No. 808,039. PATENTED DEC. 19, 1905.

J. F. GOLDING.

METAL FABRIC FOR USE IN CONCRETE AND OTHER PURPOSES.

APPLICATION FILED FEB. 20, 1905.

4 SHEETS—SHEET 1.

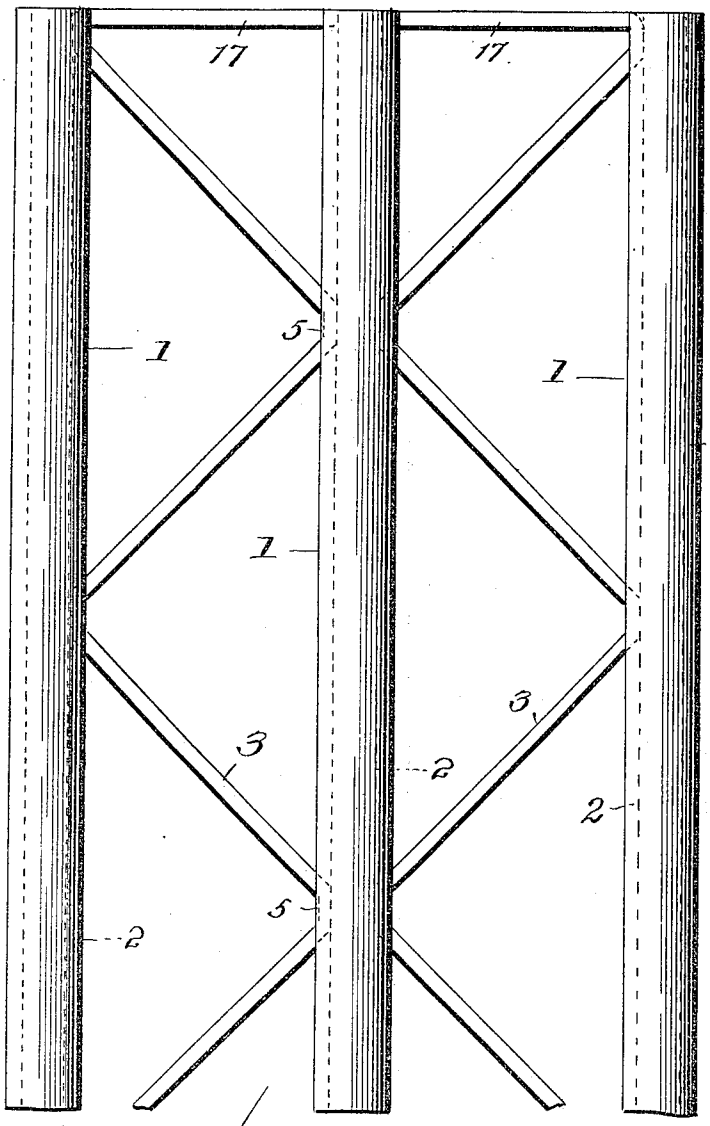


FIG. 1.

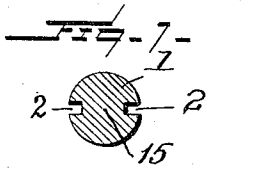


FIG. 4.

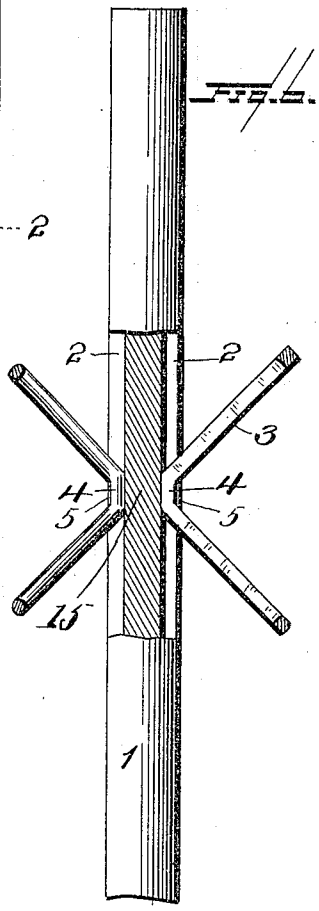


FIG. 2.

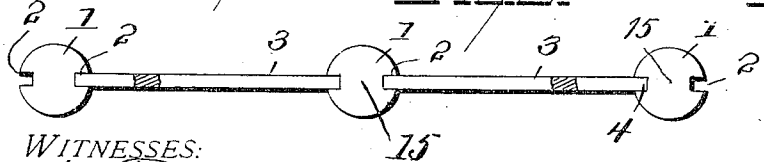


FIG. 3.

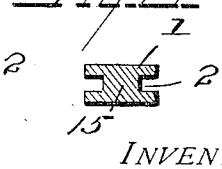


FIG. 5.

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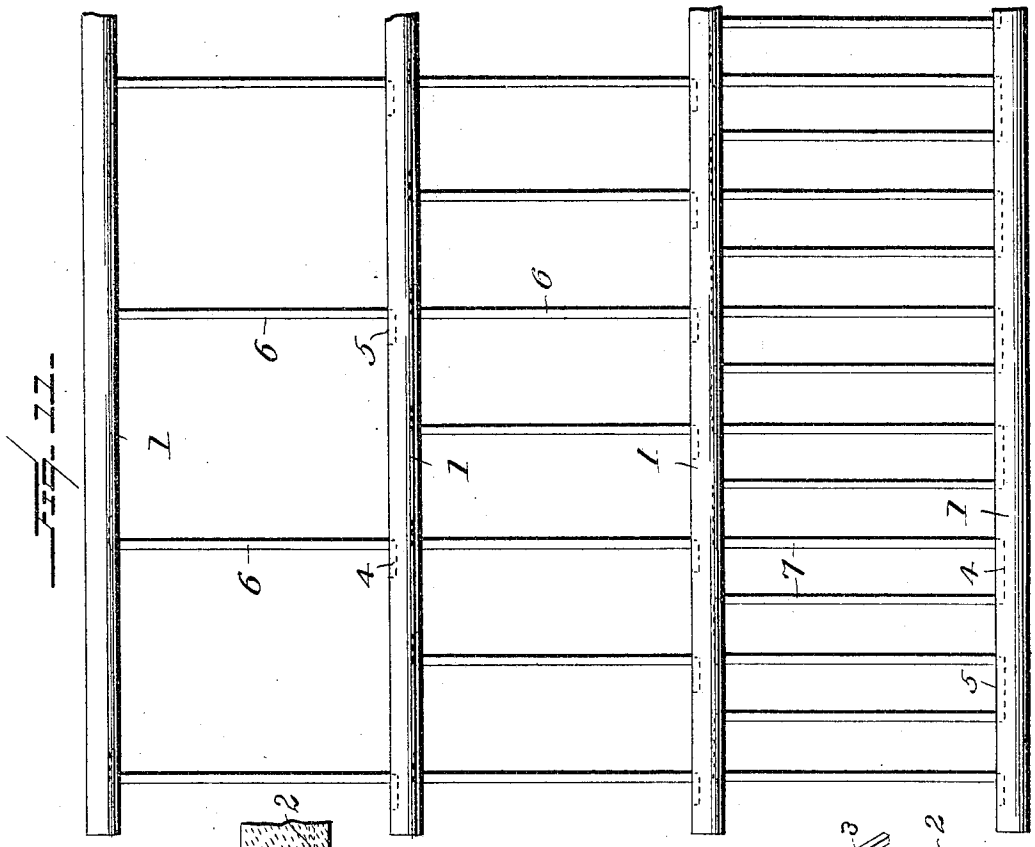
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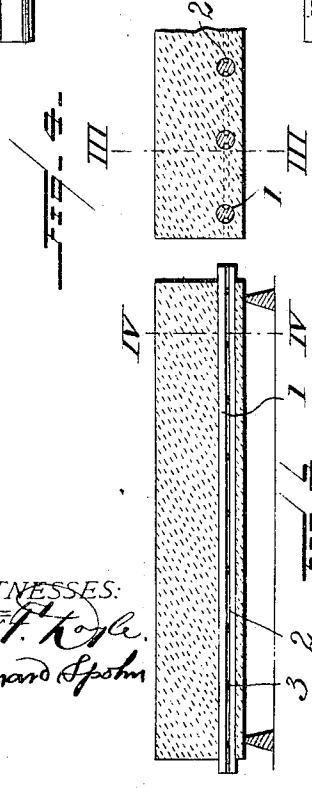
J. F. GOLDING.

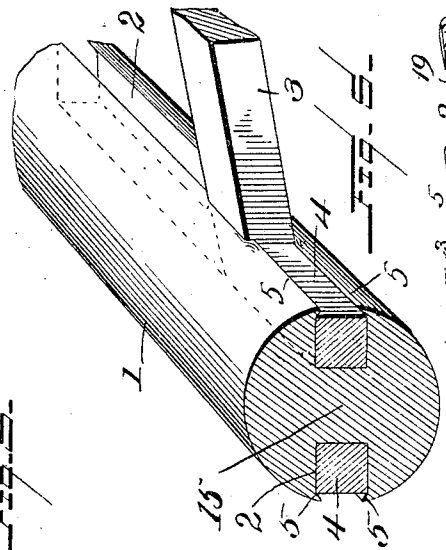
METAL FABRIC FOR USE IN CONCRETE AND OTHER PURPOSES.

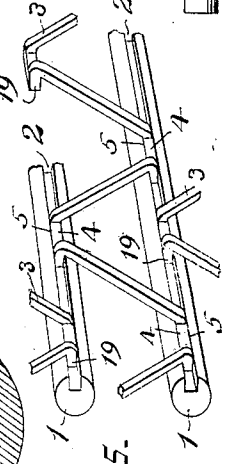
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4 SHEETS—SHEET 2.









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J. F. GOLDING.

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4 SHEETS—SHEET 3.

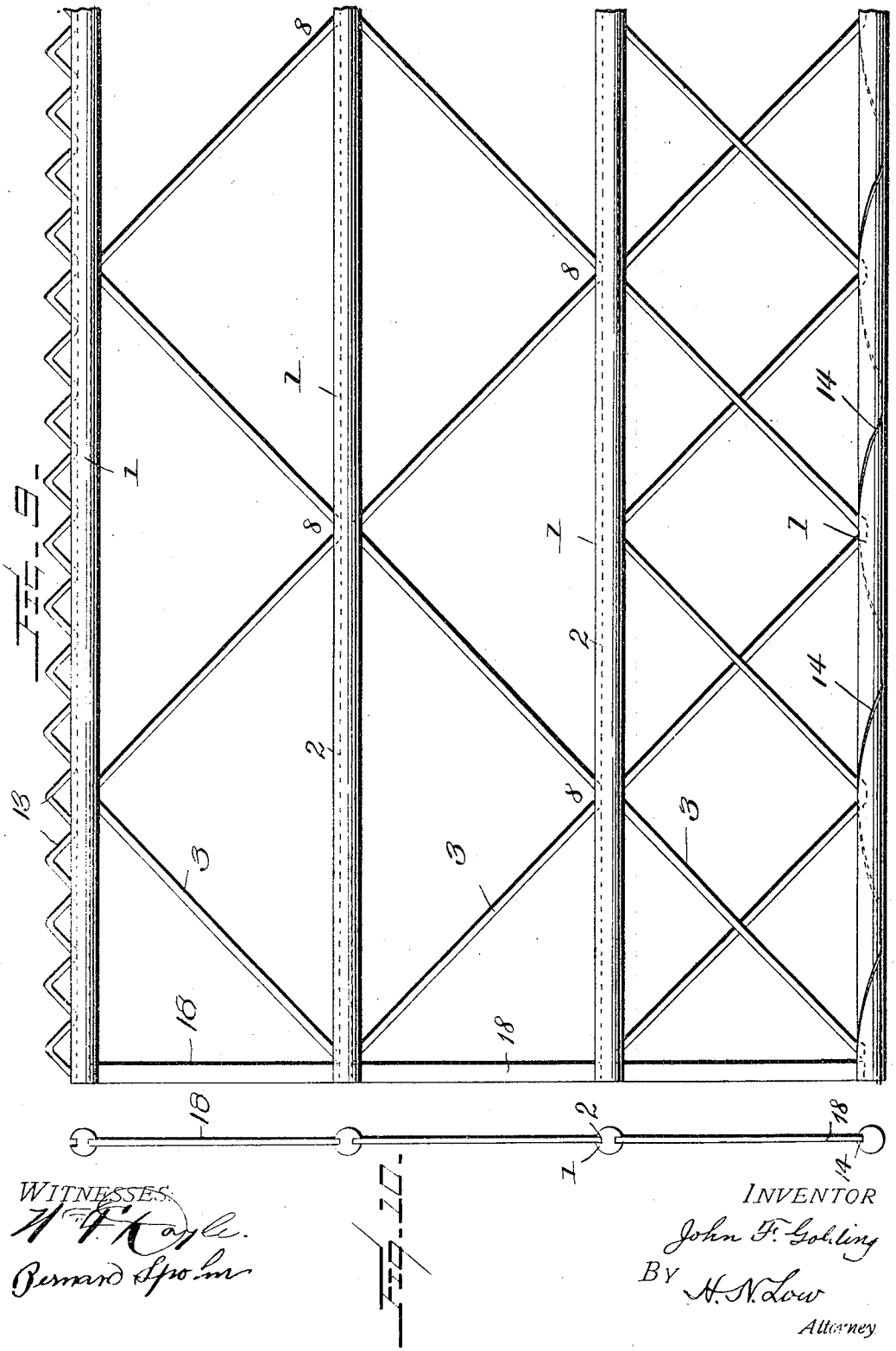


FIG. 3.

FIG. 10.

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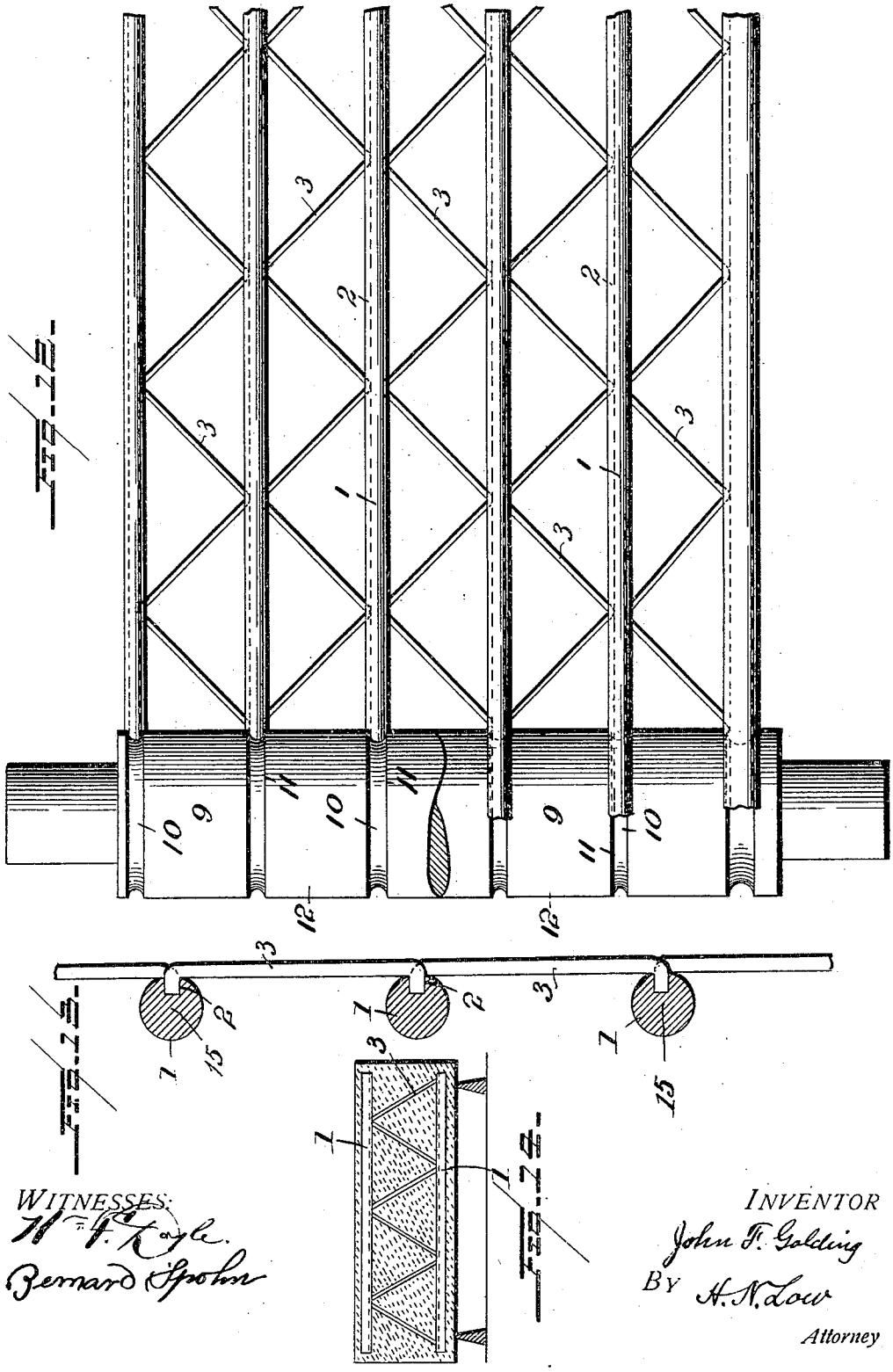
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

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METAL FABRIC FOR USE IN CONCRETE AND OTHER PURPOSES.

No. 808,039. Specification of Letters Patent. Patented Dec. 19, 1905.

Application filed February 20, 1905. Serial No. 246,608.

To all whom it may concern:

Be it known that I, JOHN F. GOLDING, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Metal Fabrics for Use in Concrete and Other Purposes, of which the following is a specification.

The object of my invention is to provide a very strong metal fabric especially adapted for use in concrete, cement, artificial stone, and the like to strengthen the same, but which may be employed for other useful purposes.

It is desirable that the strengthening means or sheet for a body of concrete should be practically continuous, unitary, or integral throughout. There are limits, however, to cutting and bending an integral sheet of metal for this purpose arising from the difficulty or expense of cutting metal of that thickness which it is often desirable or necessary to employ in the concrete structure, the impracticablity of making such distribution of the metal as to give the best results, and principally from the fact that integral sheets of the width and length required in many structures cannot be produced or cannot be made economically.

My invention provides an open-work metal fabric having its various parts practically continuous and integral, (though not literally so,) in which the metal is or may be distributed according to the strains on the structure, so as to obtain the greatest strength with the least amount and weight of metal, the parts of which fabric may be of any desired thickness, the meshes of which may be of any size, the extent or area of which can in width and length be made sufficient for the largest structures without the sacrifice of economy, which can have some members or parts made of material of greater tensile strength than the material of other members, and which has all of its parts united with practically the same strength and rigidity as are the parts of an integral sheet. The fabric is of such construction that sections of it can be made of much greater width and length than that to which metal sheets or fabrics are limited by inexpensive mechanism or appliances. Also one manufactured section may be added to another at the side thereof, so as to produce a single continuous section of any desired width, according to the requirements of the concrete or other structure, and this operation can be readily performed on the site where the structure is being erected.

With such object and advantages in view the invention consists in the parts and combinations thereof hereinafter set forth and claimed.

In order to make the invention more clearly understood, I have shown in the accompanying drawings means for carrying the same into practical effect without limiting my improvements in their useful applications to the particular constructions which, for the sake of example, I have delineated.

In said drawings, Figure 1 is a plan view of a metal open-work fabric embodying my invention. Fig. 2 is an end view of the same. Fig. 3 is a longitudinal sectional view of the fabric combined in a body of concrete, such as a floor or beam, the same being taken on line III, Fig. 4. Fig. 4 is a cross-section on line IV, Fig. 3. Fig. 5 is a perspective of a portion of the fabric, partly shown in section, at one of its points of intersection or connection of the parts. Fig. 6 is a plan view of a portion of the fabric, partly in section, at one of such points. Figs. 7 and 8 are sectional views across the grooved longitudinal or tension bar, showing two forms of such bar which are suitable for the fabric. Figs. 9 and 10 are respectively a plan and an end view of another form of the fabric. Fig. 11 is a plan view of another form of the same. Fig. 12 is a plan view of an uncompleted fabric and compressing-rolls for operating on the same, illustrating one mode of its manufacture. Fig. 13 is a sectional view across the longitudinal grooved bars, illustrating another form of connection between the parts of the fabric, in which a single groove in the bar is employed for the purpose. Fig. 14 is a vertical sectional view showing a concrete beam in which is combined a piece of the fabric of truss-like form and arrangement. Fig. 15 is a perspective view of a portion of a fabric embodying my invention in the same particular form as is shown in Fig. 13.

It will be understood that the word "con-

crete" as herein used is intended to cover all built-up structures of similar or analogous materials.

Referring to the drawings, 1 indicates the longitudinal bars of the fabric, preferably of steel and formed with one or more longitudinal grooves 2. These bars are conveniently formed by rolling, of the cross-section shown in Figs. 7, 8, or 13 or equivalent shape. The shaping of the bar 1 as described, with the groove or grooves 2, gives the bar about one-third more surface and increases its tensile strength in proportion to its weight.

3 indicates the rods or strips of the fabric which intersect with and connect the grooved bars. They are preferably of steel, of square, round, or other suitable cross-section, of which the square and round forms are indicated in Fig. 6. Portions of the rods 3 enter within the grooves 2 of the bars and are there rigidly secured by the metal of the bars being upset or compressed onto the sides of the rods. By preference the rods 3 are bent so as to have longitudinal portions 4, which are parallel with the bars 1 and extend for a short distance along in the grooves 2, and the rods are of a little less thickness than the depth of the groove, which enables the edges 5 of the bars to be bent partially around or over the rods at the parts 4. This gives a most rigid and secure union of the parts, making them, in effect, integral. As many of the bars 1 are employed as are necessary for the desired size of mesh and width of fabric, and the bars 1 and the fabric can obviously be made of almost unlimited length.

The rods 3 can be made in short sections extending only once between a pair of the bars 1, as seen at 6 in Fig. 11; but it is of advantage for strength and for convenience in assembling the parts and making the fabric to have the rods 3 continuous, so as to extend back and forth several times between a pair of bars. This construction is shown at 7 in Fig. 11 and in the other figures. The rods 3 may be thus continuous from one end of the fabric to the other. The extending of the portions 4 along the grooves gives considerable length and security of grip to the bars 1, the edges 5 bending over or overlapping first one side and then the other alternately of the rod. The bars 1 are also continuous, extending from one intersection-point 8 of the fabric to another. The bars 1 are of heavier or thicker metal than the rods 3, as illustrated. This gives sufficient metal in the bars to inclose the rods and to hold the latter by its permanent set and rigidity.

In manufacturing the metal fabric a rod may have its part 4 inserted in the groove of a bar and then the metal of the latter set onto the sides of the rod and the edges 5 bent over by a swage, and this operation may be continued until the fabric is completed; but a rolling process, which is sufficiently illustrated in Fig. 12, is far more rapid and desirable. The bars having been prepared in the form described and the rods having been bent to suit that mesh which the fabric is to have, the parts are assembled, as seen in Fig. 12. They are then caused to pass between rolls 9. The latter are formed with grooves 10, which are a little narrower than the bars 1, so that the corners 11 of the rolls are effective to upset the webs 15 of the bars and force inward the metal of the bars 1 to cause said metal to be compressed strongly against the sides of the rods and to bend the metal at the edges 5 partly over or around the portions 4 of the rods. It will be understood that the assembled parts of the fabric pass from end to end of the same between the rolls and that the process of manufacture of the fabric thus conducted is quite rapid and economical. It will be understood, further, that bars 1 of different diameters may be combined in the fabric by this process, the grooves 10 of the rolls being of corresponding different widths to suitably operate on such bars. As the bars thus pass through the grooved portions of the rolls the connecting-rods 3 pass through the spaces left between the plain portions 12 of the rolls. At its sides or edges the fabric may be terminated or finished by the bars 1, as shown in Fig. 1, or by the rods or strips, as shown at 13 in Fig. 9. After the bars have been rolled I prefer in some cases to twist them before assembling them in the fabric, thus giving the groove 2 a helical contour. This is shown at 14 in Fig. 9. When this is done, the bars are arranged in combination with the rods 3, so that the latter enter the grooves at points where the grooves come opposite to the rods. This construction is of advantage in concrete because the latter obtains a very advantageous hold upon the twisted grooves.

It is also of use in other situations. For instance, where a fabric of the character shown in Fig. 10 is used in or as a fence the grooves of the bars will not hold water, for the upturned portions of the grooves are their highest points, from which water will immediately run off. The concrete also obtains a hold in the straight grooves of the bars 1 and on the lips thereof against vertical strains and strains which are transverse to such grooves and lips. As against strains which are longitudinal of the bars the concrete has a frictional hold in the grooves and abuts against and is locked by the parts of the rods which are held in the lips of the bars 1.

A form of the fabric comprising only two of the rods 1 may be employed as a strengthening-truss in a concrete beam, Fig. 14, the said rods serving as the upper and lower chords of the truss.

In applying the described fabric to the strengthening of the concrete the fabric is

arranged so that the bars 1 serve as the tension-bars to receive the principal strains—for instance, as seen in Fig. 3. For such purposes the bars 1 may be made of very high tensile strength, whereby the whole structure comprises less metal and weight and can be made more economically. The same is true of the fabric when used in a fence, the bars 1 acting most advantageously as the straight tension members of the structure.

The strips or rods may be connected with each other by means independent of the grooved bar at points intermediate of such bars in any suitable way.

The fabric is very advantageous in columns, the grooved bars acting as compression members, while the fabric as a whole gives great tensile strength to the sides or the column.

By employing the twisted grooved bar described such a bar with a single groove has the function of a bar with two opposite grooves, in that the single groove appears on both sides of the bar and admits of the attachment of rods extending in each direction.

The fabric may be finished across the ends as desired. In Fig. 1 a part of the continuous rod passes straight across the end of the fabric, as seen at 17. In Fig. 9 separate straight strips 18 are employed.

When the web 15 of the bar, which connects the opposing lips formed by the groove, is upset, as described, it gives a permanent set to the metal of the bar, and the parts 1 and 3 are or may be so proportioned and the metal of which the bar is formed so distributed—for instance, as illustrated—that said web will have a holding strength substantially equal to the elastic limit of the rod.

My fabric is characterized by bars having relatively heavy main bodies and formed with lips extending outward from such main bodies to a sufficient distance to obtain a secure hold on the relatively lighter members or rods. The amount of metal in such heavy main bodies gives effect and permanency to the hold which the lips thus obtain.

Other equivalent ways in which the grooved bars obtain the necessary hold on the rods may be practiced. For instance, it will be understood that my invention includes such a fabric as that described in which the parts are united by contraction caused by cooling, the bars 1 for example, being first heated and expanded and then cooled and shrunk onto the parts of the rods 3 which are in the grooves of the bars and includes such a fabric in which the said parts of the rods are forced into the grooves by pressure, provided that sufficient hold of the grooves on the rods is effected.

What I claim is—

1. A metal, open-work fabric, which consists of strips or rods, and continuously-grooved bars arranged within and between the edges of the fabric, said rods being rigidly held at suitable points in said grooves by the metal of the grooved bars being upset or compressed onto the sides of the rods, substantially as set forth.

2. A metal, open-work fabric, which consists of continuously-grooved bars, and strips or rods extending between and connecting the grooved bars, said rods being continuous so as to extend back and forth between the bars from one end of the fabric toward the other, and the rods being held at suitable points in said grooves by the metal of the grooved bars being upset and compressed against the sides of the rods, substantially as and for the purposes set forth.

3. In a concrete or the like construction a strengthening, metal, open-work fabric, which consists of continuously-grooved bars and strips or rods connecting said bars and held in the grooves, said rods being continuous so as to extend back and forth between the bars from one end of the fabric toward the other, and being held in said grooves by the metal of the grooved bars being upset and compressed against the sides of the rods, substantially as and for the purposes set forth.

4. A metal open-work fabric, which consists of continuously-grooved bars and a continuous bent rod or strip which engages both of said bars at various points of their length, entering the grooves and rigidly held therein by the compression of the metal of the bars onto the sides of the rod or strip, substantially as set forth.

5. A metal, open-work fabric, for use in concrete or other purposes, which consists of bars grooved on their opposite sides and connecting members or rods passing from one bar to another and entering said grooves, the metal of said bars being swaged, bent or pressed onto the entering portions of said rods to hold the same securely, substantially as set forth.

6. In an open metal-work fabric for use in concrete and other purposes, the combination of bars having relatively heavy main bodies and formed with opposing lips extending outward from and beyond said main bodies, and lighter rods or members connecting said bars and having portions inserted between said lips, the lips being pressed upon such portions of the lighter members and firmly holding and securing them.

7. A metal, open-work fabric, which consists of strips or rods, and continuously-grooved continuous bars, portions of the strips lying within the grooves of the bars, the metal of the bars being upset or compressed onto the strips and the edges of the bars being bent partially over or around the said portions of the strips, substantially as set forth.

8. A metal, open-work fabric, which consists of strips or rods, and continuously-grooved bars, said strips being bent and having portions which extend longitudinally in the grooves of the bars, the metal of the bars being upset or compressed onto the strips and the edges of the two being bent partially over or around the longitudinal portions of the strips, substantially as set forth.

9. A metal, open-work fabric, which consists of strips or rods, and continuously-grooved and twisted bars, said strips extending from one bar to another and entering the grooves at suitable points, and the metal of the bars being upset or compressed onto the strips.

10. A metal, open-work fabric which consists of alternating thick and thin members, the thick members having grooves, the thin members having portions inserted in said grooves, and the metal of the thick members being upset and compressed onto said portions of the said thin members, substantially as set forth.

11. A metal, open-work fabric for use in concrete and other purposes, which consists of strips or rods, and longitudinal continuously-grooved bars of greater tensile strength than said rods and adapted to serve as tension-bars, the said rods being secured in the grooves of the bars by causing the lips of said grooves to be forced closer together, as described.

12. A metal open-work fabric for use in concrete and other purposes, which consists of strips or rods, and intermediate continuously-grooved bars rigidly uniting such strips or rods by means of said grooves, substantially as set forth.

13. A metal open-work fabric for use in concrete and other purposes, which consists of continuously-grooved bars, and continuous rods which are bent and extend back and forth between and connect the bars, said rods being also bent laterally at 19 to enter the grooves of the bars, the metal of the bars being upset or compressed onto the sides of the rods, substantially as set forth.

14. A metal open-work fabric for use in concrete and other purposes, which consists of grooved bars, and rods extending from one bar to another and into the grooves of the bars, the webs 15 of the bars being permanently upset to cause the walls of the grooves to press strongly and securely on the sides of the rods, substantially as set forth.

15. A metal open-work fabric for use in concrete and other purposes, consisting of the rods, and continuously-grooved bars engaging the rods, wherein the web 15 of the bar, which connects the lips formed by the groove, has a holding strength, when said lips are applied to the sides of the rod as described, substantially equal to the elastic limit of the rod, as and for the purposes set forth.

16. The combination of the bars having relatively heavy main bodies and formed with opposing lips extending outward from and beyond said main bodies, lighter rods or members connecting said bars and having portions inserted between said lips, the lips being pressed upon such portions of the lighter members and firmly holding and securing them, and a body of concrete in which said bars are embedded, the concrete entering between said lips and being locked thereby against strains transverse to the bar, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN F. GOLDING.

Witnesses:
H. N. Low,
Thomas P. Woodward.