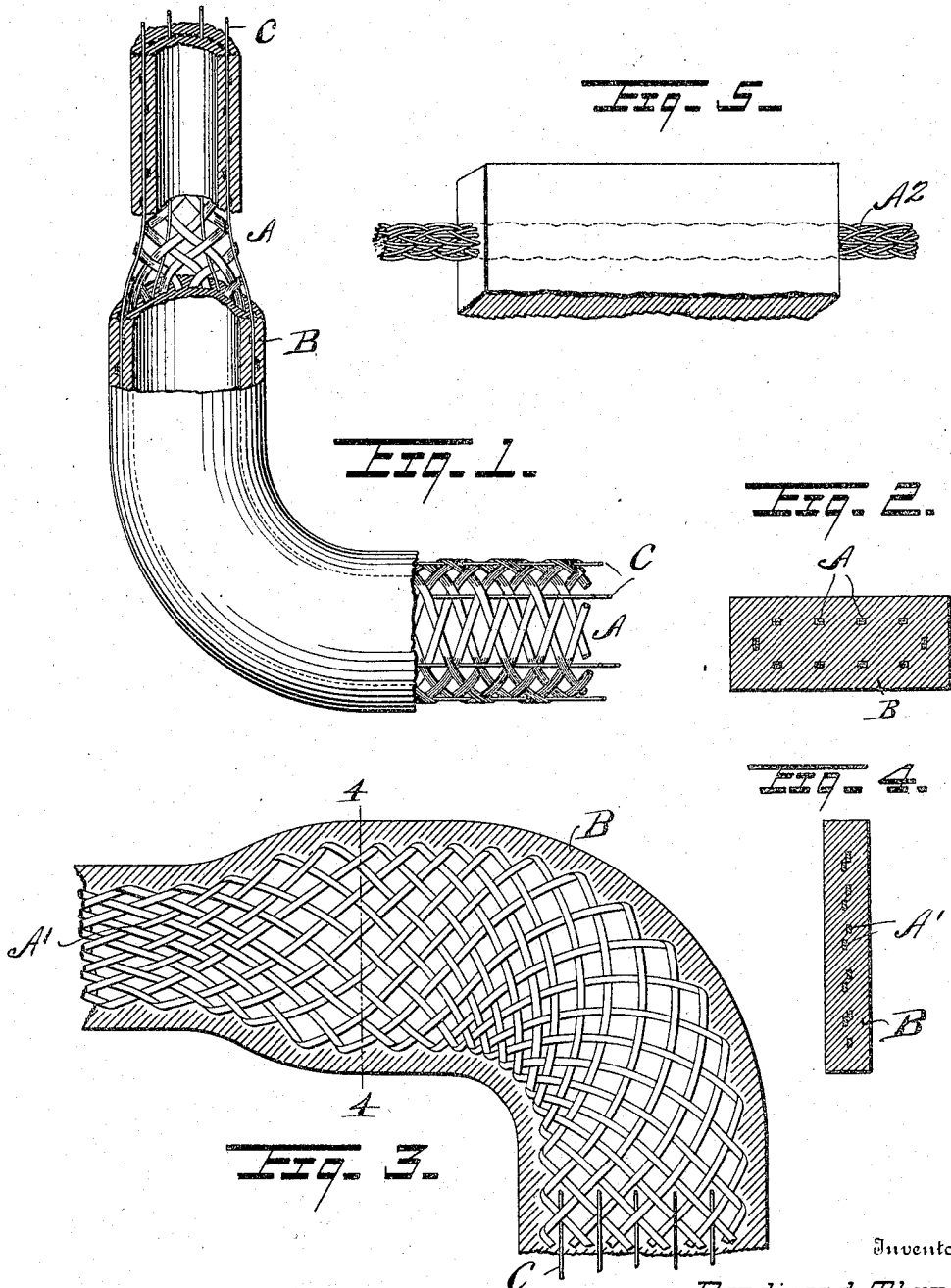


F. THUN.
 REINFORCED CONCRETE.
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939,567.

Patented Nov. 9, 1909.



Witnesses

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REINFORCED CONCRETE.

939,567.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FERDINAND THUN, a citizen of the United States, and a resident of the city of Reading, in the county of Berks and State of Pennsylvania, have invented certain new and useful Improvements in Reinforced Concrete, of which the following is a specification.

My invention relates particularly to reinforced concrete constructions, and my objects are to provide for securing a satisfactorily permanent and effective union of the reinforcing material with the applied plastic material, and for producing reinforced concrete members of varying sizes and shapes in a simple and economical manner. To this end I employ in combination with concrete covering, a suitable reinforcing material made up in the form of a braided fabric which is adapted to greatly strengthen the composite structure when embedded in the concrete covering so that distortion of its form or loosening of its union with the covering cannot occur without first crushing the concrete which fills its interstices and which is also capable, when desired, of being adjusted as to size and shape as required for different purposes, preliminary to applying the concrete covering to form the completed structure.

The invention is fully described in connection with the accompanying drawings and specifically pointed out in the claims.

Figure 1 illustrates my invention as applied to constructions of circular cross-section, the reinforcing material being shown of tubular form adjusted in diameter and in axial alinement to the required shape. Fig. 2 is a cross-sectional view of a rectangular concrete beam illustrating a modified embodiment of my invention, the reinforcing material being of flattened-tubular form adjusted to the shape and size of the beam. Fig. 3 illustrates in plan view a modification of my invention comprising a flat-braided reinforcement adapted by stretching and edgewise curvature to the differing widths and form of an irregularly shaped concrete slab; and Fig. 4 is a cross-sectional view of the same. Fig. 5 indicates a further modification in which the reinforcement is employed in the form of a tubular-braided cable the interlaced strands of which are immovably united with the concrete covering.

The advantages of concrete as a struc-

tural material and its adaptability to a greater variety of purposes when reinforced by a material of greater tensile strength in such manner as to effectively utilize the great compression strength of the concrete, is well understood; and many structures of this character have been devised in which the reinforcement must be especially adapted to practically each particular shape and size of finished structure to be produced. I have found that such lack of adjustability in the size and form of the reinforcement is a great hindrance to the prompt and economical production of effectively reinforced concrete structures; and further that it is difficult to secure proper and permanent union, under varying conditions, of the reinforcement with the concrete. In seeking to overcome these disadvantages I have discovered that a wire reinforcement in which the strands are interlocked by passing them alternately over and under each other, as effected in ordinary braiding operations, not only permits of great adjustability of the normal size and shape of the wire fabric where this is desired, owing to the fact that the crossing angles of the strands may be readily varied to suit the requirements; but also that in such a braided reinforcement, the union which is effected with the concrete covering when the interstices of the braid are filled by the concrete, is not apt to be loosened, or the strength of the structure materially affected even by defective strands thus interbraided and combined.

The drawings illustrate the application of my invention to several forms of concrete structures having braided-wire fabric reinforcements. In Fig. 1 this fabric A is represented as a tubular braid, the normally uniform diameter of which has been changed by relative lengthwise extension or contraction, to conform respectively with the reduced upper portion, the larger middle portion, and the curved lower portion of the irregularly shaped tubular structure shown;—the crossing angles of the braided wires and the dimensions of the interstices being of course changed correspondingly with the extension or contraction of the length of the fabric, but said interstices being in all cases tightly packed with the concrete material B in completing the structure. Warps, indicated at C, may be advantageously provided in the braided fabric for increasing the strength of the reinforcement;

and the warp fabric may be conveniently shaped, when desired, by using the warp threads as "pull strings", and the shape thus produced may be retained by thereafter

5 suitably locking the warps, preliminary to applying the concrete covering; or the required shape of the fabric, as adapted to a particular purpose, may be otherwise retained by suitable anchoring or tying means,

10 so as to facilitate the application of the concrete covering thereto. The hardening of the latter of course ultimately insures a rigid composite structure, in which the full tensile strength of the reinforcement and

15 compression strength of the concrete are most effectively and permanently combined, without danger of harmful loosening of the braided reinforcement, such as is liable to occur with inherently rigid reinforcements,

20 due to unequal contraction and expansion under changing temperatures or like causes. Inasmuch as the structure of the braided fabric permits of its being considerably varied in shape and size by merely changing

25 the crossing angles of the loosely crossed wires, a given size of such fabric may be utilized for quite a wide range of work, while providing in all cases a frame work which, when its interstices or openings are

30 filled by the concrete covering, forms a very rigid structure that cannot be materially distorted without exerting an excessive crushing strain upon the concrete—which strain the latter is well able to sustain. The

35 tubular braid reinforcement described, is not only adapted for solid and tubular columns or pipes of various sizes and shapes, as indicated in Fig. 1, but is also applicable to rectangular beams for instance, as indicated in Fig. 2, by merely flattening the tubular braid A as indicated; the width being

40 variable as in the Fig. 1 construction, by stretching or compacting the fabric lengthwise as required, and the adjusted form being rigidly fixed by the concrete covering applied to it and solidly filling its interstices. In the case of thin slabs or the like requiring only a single line of reinforcement, as indicated in cross section in Fig. 4,

50 a flat braided fabric A' may be employed in the same manner as the tubular braided fabric of Figs. 1 and 2; this flat braid reinforcement being similarly adjusted in width and capable of edgewise curvature as indicated in Fig. 4, to adapt it to the required

55 shape of the finished structure; and the latter effectively combining the tensile strength of the reinforcement and the compression strength of the concrete covering in which it is rigidly embedded. In the simple construction indicated in Fig. 5, where the braided reinforcement is shown in the form of a tubular-braided cable A² arranged in the same manner as an ordinary reinforcing

60 rod, a greatly improved composite structure

is produced because of the intimate union with the concrete, which latter closely fills every interstice and bend of the interlaced strands so as to unite the two materials in a peculiarly effective manner.

The warps C may be employed whenever desired for additional strength or convenience of adjustment, without interfering with the adjustability of the reinforcement to the particular form of the finished structure.

The size and form of wire employed in the braided reinforcement, as also its diameter or width and looseness of texture, are limited only by the braiding mechanism provided to produce it, and my invention is therefore applicable to the construction of concrete members of great variety in size as well as form.

What I claim is:—

1. A reinforced structure of concrete or the like comprising a braided wire fabric provided with interwoven warp wires adapted to control extension of the fabric and concrete covering therefor filling the interstices of the fabric.
2. A reinforced structure of concrete or the like comprising a braided wire fabric provided with interwoven warp wires and adjustable in width by lengthwise stretching or contraction upon said warp wires, and concrete covering therefor filling the interstices of the adjusted fabric.
3. A reinforced structure of concrete or the like comprising a loosely braided tubular fabric of wire or the like provided with interwoven warp wires and adjustable in width by lengthwise stretching or contraction upon said warp wires and concrete covering therefor filling the interstices of the adjusted fabric.
4. A reinforced structure of concrete or the like comprising a loosely braided wire fabric provided with interwoven warp wires and having a portion thereof to one side of its longitudinal center line extended by stretching and an opposite portion contracted upon an interwoven warp wire to thereby form a bend.
5. A reinforced structure of concrete or the like comprising a loosely braided wire fabric provided with interwoven warp wires and having a portion thereof to one side of its longitudinal center line extended by stretching and an opposite portion contracted upon an interwoven warp wire to thereby form a bend, and concrete covering for said shaped fabric filling the interstices thereof.
6. A reinforced structure of concrete or the like comprising a loosely braided wire fabric provided with interwoven warp wires and having a portion thereof to one side of its longitudinal center line extended by stretching the braided wires upon an inter-

woven warp wire and an opposite portion contracted upon another interwoven warp wire to thereby form a bend.

7. A reinforced structure of concrete or
5 the like comprising a loosely braided wire fabric provided with interwoven warp wire and having a portion thereof to one side of its longitudinal center line extended by stretching the braided wires upon an inter-
10 woven warp wire and an opposite portion

contracted upon another interwoven warp wire to thereby form a bend, and concrete covering for said shaped fabric filling the interstices thereof.

In testimony whereof, I affix my signa- 15
ture, in the presence of two witnesses.

FERDINAND THUN.

Witnesses:

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