No. 865,477. PATENTED SEPT. 10, 1907.

H. F. COBB.

REINFORCED CONCRETE STRUCTURE.

APPLICATION FILED FEB. 18, 1907.

Fig. 1

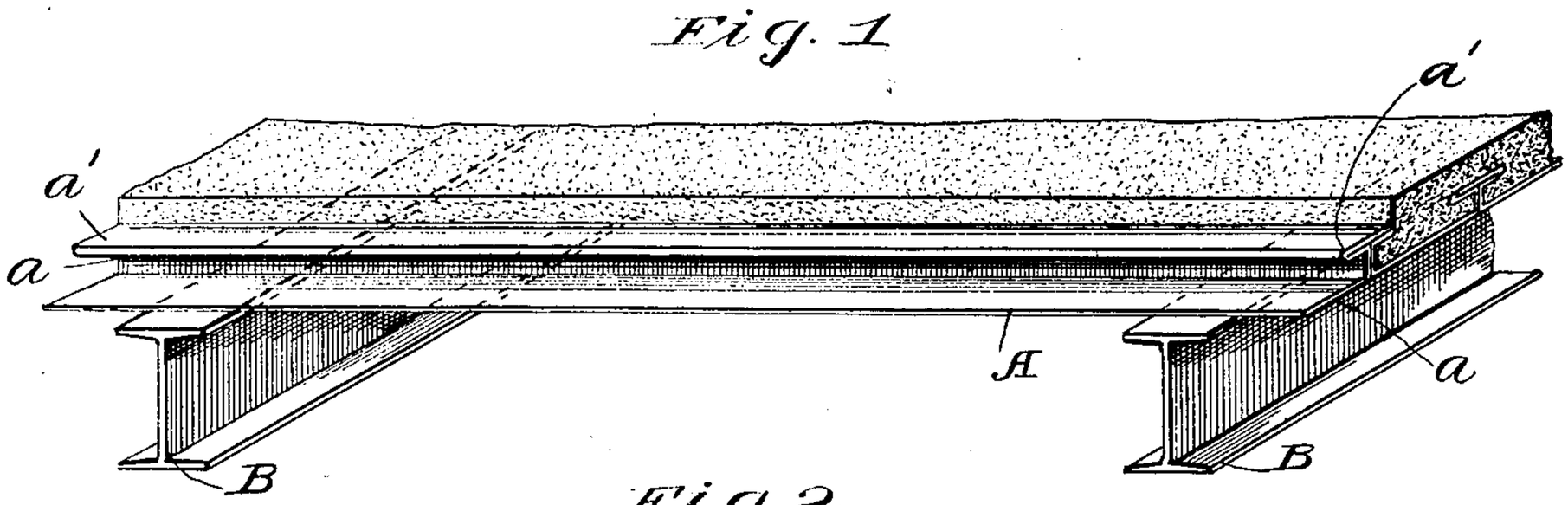


Fig. 2

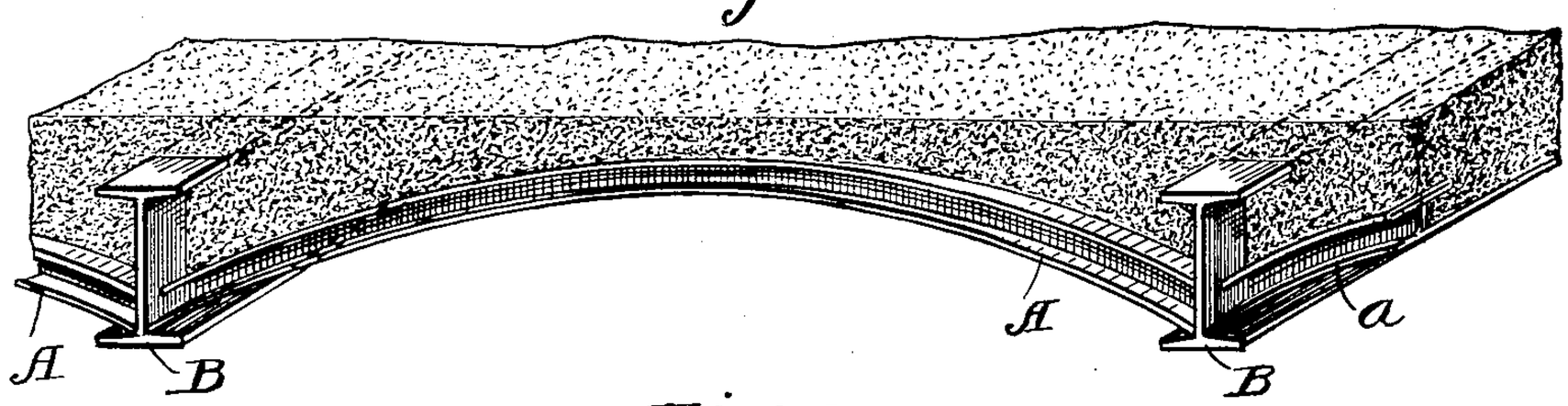


Fig. 3

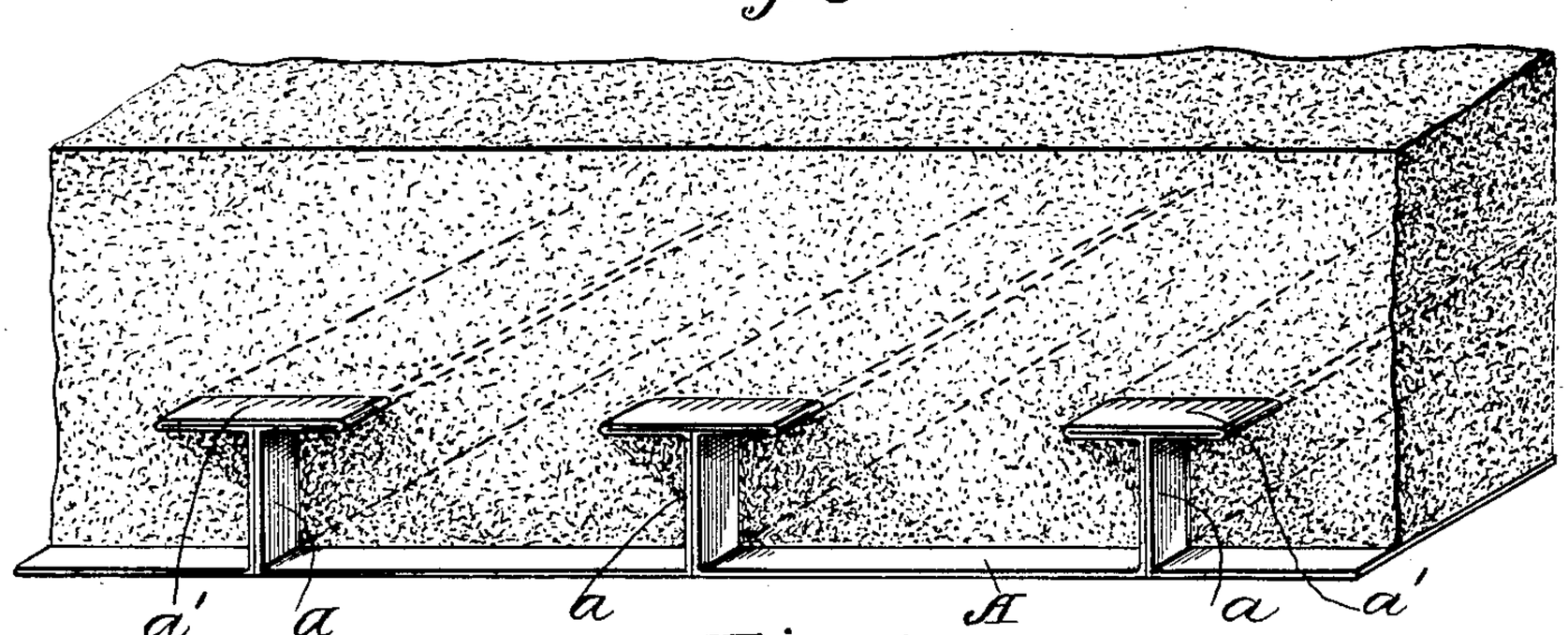
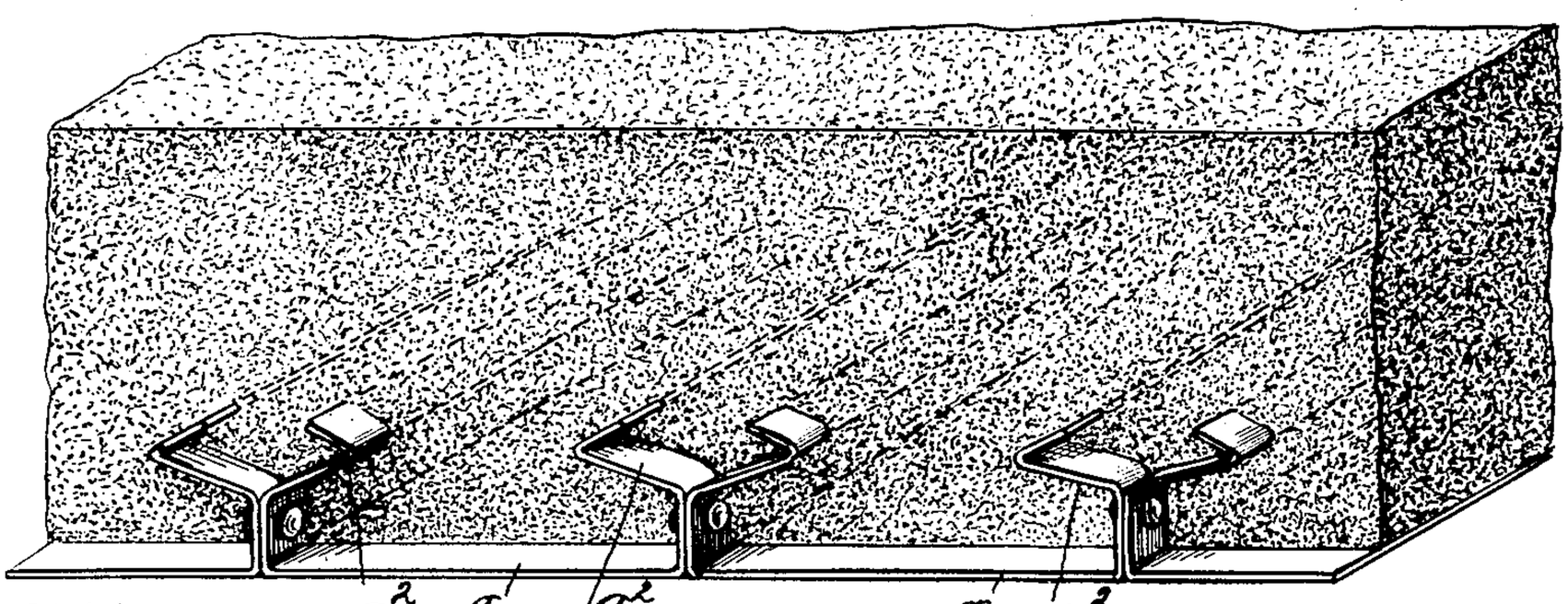


Fig. 4



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REINFORCED CONCRETE STRUCTURE.

No. 865,477. Specification of Letters Patent. Patented Sept. 10, 1907.

Application filed February 18, 1907. Serial No. 357,799.

To all whom it may concern:

Be it known that I, HERBERT F. COBB, a citizen of the United States, and a resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Reinforced Concrete Structures, of which the following is a specification, the principle of the invention being herein explained, and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

My invention relates to structures of concrete, and particularly to the construction of concrete roofs, floors, stairways, sidewalks, and the like.

The object of the invention is the provision for use in combination with the cement filling entering into such construction of an improved type of combined centering and reinforcement.

To this end said invention consists of means hereinafter fully described and particularly pointed out in the claims.

The annexed drawing and the following description set forth in detail certain constructions embodying the invention, such disclosed constructions, however, being illustrative of only a few of the various forms in which the principle of the invention may be used.

In said annexed drawing: Figure 1 represents in perspective a section of a flat roof, floor, or the like, embodying one form of my improved centering and reinforcement; Fig. 2 is a similar view in perspective of an arched floor or roof construction, showing the same form of centering in use in this connection; Fig. 3 is an enlarged view, taken end on, of a section of a concrete structure in which is incorporated the form of centering shown in the two preceding figures; and Fig. 4 is a view similar to that of Fig. 3, but showing a slightly modified form of the centering.

The most common of the methods at present prevailing in the erection of concrete structures of the kind first enumerated involves putting a continuous wooden platform, called "centering", across the space between the roof or floor supports at the level desired for the lower surface of the finished concrete structure. The next step is to lay reinforcing rods or netting on top of this centering and to thoroughly embed them in the layer of concrete which is thereupon applied on the upper surface of the centering. When the concrete has set the centering is, of course, torn down. In place of wooden platforms, metallic forms have also been used where practicable. The cost of putting up and taking down this centering is very large, and has led to the use of wire netting or metallic sheets, either plain or corrugated, as a substitute for the removable platforms, such netting or sheets being left permanently in place. A further advance in the art has consisted in so forming metallic centering, of the permanent character last referred to, that the concrete bonds securely to it, and thereby transmits to it a portion of the stresses which it would otherwise have to carry alone. In the present development of this form of metallic centering, such centerings, although adapted thus to act as reinforcements for the concrete, have been of such a form that the under surface must be plastered in order to permanently protect it from corrosion. Otherwise it will become thinner and thinner until eventually there will be little or no reinforcement left for the concrete. The necessity for plastering, thus present in the use of this type of centering, adds very greatly to the expense of construction.

By my invention I propose to so form and employ metallic sheets that they will act both as centering and reinforcement for concrete structures, and will not require plastering on the under side in order to insure the permanence of such reinforcement. This I accomplish by the provision of ribs on the upper side of the sheets, such ribs being adapted initially to stiffen the sheet so as to enable it to support the concrete when setting, as also subsequently to enter into, and reinforce the solidified concrete as thoroughly and permanently as where reinforcing material, entirely independent of the centering, is employed. In other words, such ribs, while connected with the sheet to sustain the latter as described, are of such a form that they will be almost entirely enveloped by the concrete and so be effectually protected from corrosion. The sheets may hence be made of minimum thickness and weight, and the strength and durability of the completed structure will be only very slightly impaired, indeed, by the total subsequent destruction of the same.

In the preferred form of my invention I make the combined centering and reinforcement out of a continuous sheet A of metal, which is crimped at suitable intervals to form a series of upwardly extending spaced corrugations *a*. These corrugations are effectually closed at the point where they leave the sheet proper and for some distance thereabove forming a web and their upper portions are made laterally divergent so as to produce in effect a reinforcing member *a'* that is fully the equivalent of a bar or rod of the type ordinarily used as out and out reinforcement in connection with the removable platform type of centering. The resultant **T** cross-section assumed by the closed corrugations will ordinarily provide the largest measure of stiffening for the sheet, while, at the same time, affording an efficient and economical bonding member. Where desired, however, by omitting one arm of the **T**, a corrugation of inverted **L** section is produced that may, for some purposes, prove equally efficacious and with a still greater economy in the matter of material. In fact,

almost any form of corrugation will answer the purpose so long as the contiguous, or inturned faces of the web portion are brought into such intimate contact as to prevent the circulation of air through the corrugation, and so long as the form of the corrugation is such as to give it a greater cross-section for the same height than it would have if it consisted of a fold with both sides straight and perdendicular at all points to the sheet proper. I should state further that I contemplate also making the corrugations independently of the sheet and then welding, riveting or otherwise securing them to the face of the latter as ribs.

In Fig. 4 is illustrated yet another form which, in practice, is most conveniently made by bending up and flaring in the manner shown the contiguous edges a^2 of adjacent sheets, and then riveting such upturned edges together. For present purposes, however, this structure may be regarded as a specific form of the corrugation first considered, being produced thereform by simply slitting such corrugations lengthwise and spreading their upper portions apart.

In the utilization of my improved combined centering and reinforcement in actual construction, the sheets are laid upon the beams B or equivalent supports provided as a foundation for the structure, so as to dispose the corrugations or strengthening ribs transversely of such beams. Where the structure is to be made flat on the under side, the sheets are preferably placed directly upon the upper surfaces of the beams, and extend straight across from one to the other as shown in Fig. 1. In erecting arched structures, the sheets are still disposed to bring the corrugations transversely with respect to the beams, the ends of the sheets resting on the lower horizontal flanges of the beams, Fig. 2. Whatever the type of the structure in which my invention is thus employed, it will be seen that the sheet can be made very light since it is strengthened to sustain the load of the concrete before the latter sets by the same ribs or corrugations that, after such setting, serve to reinforce the concrete almost entirely independently of the sheet. Hence, should the exposed sheet metal on the under side be entirely eaten away, due to corrosion, the concrete will still be properly reinforced by the T rib portions which are inclosed and protected against rusting. Plastering and painting the underside may both be omitted, where not desired for ornamental reasons, without endangering in the slightest the permanence of the structure.

I am aware that it has heretofore been sought to strengthen sheet metal centerings designed to be permanently placed in the structure by corrugating the same, but I am not aware that such corrugations have ever been made of such form and construction as to adapt them, not only initially to assist the sheet in sustaining its load of wet cement filling, but also subsequently to enter into the concrete structure as an effective and permanent reinforcement, without the necessity of plastering or otherwise protecting the under side of the sheet.

The outer portion of the corrugation, it is to be understood, taking the place, as it does, of reinforcing elements that have heretofore been wholly embedded in the concrete, must be effectually preserved from the deteriorating influences of air and moisture, as also from that still more destructive agency, fire. I have found that by closing the lower web portion of the corrugation in the manner above described that any circulation of air through the corrugation is effectually prevented, this even where a dead air space is included in the outer portion of the corrugation; and by making such web of a sufficient height this outer portion, or reinforcing element proper, is secured wholly beyond the ravages of fire. The permanence of the structure is thus insured not only against the more subtle inroads of corrosion, which in time will destroy the sheet intermediate between the corrugations, unless protected by plastering, but also against the other more destructive agencies noted. This portion of the corrugation constituting the reinforcing element in the completed structure further serves while the concrete is setting to resist lateral bending or in other words buckling of the corrugation. It is to this end that the particular form of cross section shown has been adopted thereby providing in effect an I beam, the lower flange of which is formed by the sheet intermediate of the successive corrugations.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the construction herein disclosed, provided the means stated by any one of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. As a new article of manufacture, a combined centering and reinforcement for structures of concrete, comprising a metallic sheet crimped to form a series of integral spaced corrugations, such corrugations having a cross section of substantially T-shape and the contiguous faces thereof being brought into intimate contact so as to prevent the circulation of air through the corrugation.

2. In structures of the class described, the combination with supporting beams or walls; of a cement filling and a combined centering and reinforcement for such filling comprising a metallic sheet crimped to form a series of integral spaced corrugations on its upper face transversely disposed with respect to said supporting walls, each corrugation having a lower web portion the contiguous faces of which are brought into intimate contact so as to prevent the circulation of air through the corrugation and an outer transversely expanded portion of a cross-section adapted to resist lateral bending of the corrugation and thus to assist the sheet in sustaining said cement filling while wet, such outer portion being adapted to enter into the completed structure as a reinforcing member independently of any connection with said sheet when said cement filling has set.

3. In structures of the class described, the combination with supporting beams or walls; of a combined centering and reinforcement comprising a metallic sheet crimped to form a series of integral spaced corrugations on its upper face transversely disposed with respect to said supporting walls, each corrugation having a lower web portion and a continuous outer portion bent away from a plane which is perpendicular to the surface of said sheet at the line of junction of said corrugation therewith, the contiguous faces of such web portion being brought into intimate contact so as to prevent the circulation of air through the corrugation; and a cement filling applied to such face of said sheet and embedding said corrugations.

4. In structures of the class described, the combination with supporting beams or walls; of a combined centering and reinforcement comprising a metallic sheet crimped to form a series of integral spaced corrugations on its upper face transversely disposed with respect to said supporting walls, each corrugation having a lower web portion and a continuous upper laterally divergent portion, the contiguous faces of such web portion being brought into

intimate contact so as to prevent the circulation of air through the corrugation; and a cement filling applied to such face of said sheet and embedding said corrugation.

5. In concrete structures of the class described, the combination with supporting beams or walls; of a combined centering and reinforcement comprising a metallic sheet crimped to form a series of integral spaced corrugations, said corrugations being closed and having a cross-section of substantially T-shape, said corrugations being further disposed transversely of said supporting walls and adapted to serve as reinforcing members in the completed structure independently of said sheet; and a cement filling applied to such face of said sheet and embedding said corrugations.

Signed by me, this 13th day of February, 1907.

HERBERT F. COBB.

Attested by:
D. S. DAVIES,
JNO. F. OBERLIN.