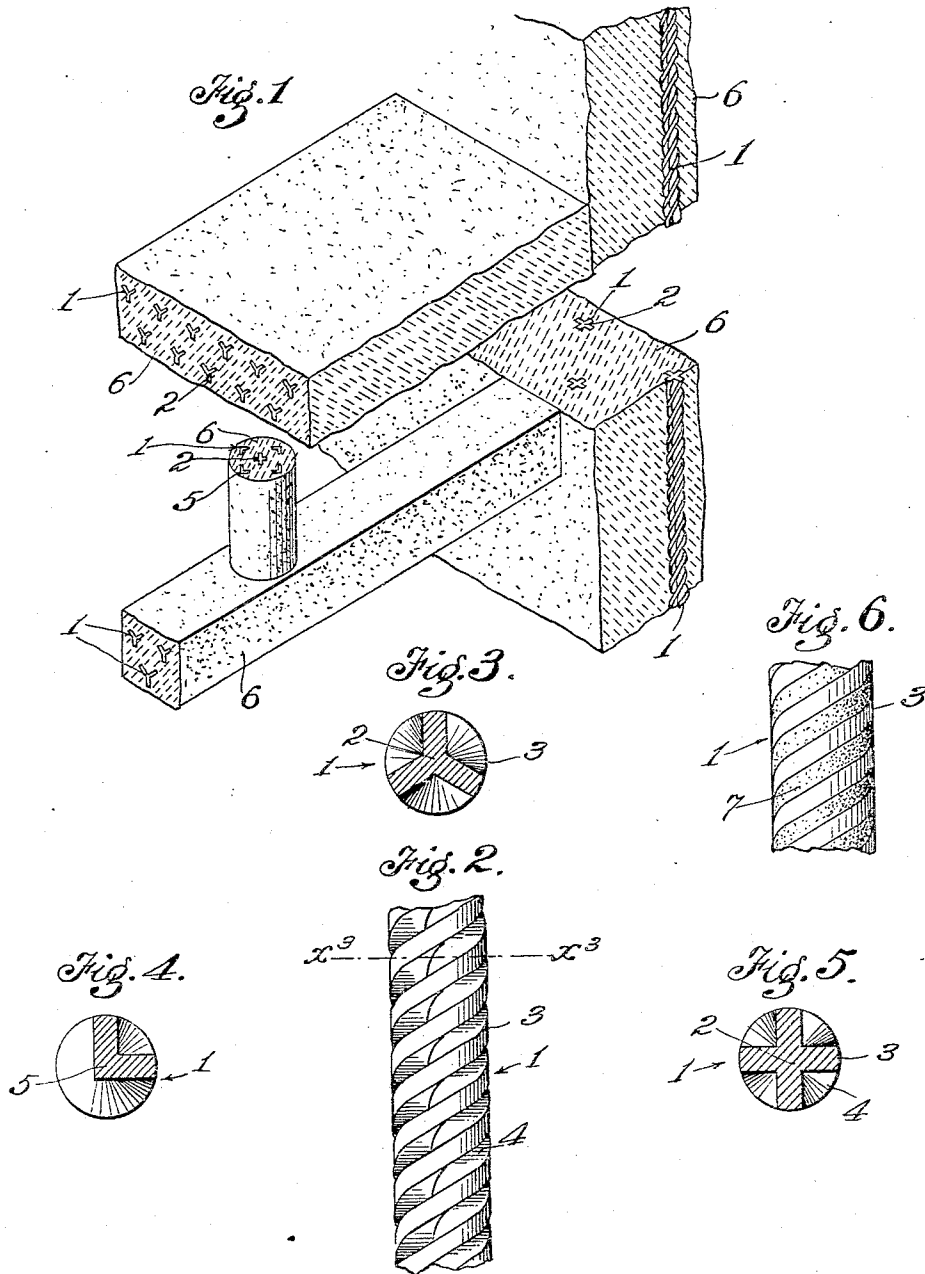


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 REINFORCED CONCRETE CONSTRUCTION.  
 APPLICATION FILED SEPT. 26, 1906.

931,049.

Patented Aug. 17, 1909.



Witnesses:

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# UNITED STATES PATENT OFFICE.

RALPH DE LECAIRE FOSTER AND GUSTAV SCHULZ, OF SAN DIEGO, CALIFORNIA.

## REINFORCED CONCRETE CONSTRUCTION.

No. 931,049.

Specification of Letters Patent.

Patented Aug. 17, 1909.

Application filed September 26, 1906. Serial No. 336,329.

*To all whom it may concern:*

Be it known that we, RALPH DE LECAIRE FOSTER and GUSTAV SCHULZ, both citizens of the United States, residing at San Diego, in the county of San Diego and State of California, have invented new and useful Improvements in Reinforced Concrete Construction, of which the following is a specification.

10 This invention relates primarily to providing an improved substantial reinforcement for concrete construction either in the vertical or horizontal.

One of the principal objects of this invention is to provide a reinforced structure comprising a member which is designed to receive an amount of cement or other plastic material proportionate to the amount of metal, whereby it is capable of withstanding  
20 excessive horizontal and vertical strains.

It is also contemplated to construct a reinforcing girder which practically forms a unit when embedded in walls of concrete in order to increase the rigidity of those parts  
25 which are adapted to carry the greatest strain either of buildings or superstructure.

In the construction about to be described it is also a very important design of applicants to overcome the tendency of the reinforcing member to bend and be contorted by superimposed weights and stresses after being embedded in the concrete, especially when used as a horizontal girder, which tendency is a predominant drawback in the  
35 girders and cross-beams employed in connection with the erection of dams, walls, and other parietal structures. Toward the accomplishment of this end we intend to distribute over a determined area of metal an  
40 approximately like area of plastic substance, after leaving suitable interstices in the metallic girder or skeleton, which interstices are approximately equal in width to the width or space of the metal itself; in other  
45 words, the strain exerted upon the metal will be no greater than the strain directly exerted upon the inclosed layer of plastic material. Consequently, the hardening of the substance within the spaces formed between the metal  
50 operates to increase the tensile strength and rigidity in all forms of structure, including among other structures, horizontal and vertical beams, posts and columns. In this manner the metal with the cement or plastic  
55 substance, after the same has hardened, may be used independently of any walls or sub-

structure, as a column, whereby the same tensile strength would be derived from a column of this kind as one which is embedded in a solid wall of cement. That is to say,—in some instances, the girder, column, or the like, may be devoid of any matrix or coating outside of the metal. The interstices between the metal may be approximately equal to the amount of metal itself, and it is obvious that in such case, after the metal has been supplied with the necessary amount of plastic cement or material and the hardening thereof has occurred, the lateral strains are equally distributed among  
70 the metal strands as well as upon the cement lying between the metallic layers or strands. That is to say,—using a horizontal beam for illustration, if the strain is exerted directly from above on the center point of the beam, the tendency to yield to the pressure is counteracted by the solidity of the interposed composition of matter which distributes the amount of weight equally, or approximately  
80 equally, throughout the beam. If the strain is exerted on any point of the girder, whether in the center or to the sides thereof, the cement operates to offset the tendency to bend on that side of the girder which has the greatest tendency to yield to such pressure.  
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In the construction we are about to describe, the reinforcing member comprises a strip or strips of metal rolled one part on the other similar to the vernations in a leaf or bud, whereby folds are alternately left in  
90 the reinforcing member, between each of which a space or groove results, this being used to receive a suitable filler. Thus, in the construction of a reinforcement of this character for concrete and like materials, the use  
95 of hardening filler in the spaces formed by the spun metal conduces materially to the conformation of a unit. In this form the coiled member with concrete filler may be used independently as a girder, or collectively in a wall, in which instance the metallic skeleton previously properly formed is placed without the filler in the concrete or other plastic material which enters into the spaces of the spun strip and, upon the hardening, produces a member equally effectual  
100 in its adaptation to withstanding unequal strains, weights, and pressures, as the skeleton which has been previously formed into a column and the material then placed in the interstices formed in the operation of coiling before utilizing the column in walls, etc. It  
110

is apparent that the mass of filler is proportionate to the area of the space between the individual coils formed by the spun member; consequently, the strain is proportionately divided between the metallic member and the interposed layer or filler, the cement becoming a support for the metallic member. Each strip of metal may form part of a cross, may be twisted upon itself from the point of its vertical axis, and thereupon intertwisted upon the axis of the four,—more or less,—strips of metal forming the convolute and constituting an ascending series of spirals spun about a common axis.

In some instances the metal strip may be in the form of an angle-iron having only two strands or limbs, as will appear more fully from the subjoined particular description.

The accompanying drawings illustrate the invention:

Figure 1 is a perspective view of a wall showing a plurality of reinforcing metallic coils embedded therein, and horizontal flooring as well as vertical columns each having one or more metallic members forming part of our invention. Fig. 2 is a fragmentary elevation of three strips of metal integrally united and twisted. Fig. 3 is a transverse section on lines  $x^2-x^3$  of Fig. 2. Fig. 4 is a transverse section of a modified form. Fig. 5 is a transverse section of another modified form. Fig. 6 is a fragmentary elevation of three strips of metal integrally united, twisted, and provided with a filler.

Referring to the drawing, 1 shows a metallic member consisting of a plurality of flattened strips integrally and centrally united, the central point forming substantially a core, as seen at 2. In this instance three strips have been used to illustrate the invention, but of course it is within the scope of the invention to employ as many as may be desirable in the course of manufacturing the reinforcing member. The united three strips are twisted upon themselves about their point of junction, the twists being illustrated at 3, and being such that where three strands or strips are used, spaces will be left alternately between the strands or strips of metal, which spaces in the course of manufacturing the reinforcing member are approximately equal to the thickness of the metal. The amount of material between the spaces is equal in mass to the mass of metal, that is to say the thickness of the convolved coils or strands is equal to the thickness of the interposed plastic substance, therefore a column so constructed is practically a solid, the alternate twists of the strands and concrete mutually supporting each other. By thus providing a column so proportioned, the direct strain exerted on the same by superimposed stresses and weights is in no manner restricted to one or the other of the

elements forming the components in a column of the character, nor are they distributed among both, but both being united and constituting a solid, they bear upon the finished column as a concrete whole in which the masses of both have been consolidated. Furthermore the interstices formed by closely alining the coils are in the nature of a continuous groove extending about a core formed by the convolving of the strands which serves as a holder for the same when used to withstand considerable pressures. These spaces are illustrated at 4, and are adapted to receive a filler of plastic material such as concrete and the like.

In Fig. 4 we have illustrated simply two strands or strips of metal standing approximately at right angles to each other, and having at the intersection of the angle its core, seen at 5, about which the strips are twisted in the shape of a spiral, the circumferential strands of which are spaced as in the former case,—that is in Fig. 2,—to receive a hardening material. The angularity of the connected pieces is immaterial so long as in the course of the formation of the twists spaces are provided to receive an amount of concrete or other hardening material which is capable of withstanding pressure when so supported by the adjoining twists of steel. In this manner a girder is formed of steel and concrete, both bodies being mutually supported. The coiled member, as such, may be placed in the structure or wall and floor without having its interstices previously supplied with concrete, so that the concrete used in the construction of walls and flooring, entering in a plastic state into the coil, forms practically a unit. The matrix or coherent mass 6, embedding the coils or reinforcing girder 1, by cohesion, becomes a solid which is materially preserved by the metallic windings 3, and its adhesion to the coils formed in the girder.

In Fig. 6 the filler is illustrated at 7 and follows throughout the formation of the convolved strips of metal. The application of the filler-medium in a state of semi-fluidity causes the thorough embedding of the spaced and spun strips, and each coil separately and in numbers receives an equal amount of filler. A column thus formed is not characterized by strata or schists frequently found in natural rock, and has greater resisting qualities by reason of the rib formed by the coil and the natural cohesion of cement. On the other hand, if the metallic member after being spun is set in place, as illustrated for instance in Fig. 1, the effect is practically the same, since the filler of concrete readily fills the interstices of the coils, and forming a unit, makes a solid wall or floor. The metallic strips or girders made in the manner previously described, form component parts of a floor,

wall, or other structure after they have been embedded in the concrete or other plastic substance.

- This invention is directed toward the production of a metallic girder or column composed of a series of flattened strips of metal twisted about a common axis and inter-twisted with any number of other strips whereby to form a spirally-spun skeleton having spaces or interstices formed about a core for the purpose of receiving a filler.

- It is within the scope of this invention to employ a solid core having grooves of a spiral shape provided therein, as well as to provide a hollow body having grooves or spaces formed in the body either by cutting, or by forming these grooves by twisting about the hollow body metallic strips in such a manner as to be the equivalent of a groove.
- After the insertion of the metallic girders, columns, etc., in the mass of material, or even previous thereto, these skeleton-like frames may be anchored in any suitable manner known to the art.

- What we claim is:—

1. A concrete reinforcing rod comprising

three or less flanges projecting radially and spirally twisted until the distance between the spirals longitudinally of the rod is equal to the thickness of a flange, and a hardened plastic material in the grooves thereby formed between flanges whereby the amount of said hardened plastic material in a cross section is greater than the amount of the metal.

2. A concrete reinforcing rod comprising flanges projecting radially and spirally twisted until the distance between the spirals longitudinally of the rod is equal to the thickness of a flange, and a hardened plastic material in the grooves thereby formed between flanges whereby the amount of said hardened plastic material in a cross section is greater than the amount of the metal.

In testimony whereof, we have hereunto set our hands at San Diego, California, this nineteenth day of September 1906.

RALPH DE LECAIRE FOSTER.  
GUSTAV SCHULZ.

In presence of—

GEO. J. LEAVY,  
J. F. MALONEY.