may concern:

Be it known that I, WILLIAM JOHN STEWART, of Ormeau Road, Belfast, in the county of Down, Ireland, building and engineering contractor, have invented certain new and useful Improvements in Reinforced Concrete Structures, of which the following is a specification.

One object of my invention is to provide a novel construction of reinforced concrete especially designed for use as a protective covering or armor, although it is obvious it may be employed for other purposes.

It is also desired that the reinforced concrete structure forming the subject of my invention shall be of such nature as to resist to a maximum extent the passage through it of projectiles and shall also be of such design as to distribute over a relatively large area the force of a blow whether this is due to the impact of a projectile or to the collision of any other object with said structure.

Another object of the invention is to provide a structure having the characteristics above noted which shall be substantial and durable and whose outer surface shall be particularly designed with a view to preventing its penetration by a projectile.

These objects and other advantageous ends I secure as hereinafter set forth, reference being had to the accompanying drawings, in which:—

Figure 1 is a horizontal section of a part of a structural frame made according to my invention; Fig. 2, is a series of detached sections illustrating the various means for jointing or attaching the reinforced concrete slabs employed as part of my invention; Fig. 3, is a series of detached sections illustrating the various means for connecting the slabs of adjacent layers; Fig. 4, is a front elevation illustrating one form of surface construction designed to deflect a projectile; Figs. 5 and 6 are sections respectively taken on the lines 5—5 and 6—6, Fig. 4; Figs. 7 and 9 are front elevations of modified forms of surface construction for the outside slabs; Fig. 8, is a vertical section on the line 8—8, Fig. 7; Figs. 10 and 11 are sections on the lines 10—10 and 11—11, Fig. 9; Figs. 12 and 13 are two plan views to some extent diagrammatic, illustrating two forms of reinforcement which may be employed in my invention; Fig. 14, is an end elevation of

the structure shown in Fig. 13; Figs. 15 and 16 are respectively a plan and a side elevation illustrating the construction and arrangement of reinforced concrete filling blocks which may be employed as part of my invention, and Figs. 17 and 18 are respectively a side elevation partly in section and a transverse section, illustrating one form of spring construction which may be employed between any two adjacent slabs of my protective structure.

In the above drawings A, B, and C represent three substantially parallel walls or partitions each made of a series of rigidly connected reinforced concrete slabs. The outermost wall indicated at A being preferably made thinner than the others and the innermost wall C being the thickest.

Each of the slabs is provided with any desired number of strengthening ribs indicated at a^2 , b^2 , and c^2 , and for the purpose of connecting adjacent slabs in each wall, each of said slabs is provided with a rib or inturned flange as indicated at f and f' , and a suitable dowel pin or rod f^3 serves to hold these adjacent flanges from relative movement, by reason of the fact that it is held in a recess partly formed in each of the abutting flange faces.

In some instances as shown in Fig. 2, one of the slabs may be recessed or tongued while the other is provided with a suitable corresponding recess or construction for contacting therewith or in some cases a locking bar f^4 , fitting into correspondingly shaped recesses, may be employed. Again two adjacent slabs may have inserted between them a concrete section f^c held in place either by reinforcing rods a' which extend into it from both of the slabs, or by reason of the fact that the concrete of which it is made forms a bond with the concrete of said adjacent slabs or by both these means. The slabs of one of the walls, of which there may be more or less than three as found advisable, may be united to each other at intervals in any of a number of ways; as shown for example in Fig. 3. In this figure the slab b which may be assumed as forming part of the wall B, may be connected to the slab a by dowel pins or rods g^4 which fit into recesses in both of said elements, which may be held by dowel pins g^3 to one of two adjacent slabs a , while this lat-

ter is held to its other slab by an independent dowel pin.

It will be noted that the slabs constituting two adjacent walls are staggered as to their positions, that is to say, the joint between the two slabs of one of the walls is some distance away from the joint between the two nearest slabs of the second wall, and in the case shown, the arrangement is such that the joint between two slabs a of the wall A is midway between one of the ribs b^2 of the wall B and the point of junction of the slab to which said rib belongs, with the next adjacent slab.

As shown in Fig. 1, the various walls are spaced apart and the holes between them which are subdivided by the flanges and ribs of the slabs, are filled with some material designed to increase the resistance of the structure to penetration. For this purpose I fill such divided hollow spaces with suitable cases or containers i made of steel or fine steel wire and fill said cases with concrete blocks j such as are shown in Figs. 15 and 16 formed either with or without interior reinforcement. Those of said blocks immediately adjacent the front faces of the walls B and C are preferably made with their faces adjacent said walls having inclined or pyramidal forms so designed that but limited portions of said faces engage the adjacent wall face.

If desired, the cases may be filled with sand or other suitable material and the cases or blocks may be so placed as to break joints as illustrated in Figs. 1 and 15.

The form of reinforcement for the concrete blocks j is that shown in Figs. 1, 15 and 16 and preferably consists of a tapering helical coil of steel wire j' which not only serves to hold together the parts of a block but is also designed to retard to a maximum extent the passage of a projectile through it. In some instances these blocks may be used to fill the hollow spaces between the walls without the inclosing casings. The slabs of each of the various walls are preferably reinforced by grills of longitudinal and transverse bars of high tension steel, in addition to which there is a second reinforcement of a similar construction but made of some tough iron such as Lowmoor. This may be followed by a third layer of high tension steel which would preferably be of the form shown in Fig. 12; *i. e.* a series of overlapping circular coils. It will be understood that these various reinforcements are embedded in the concrete of the wall independently of each other so that there is no mechanical bond connecting one of them to the other. It will be understood that this reinforcement may be varied as to the number of layers.

In order to deflect a shell or a projectile striking the face of the structure, this face

may be provided with a series of raised surfaces as shown in Figs. 4 to 11 inclusive at h , being made to extend in any desired direction, and of such a form that their various portions lie at an acute angle to the plane of the slab, thereby tending to deflect a shell striking the surface from above, so that even though it had sufficient force to penetrate the structure, it is deflected to some extent from a straight line.

If desired, springs k may be mounted between the surface of a structure l to be protected and the main portion of my protective structure in order to still further deaden any shock which would ordinarily be transmitted from the protective structure to said body l .

It is of course obvious that suitable capping may be applied to the top and bottom of my improved protective structure, but inasmuch as the detail construction of such capping forms no part of the present invention, it has not been illustrated. In some instances plates of sheet steel as indicated at b^4 in Fig. 1, may be mounted on one face of one of the walls in order to still further render the structure proof against penetration or injury by projectiles.

I claim:—

1. A protective structure consisting of a plurality of substantially parallel walls of concrete spaced apart, each of said walls being made of a series of connected slabs, the joints between the adjacent slabs of one wall being staggered relatively to the joints between the slabs of another wall, with blocks in the spaces between said walls, the faces of said blocks adjacent one of the walls having parts only of their areas engaged with the wall.

2. A protecting structure consisting of a plurality of substantially parallel walls of reinforced concrete spaced apart and having filling material within the hollow spaces between them, the outer one of said walls being thinner than the other and having embedded in it a layer of overlapping metallic coils.

3. A protecting structure consisting of a plurality of substantially parallel walls made of reinforced concrete; said walls being spaced apart and having in the spaces between them a body of concrete blocks, and the faces of said blocks adjacent one of the walls having limited portions of their areas in engagement with said walls.

4. A protecting structure consisting of a plurality of substantially parallel walls of reinforced concrete; said walls being spaced apart and having within the hollow spaces between them a body of independent concrete blocks; each of said blocks having reinforcing material embedded in it in position to retard the passage of a projectile.

5. A protecting structure consisting of a plurality of substantially parallel walls of

reinforced concrete; said walls being spaced apart and having within the hollow spaces between them a body of independent concrete blocks each having within it a tapering coil of steel wire.

6. A protecting structure consisting of a plurality of substantially parallel walls of reinforced concrete; reinforcement for said walls including a mass of metallic grill work; and a layer of overlapping coils of metal.

7. A protecting structure consisting of a plurality of walls of reinforced concrete, the outer one of said walls having its surface subdivided into a series of raised portions; the greater part of the surface of each of

said portions being inclined at an acute angle to the plane of the wall.

8. A protecting structure consisting of a plurality of substantially parallel walls of reinforced concrete spaced apart and having filling material in the hollow spaces between them; with a wall reinforcement including metallic rods embedded in the concrete, and a continuous sheet of metal.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses.

WILLIAM JOHN STEWART.

Witnesses:

GEORGE BROWN,
JOHN MORROW.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
