

No. 680,983.

Patented Aug. 20, 1901.

C. RUDOLPH.
FLEXIBLE METALLIC TUBING.
(Application filed Mar. 12, 1900.)

(No Model.)

FIG. 1.

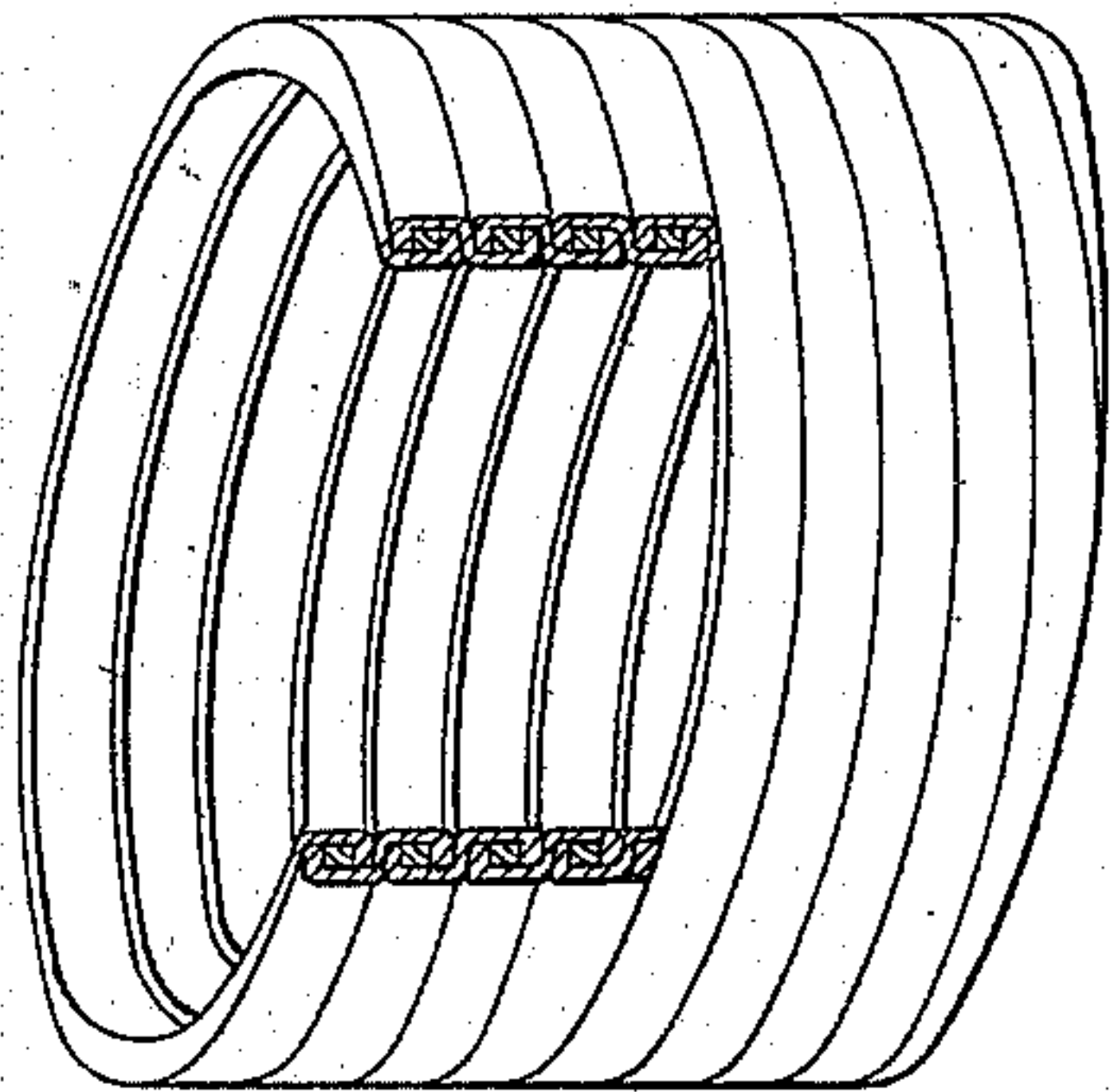


FIG. 2.

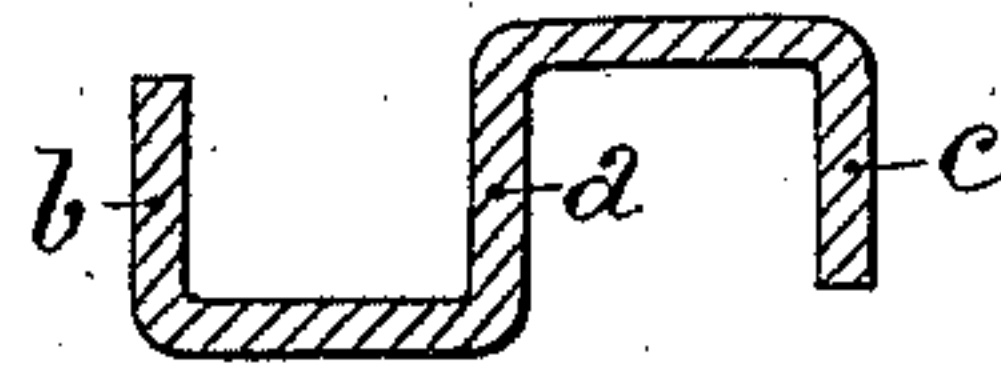


FIG. 3.

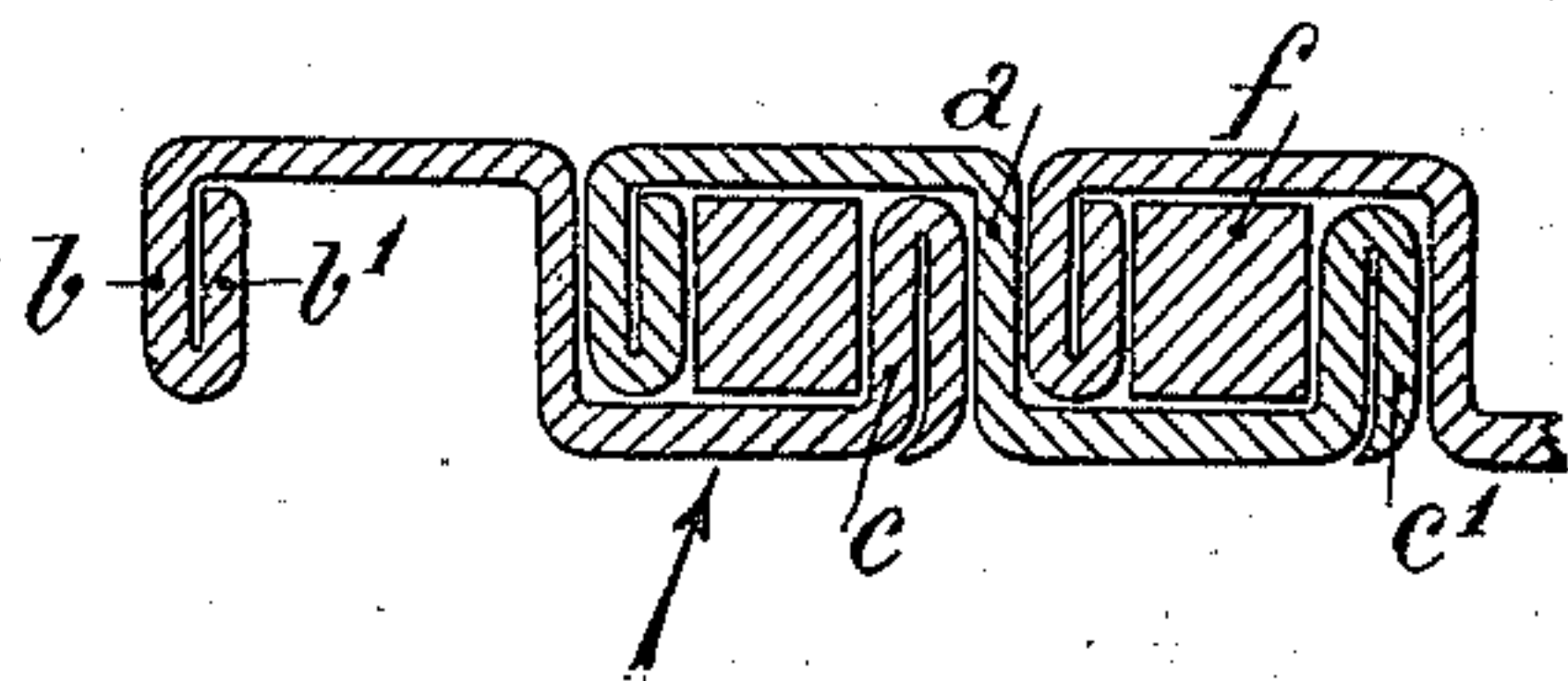


FIG. 4.

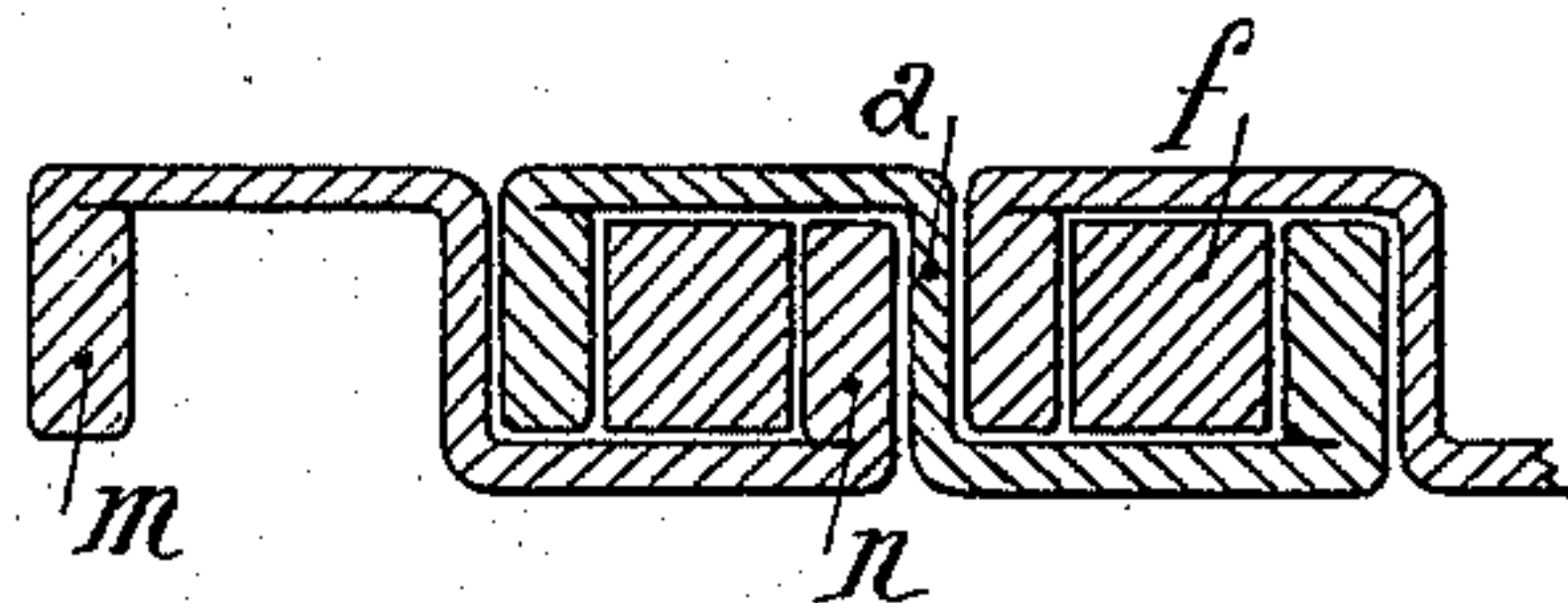


FIG. 5.

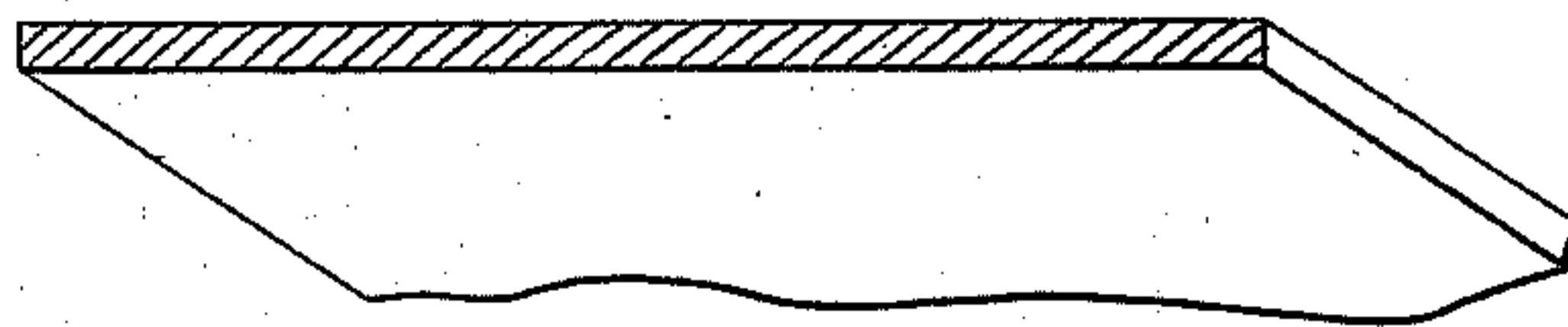


FIG. 6.

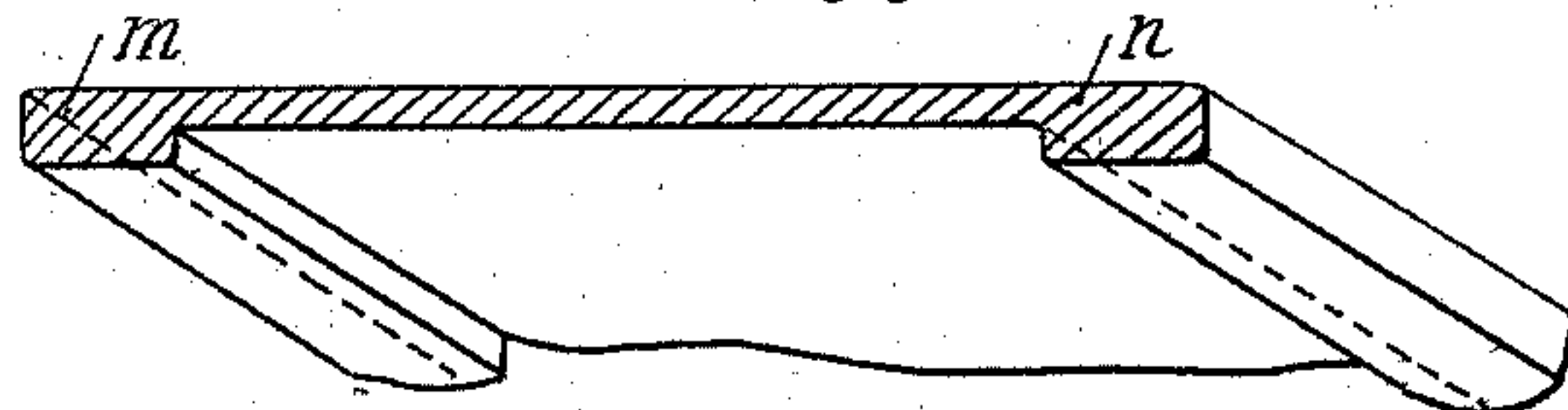
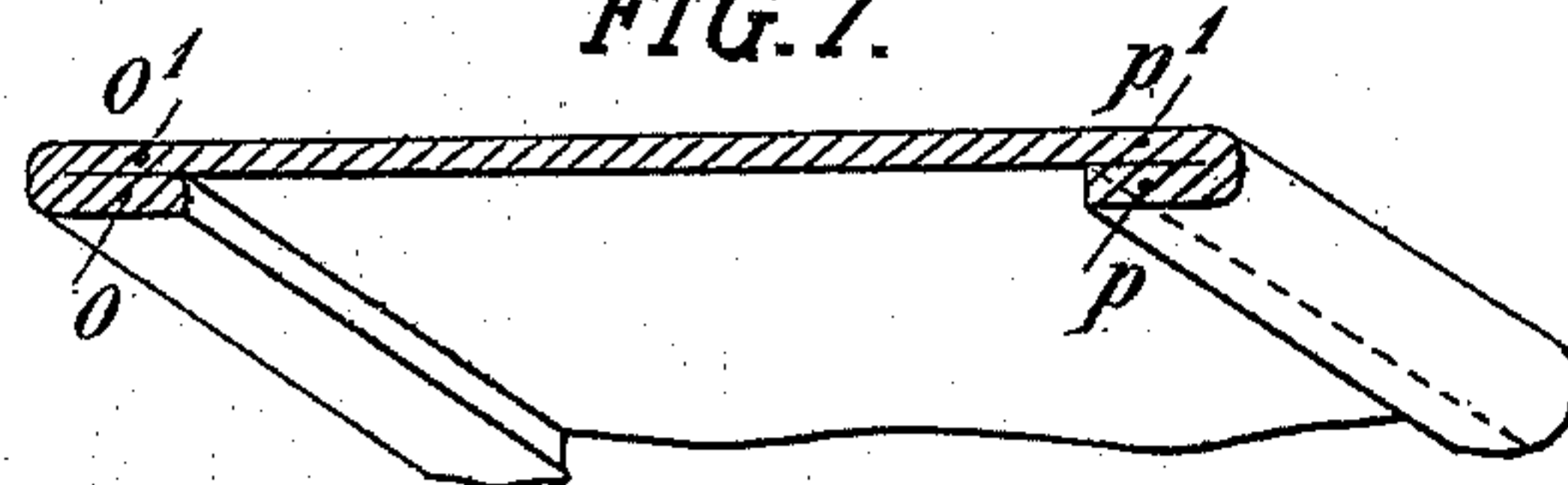


FIG. 7.



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FLEXIBLE METALLIC TUBING.

SPECIFICATION forming part of Letters Patent No. 680,983, dated August 20, 1901.

Application filed March 12, 1900. Serial No. 8,357. (No model.)

To all whom it may concern:

Be it known that I, CHARLES RUDOLPH, manufacturer, a citizen of the Republic of France, residing at Paris, in the Republic of France, have invented a certain new and useful Improvement in Flexible Metallic Tubing, of which the following is a full, clear, and exact description.

My invention relates to that kind of flexible tubes formed of suitably-shaped metallic bands wound spirally in such a way that the edges of adjacent turns or coils engage one with another.

The object of the invention is to provide means for reinforcing the outer sides of the profiles at present employed, so as to give more strength, durability, and tightness to this kind of tubing, while preserving for it a great flexibility.

The invention will be described first with reference to the accompanying drawings, and then the part, improvement, or combination which I claim as my invention will be particularly pointed out and distinctly claimed.

In the accompanying drawings, illustrating my invention, in the several figures of which like parts are similarly designated, Figure 1 is a view in perspective and partly in section of a part of a tube formed by spirally winding a corrugated band or strip in accordance with my invention. Fig. 2 is a section, on a larger scale, of a shape (profile) at present employed which is not provided with the improvement of my invention. Fig. 3 is a section of a shape (profile) which forms the subject of my Patent No. 653,487, dated July 10, 1900. Fig. 4 is a section of the shape (profile) forming the subject of the present invention. Fig. 5 is a view in perspective and partly in section of a strip or blank from which is prepared my corrugated and strengthened band. Fig. 6 is a perspective view illustrating one method of strengthening the edges of the strip or band. Fig. 7 is a perspective view illustrating another method of strengthening the edges of the strip or band.

It is known, as will be seen by reference, for example, to English Patent No. 9,478, of August 8, 1885, that flexible tubes may be made by winding in a spiral manner a corru-

gated strip or band the corrugations of which or the cross-section or profile of which resembles the letter S, as may be seen by reference to Fig. 2 of the present drawings, this shape or profile forming two juxtaposed channels having one common side *a* and the mouths of the channels being turned in opposite directions. In winding the corrugated strip or band in a helix its outer edges *b* and *c* enter the adjacent channels of the adjoining turns or coils of the band, and as there is play in this system of engagement the tube may be lengthened or shortened or even be bent in any direction. In order to insure the tightness of these pipes, a cord or packing *f* of india-rubber or other suitable material is inserted between the sides of the bands which engage one with the other, as illustrated in Figs. 1, 3, and 4. Tubes or pipes of this character are intended for containing gas and liquids of all kinds, and it has been noticed that most of these fluids, even water, oxidize somewhat rapidly the outer edge *c*, which in winding the corrugated band lies in the interior of the tube, and that this edge being partially destroyed by rust the pipe or tube would rapidly become useless. One form of construction designed to remedy this oxidation, and consequently the wearing away of the internal edge *c*, forms the subject of my patent hereinbefore mentioned and is illustrated in Fig. 3 of the present drawings. As seen by reference to Fig. 3, (the interior of the tube being indicated by the arrow,) the edge *c* is protected by a strip *c'*, bent back on itself and beveled off on the external face of the side *c*. In consequence with this arrangement the water or any other substance which attacks the metal and which is contained in the interior of the tube will first oxidize and wear away the bent-back part *c'*, which at the same time will rub against the side of the center *a*, and the part *c'* will be worn first. On the outside of the tube, where there is no reason to fear the rusting of the extreme edge *b*, the bent-back part *b'* is made against the internal face of the edge *b*, and thus the said part *b'* serves to strengthen the tube against pressure exerted from within the tube.

As already indicated, the present invention consists in the means for strengthening

the outer edges of tubes of this character, and in carrying out my invention the extreme strengthened edges are not formed, as in the patent mentioned, by bending back the outer edges of the bands; but the strengthened edges are obtained by forming them in one piece with the body of the strip. As illustrated in Fig. 4, the extreme edges *m* and *n* have a thickness greater than that of the body of the corrugated band which forms the tube. As a result of this construction the edge *n* thus strengthened affords greater resistance against the attacks of rust, and the edge *m* affords increased strength in the pipe for the resistance of pressure within the pipe. The advantage of this construction relatively to that shown in Fig. 3 is that the edges thus strengthened form an integral and homogeneous part of the strip, and thus remove the existence of spaces between the component parts of the edges of the strips, such as shown between the parts *c* and *c'* of Fig. 3, which afford lodgment for the gas or fluids introduced into the pipes, and which lodgment increases a tendency to oxidation and consequent weakness and destruction.

Another advantage accruing from the provision of integral strengthened edges, such as the outer edges *m*, is that the packing *f* is not subjected to the pinching or tearing action found to result in the use of such a construction as is illustrated in Fig. 3.

These and other advantages resulting from my present improvement will be more readily understood in view of the following explanation of the manner in which I provide the strips with integral strengthened edges.

One construction which may be employed for carrying out the present invention consists of a flat metal band or blank of greater thickness throughout than the finished article and which may be profiled for forming the strip from which the tube is to be made. This flat band or blank is shown in Fig. 5. This band or blank is laminated between rollers of a rolling-mill, so as to give it the shape shown in Fig. 6, and as represented in Fig. 6 the band is rolled relatively thin in the middle, while its extreme ends or edges *m* and *n* are thick. This band is then corrugated so as to produce a profile such as shown in Fig. 4.

Another construction consists in the use of a metal strip or blank of the thickness of the finished band, and its ends are bent, as

at *o* and *p*, to give the height corresponding to the height of the outer edges for forming the tube, and the folded edges *o* and *p* are joined with the adjacent parts *o'* and *p'* of the band either by soldering or brazing them in the usual way or preferably by soldering or brazing them by electric process. The band thus prepared is corrugated as in the other instances.

It will be understood that I do not limit the application of my improvement to the particular shape or profile indicated in Fig. 4, but expressly reserve the right to use any desired kind of profile, and particularly that shown in the Patent No. 605,587, dated June 14, 1898, and granted to me and Georges Levasseur.

I may make the extreme strengthened edges of a thickness twice as great as that of the body of the band, and when these strengthened edges are obtained by laminating it is obvious that I can make them more or less thick, according to the uses to which the tube is to be put.

What I claim is—

1. A rolled metal strip, for use in forming flexible tubes by spirally winding said strip, provided with integral, homogeneous, thickened flanges, substantially as described.

2. A flexible tube, comprising a metal strip the edges of which are integrally and homogeneously thickened to form reinforced flanges, said flanges interlocking with interposed packing, substantially as described.

3. In a flexible metallic tube formed by winding in a spiral manner a corrugated (profiled) metallic band, the combination with the corrugated metallic band of outer edges having greater thickness than the body of the band, substantially as described.

4. In a flexible metallic tube formed by winding in a spiral manner a corrugated metallic band, a laminated band for forming the said tube having its outer edges of greater thickness than the body of the band, substantially as described.

In witness whereof I have hereunto signed my name, this 2d day of March, 1900, in the presence of two subscribing witnesses.

CHARLES RUDOLPH.

Witnesses:

AUGUSTE TOURNOL,
VICTOR DE MORENDOWSKI.