R. A. CUMMINGS.

REINFORCED CONCRETE PILE, COLUMN, OR POLE.

APPLICATION FILED SEPT. 27, 1909.

1,041,034. Patented Oct. 15, 1912.

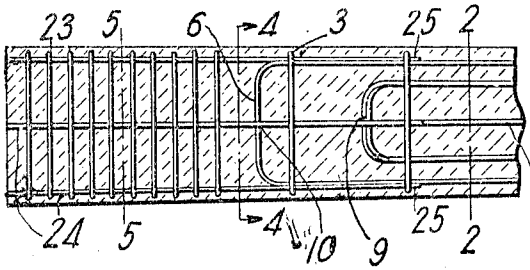


FIG.2

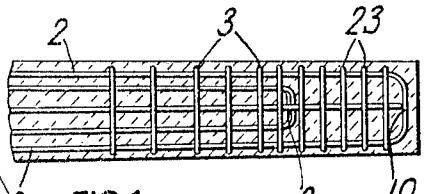
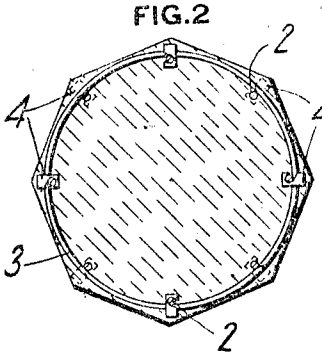


FIG.1



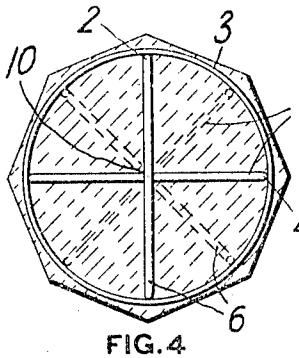


FIG.4

FIG.5

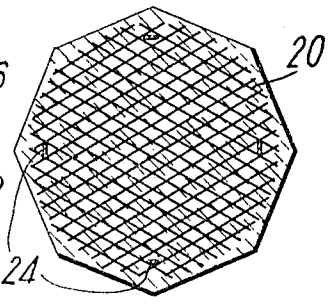
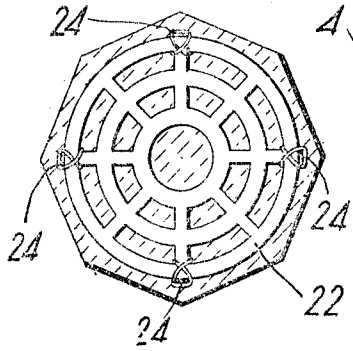


FIG.7



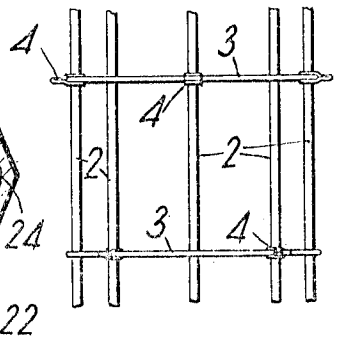
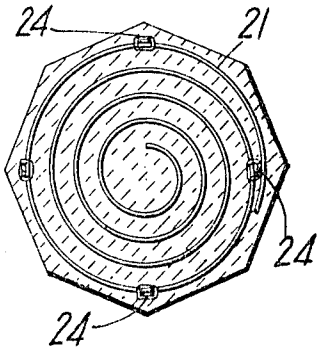


FIG.3

FIG.6



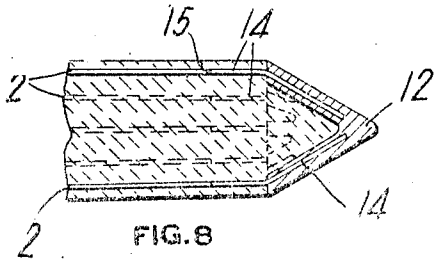


FIG.8

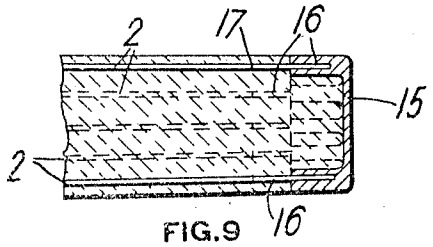


FIG.9

WITNESSES

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UNITED STATES PATENT OFFICE.

ROBERT A. CUMMINGS, OF BEAVER, PENNSYLVANIA.

REINFORCED-CONCRETE PILE, COLUMN, OR POLE.

1,041,034. Specification of Letters Patent. Patented Oct. 15, 1912.

Application filed September 27, 1909. Serial No. 519,359.

To all whom it may concern:

Be it known that I, ROBERT A. CUMMINGS, a resident of Beaver, in the county of Beaver and State of Pennsylvania, have invented a new and useful Improvement in Reinforced-Concrete Piles, Columns, or Poles, of which the following is a specification.

This invention relates to reinforced concrete and similar piles, columns, poles, posts and similar structures.

The object of the invention is to provide an improved structure of greater strength than those heretofore used and particularly a pile, post or pole which can be handled without danger of breaking and which can be driven without crushing the top.

Generally stated, the invention consists of an improved construction of pile, column, pole or post provided with a series of longitudinal reinforcing members securely anchored at both ends in the body of cementitious material and joined at intervals by suitable hoops or bands, said structure being provided at the ends, and also intermediate the ends if desired, with a series of transverse reinforcements placed close together and arranged to take care of the lateral tension strains induced by the compressive loads or due to the driving of the pile or post.

The invention comprises the construction and arrangement of parts hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a side view of the metallic reinforcement for a pile embodying the invention; Fig. 2 is a cross-section on an enlarged scale on the line 2—2, Fig. 1; Fig. 3 is a side view of the longitudinal bars with the transverse hoops or rings; Fig. 4 is a cross-section on the line 4—4 Fig. 1; Fig. 5 is a cross section on the line 5—5, Fig. 1; Figs. 6 and 7 are cross-sections showing modified forms of transverse reinforcement; Fig. 8 is a longitudinal sectional view showing a modification at the lower end of a pile embodying the invention; and Fig. 9 is a similar view of a modification at the upper end.

The drawings show the invention applied to a pile. The pile shown is mainly formed of cement, concrete or similar cementitious material in which is embedded the metallic reinforcement which is entirely covered thereby. The reinforcement comprises a series of longitudinal or vertical reinforcing bars or rods 2 arranged near the surface of the cementitious material and which in number and size will be chosen to suit the particular structure to be reinforced. The drawings show eight round rods arranged in four pairs, the two members of each pair being diametrically opposite each other. These longitudinal bars or rods are connected at intervals by means of endless bands or hoops 3, also shown as formed of round rods and preferably having their ends welded together to form a jointless endless hoop or band which encircles the longitudinal bars and is secured thereto in a suitable way, preferably by means of a metallic clip or connecting member 4, such as shown in my Patent No. 879,148 granted Feb. 18, 1908.

The longitudinal reinforcing members are securely anchored at both ends in the body of cementitious material. This may be accomplished in various ways. As shown in Figs. 1 and 4, it is accomplished by joining together the ends of two oppositely arranged bars by means of straight diametric transverse portions 6. For convenience of manufacture, I take a bar and bend the same to form an endless loop and weld the ends together, said endless loop forming the two oppositely arranged vertical reinforcing members and the end connecting portions 6. The reinforcing bars, therefore, at their ends are anchored in the cementitious material by means of integral loops. Two pairs of the reinforcing bars are shorter than the other two pairs and their transverse connecting portions cross at the points 9, while the longer two pairs of reinforcing bars have their transverse connecting portions crossing at points 10. This, however, is merely a matter of convenience in arranging the loops so that they do not interfere one with the other.

Instead of providing the longitudinal reinforcing members with loops at the lower ends, I may follow the construction shown in Fig. 8. In this case the point of the pile is formed by means of a shoe or protector 12 which may be formed of concrete wood, pressed metal, or other suitable material, but preferably is a casting having cast therein short metal pieces 14 which are welded at 15^a to the lower ends of the longitudinal reinforcing bars 2. This shoe not only serves as a protection for the lower end of the pile but also is an anchor for the lower

ends of the longitudinal bars, and is specifically claimed in my co-pending application, Serial No. 533,452, filed December 16, 1909. Similarly, at the top I may provide a suitable metal or other cap 15, preferably a casting having cast thereinto the short pieces of rods 16 which are welded at 17 to the longitudinal reinforcing bars 2. This cap serves not only as a protection for the upper end of the pile, post, pole or column but also as an anchor for the upper ends of the longitudinal reinforcing bars.

At the upper end, and also preferably at the lower end of piles, posts, or other structures which are designed to be driven or to receive heavy loads, and also if desired, at points intermediate the length thereof, I provide special transverse reinforcements to take care of the tension strains induced in the cementitious body by hammer blows or other heavy loads. It has been demonstrated that when, for instance, a concrete pile is placed under a destructive load, such as a blow of the hammer in driving the same, the fracture begins with the spalling or breaking out of portions of the side faces of the pile and extending around the same. Such portions never break out at any point where the pile is supported, or at the point where the load is appdied but only intermediate these points. The broken out parts occur substantially intermediate the ends or between supports. This form of fracture is due to the fact that when the load is applied, the vertical compression stresses induce lateral stresses tending to spread or flatten out the column, the same as when a compressive load is applied to a rubber cylinder the latter tends to flatten out, thereby inducing horizontal or lateral stresses which produce tension strains in the material. In concrete columns similar lateral tension strains are induced. To effectively take care of such stresses, and particularly at the top and bottom of a pile, where such stresses are particularly severe during the driving of the pile, and to increase the unit strength of the concrete, I provide suitable lateral transverse reinforcements. These may be of various forms, such as ordinary perforated sheet metal. Fig. 5 shows ordinary metallic mesh or what is known as expanded metal 20 for this purpose. Fig. 6 shows a spiral 21 formed from a suitable bar or band of metal, and is shown, described and claimed in my copending application before mentioned and Fig. 7 shows a perforated sheet metal plate 22. Whichever form of transverse reinforcement is employed such reinforcements are placed quite close to each other, as shown at 23 Fig. 1. In ordinary sized piles these are placed as close together as one inch but I do not limit myself to this dimension. These transverse reinforcements, and the cement form laminæ of metal and cement, and the metal takes care of the lateral tension stresses induced in the cement. This feature is broadly claimed in my application Serial No. 501,628, filed June 11th, 1909. This application shows an improvement over the design shown in the prior application referred to, in that the spacing members in the transverse reinforcements are secured to the longitudinal reinforcing bars. To effectively do this, it is, of course, essential that the metal occupy or comprise a substantial portion of the cross-section of the structure in any one transverse plane. To hold these reinforcements in position while molding the column or other structure, they are united by longitudinal members 24, such as wiring them together. The members 24 merely serve as spacing members for the transverse reinforcing members and are in turn united at 25 to the longitudinal reinforcing members 2 of the main body of the column, being secured to the members 2 by means of the bands or hooks 3. The spacing members 24, however, are formed of light metal so that the end of the structure can be readily broken as is necessary in a group of piles where all piles cannot be driven to the same depth. With these transverse reinforcements in the upper end of the pile the latter can be driven without any particular protecting cap. Fig. 1 shows such transverse reinforcements at the top and bottom of the pile, but if desired the same may be supplied for any or all parts of the structure, either alone or with longitudinal reinforcing members.

The longitudinal reinforcing members hold the pile against fracture under bending stresses, such as when handling or hoisting the same, and by reason of their anchorage in the concrete make the pile very strong. It has been demonstrated that before a reinforced pile or column can break the longitudinal reinforcing members must slip in the concrete. By firmly anchoring the same as above described, this is prevented and the fracture of the pile or column is resisted by the compressive strength of the concrete between the anchors, and as the compressive strength of concrete is very high, the pile is practically unbreakable by bending stresses.

The longitudinal reinforcing bars described may, of course extend for the whole or any desired portion of the length of the pile, post, pole, or column or similar structure. Likewise, the transverse reinforcements described may be placed uniformly from end to end of the structure or distributed therein in any desired manner, and not merely located at the ends as illustrated.

What I claim is:

1. An artificial pile, column or pole comprising a body of cementitious material, main reinforcing members comprising lon-

gitudinal members embedded therein and united at their ends by transverse members and firmly anchored at both ends in said cementitious material, a series of transversely arranged metal reinforcements in the upper end of said cementitious body beyond the longitudinal reinforcing members and spaced sufficiently close together to reduce surface fracture, and means for spacing said transverse members apart, said means being connected to said main reinforcing members.

2. An artificial pile, column or pole comprising a body of cementitious material, longitudinal reinforcing members embedded therein and firmly anchored at both ends in said cementitious material but not extending for the full length thereof, a series of transversely arranged metal reinforcements in the upper portion of said cementitious body and spaced sufficiently close together to reduce surface fracture, and bars secured to said transverse members to space them apart and being connected to said longitudinal members.

3. An artificial pile, column, post or pole comprising a body of cementitious material, longitudinal reinforcing members embedded therein, transversely arranged endless hoops or bands secured to said longitudinal reinforcing members, a series of transversely arranged metal reinforcements spaced sufficiently closely together to reduce surface fracture, and longitudinal spacing members secured to said transverse reinforcements and to the main metal reinforcement structure.

4. An artificial pile, column, post or pole comprising a body of cementitious material, longitudinal reinforcing members embedded therein and anchored at both ends in said cementitious material but not extending for the full length thereof, transversely arranged endless hoops or bands secured to said longitudinal members, a series of transversely arranged reinforcements in the upper portion of said cementitious body beyond the longitudinal reinforcing members, and spacing members connected to said transverse reinforcements and to the main metal reinforcing structure.

5. An artificial pile, column, post or pole comprising a body of cementitious material, longitudinal reinforcing members embedded therein, and a series of transversely arranged metal reinforcements embedded in the cementitious material and each comprising a substantial portion of the cross sectional area of the structure in any one plane and placed sufficiently close together to reduce surface fracture, and means connecting said transverse reinforcing members to the longitudinal members.

6. An artificial pile, column, post or pole comprising a body of cementitious material, longitudinal reinforcing members embedded therein, a series of transversely arranged metal reinforcements also embedded therein and each comprising a substantial portion of the cross sectional area of the structure in any one plane and placed sufficiently close together to reduce surface fracture, and spacing members secured to said transverse reinforcements and connecting them to the longitudinal reinforcing members.

7. An artificial pile, column, post or pole comprising a body of cementitious material having embedded in its upper end a series of transverse metallic reinforcements each comprising a substantial portion of the cross-section of the pile, column, post or pole, and placed sufficiently close together to reduce surface fracture, longitudinal reinforcing members embedded in the cementitious material and firmly anchored at both ends therein, and bars for spacing the transverse reinforcements apart and connecting them to said longitudinal reinforcing members.

8. An artificial pile, column, post or pole comprising a body of cementitious material having embedded in its upper end a series of transverse metallic reinforcements, each comprising a metal sheet provided with openings therethrough through which the cementitious material may bond, and having radial portions and an outer peripheral portion said transverse reinforcements being placed sufficiently close together to reduce surface fracture.

In testimony whereof, I have hereunto set my hand.

ROBERT A. CUMMINGS.

Witnesses:
F. W. WINTER,
JAS. L. WELDON