

No. 839,381.

PATENTED DEC. 25, 1906.

E. T. GREENFIELD.

TUBING.

APPLICATION FILED JAN. 24, 1906.

Fig. 1,

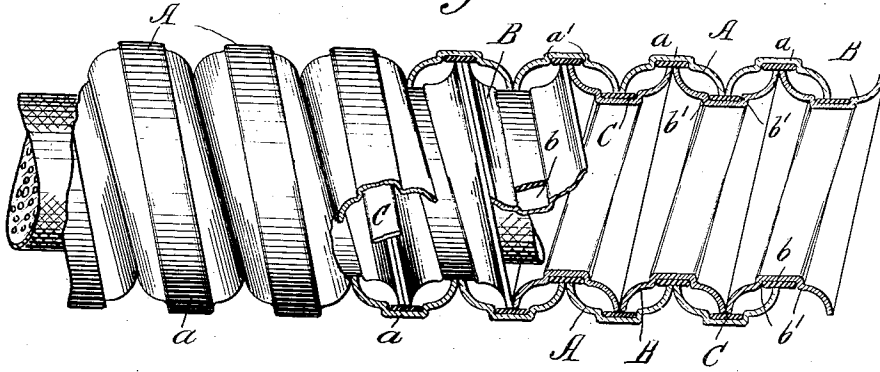


Fig. 3,

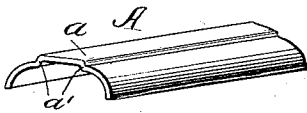


Fig. 4,

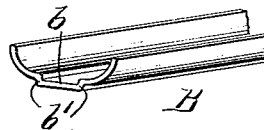
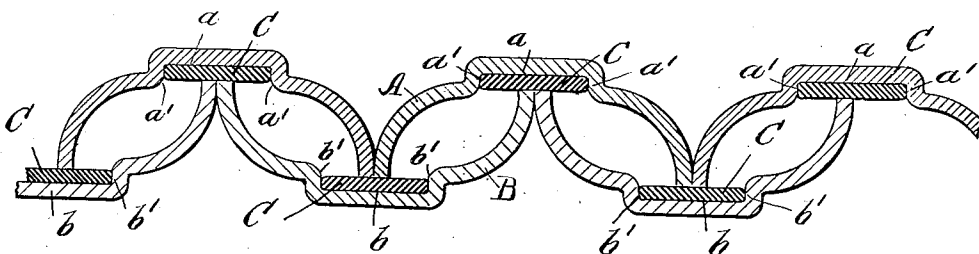


Fig. 5



Fig. 2



WITNESSES:

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TUBING.

No. 839,381.

Specification of Letters Patent.

Patented Dec. 25, 1906.

Application filed January 24, 1906. Serial No. 297,645.

To all whom it may concern:

Be it known that I, EDWIN T. GREENFIELD, a citizen of the United States, residing at Kiamesha, in the county of Sullivan and State of New York, have invented a certain new and useful Improvement in Tubing, (Case C,) of which the following is a description.

The invention relates generally to a structure of the general character commonly employed either as conduit or armor for electric conductors or cables or to contain and conduct a fluid agent, such as steam.

One of the objects of the invention is to provide such a structure which shall be of great strength and durability, which shall be sufficiently flexible for practical use, and which shall when bent present at all parts of its walls a double thickness of the metal used.

In an approved form in which the invention may be employed the tubing is made of spirally-formed strips of metal, such strips being curved between their lateral edges in any suitable manner—as, for instance, by means of die-rolls of the character of those illustrated in Letters Patent No. 630,502, heretofore granted to me. Two such strips are employed, and these are wound, bent, or otherwise formed into two series of relatively movable spirals, one series being inside the other. Preferably such strips will prior to the spiraling operation be curved in the manner above indicated in opposite directions, the spirals of each series having their adjacent edges in substantial alinement and when the tubing is straight preferably in contact. With each of the laterally-curved strips is combined a reinforcing-strip and in addition means for determining the maximum permissible movement of one spiral relatively to the spirals adjacent thereto. Upon any movement of the spirals within the limit so determined—as, for instance, when the tubing is bent at a sharp angle—the movement of two spirals (for example) of the outer series away from each other uncovers a portion of a spiral of the inner series at the point, however, where the same is protected by the reinforcing-strip, such point therefore presenting a double thickness of the

material used. Such a preferred embodiment of the invention is illustrated in the drawings, in which—

Figure 1 is a side elevation, partly in section, illustrating the invention as used in the armoring of electric cables. Fig. 2 is an enlarged section; and Figs. 3, 4, and 5 are perspective views illustrating portions of the several parts employed, Fig. 3 a portion of one of the outer spirals, Fig. 4 a portion of one of the inner spirals, and Fig. 5 a portion of the reinforcing-strip above referred to.

Referring to the drawings, it will be understood that prior to the spiraling operation the flat strips, preferably of metal, are given the curvature or substantially the curvature illustrated in any suitable manner—as, for instance, by passing the same between the die-rolls illustrated in the patent heretofore granted to me, as above specified—and these die-rolls may be employed to force the strips curved thereby into a suitable bending-die for the spiraling operation, or such strips may be drawn upon a mandrel or spiraled by means of a series of coacting rolls. This mechanism forming no part of the present invention will not be described in detail.

The tubing is composed of inner and outer series of spirals, (A B, respectively,) the lateral curvature of each of these being here shown as substantially the same, save that the curvature of one is in the reverse direction of that of the other.

The strip A is given an approximately semicircular form in cross-section, as clearly shown in the drawings, its exterior presenting an outwardly-bowed surface. The strip B is also given an approximately semicircular form, its exterior presenting an inwardly-bowed surface. As each of these strips is spiraled to form the tube, a reinforcing-strip C is combined with the spirals of each series. These reinforcing-strips may be secured to the spirals in substantially the position in which they are illustrated in the drawings by any suitable means—as, for instance, by soldering. I prefer, however, to provide during the laterally-curving operation for the coaction of said reinforcing-strips C with each of the strips of which the spirals A and B are formed and at the same time to so

form said spirals as to guard against excessive movement of the same relatively to each other. To this end, as the strips A and B are laterally curved in the manner above mentioned, I form in each a depression *a b*, preferably of substantially the width of the reinforcing-strip C and having the shoulders *a' a'* and *b' b'*.

The reinforcing-strips C may be fed simultaneously with the strips A and B as said strips are formed into the spirals illustrated in Figs. 1 and 2, and may be either so crowded into the recesses *a* as to make additional securing means unnecessary, or they may be soldered or otherwise additionally secured in said recesses.

As clearly shown in the drawings, the inner series of spirals B and the outer series of spirals A break joints, the lateral edges of the spirals of both series being in alinement, (and normally in contact, if desired.) The lateral edges of each of the outer series of spirals A are here shown as bearing upon the reinforcing-strips, forming part of two of the inner series of spirals B. Also the lateral edges of each of the spirals B are here shown as bearing upon the reinforcing-strips forming part of two of the outer series of spirals A. It will therefore be clear that when the tubing so formed is flexed or bent the spirals A or B, or both, will be moved relatively to each other, thus occasioning, for example, the separation of the lateral edges of the spirals of both the inner and outer series. This movement of separation of such lateral edges is determined by the distance between the shoulders *a' a'* and *b' b'* of the recesses *a b*. Where this (maximum) separation of the spirals has taken place, the reinforcing-strips at those points are exposed; but these being of substantially the thickness of the strips from which the spirals themselves are made strengthen such spirals, presenting at the exposed point practically a double thickness of the metal employed. In other words, whether the tubing be straight or bent at no time is there less than a double thickness of metal throughout the entire structure, whereas were such reinforcing-strips not employed the tubing would present such a double thickness of metal only when straight, and when flexed or bent but a single thickness would be presented at the points of separation of the spirals.

Having now described my invention, what I claim as new therein, and desire to secure by Letters Patent, is as follows:

1. A series of outer spirals, a series of inner spirals coacting therewith, and reinforcing-strips between said inner and outer series engaged by the edges of the spirals of one of said series, substantially as set forth.

2. A series of outer spirals and a series of inner spirals coacting therewith, the spirals of each series being movable relatively to each other, those of said outer series being bowed outward between their lateral edges and provided with a reinforcing-strip, substantially as set forth.

3. A series of outer spirals and a series of inner spirals coacting therewith, the spirals of each series being movable relatively to each other, those of said inner series being bowed inward between their lateral edges and provided with a reinforcing-strip, substantially as set forth.

4. A series of outer spirals and a series of inner spirals coacting therewith, the spirals of each series being movable relatively to each other, the spirals of said outer series being bowed outward between their lateral edges and the spirals of said inner series being bowed inward between their lateral edges, and reinforcing-strips combined with said spirals, substantially as set forth.

5. A series of outer spirals and a series of inner spirals coacting therewith, the spirals of each series being movable relatively to each other and those of one series breaking joints with those of the other series, the spirals of said outer series being bowed outward between their lateral edges and the spirals of said inner series being bowed inward between their lateral edges, and reinforcing-strips combined with said spirals, substantially as set forth.

6. A series of outer spirals and a series of inner spirals coacting therewith, the spirals of both series being reversely curved, and reinforcing-strips combined with the spirals of both series, substantially as set forth.

7. A series of outer spirals and a series of inner spirals coacting therewith, the spirals of both series being reversely curved, a recess formed in each spiral, and a reinforcing-strip in such recess, substantially as set forth.

8. A series of outer spirals, a series of inner spirals, the spirals of both series being reversely curved, and a recess formed in each spiral and having shoulders determining the maximum permissible movement of the lateral edges of adjacent spirals, substantially as set forth.

9. A series of outer spirals, a series of inner spirals coacting therewith, the spirals of both series being reversely curved, a recess formed in the spirals of both series, reinforcing-strips in such recesses, and means adjacent to such recesses for determining the maximum permissible movement of the spirals relatively to each other, substantially as set forth.

10. An outer series of spirals, each bowed outward between its lateral edges and pro-

vided intermediate of such edges with a reinforcing-strip, and a series of inner spirals, each bowed inward between its lateral edges and provided intermediate of such edges with
5 a reinforcing-strip, the spirals of one series breaking joints with the spirals of the other series and the lateral edges of the spirals of one series coacting with the reinforcing-

strips of the spirals of the other series, substantially as set forth.

This specification signed and witnessed this 22d day of January, 1906.

EDWIN T. GREENFIELD.

Witnesses:

S. O. EDMONDS,
D. G. EDMONDS,