

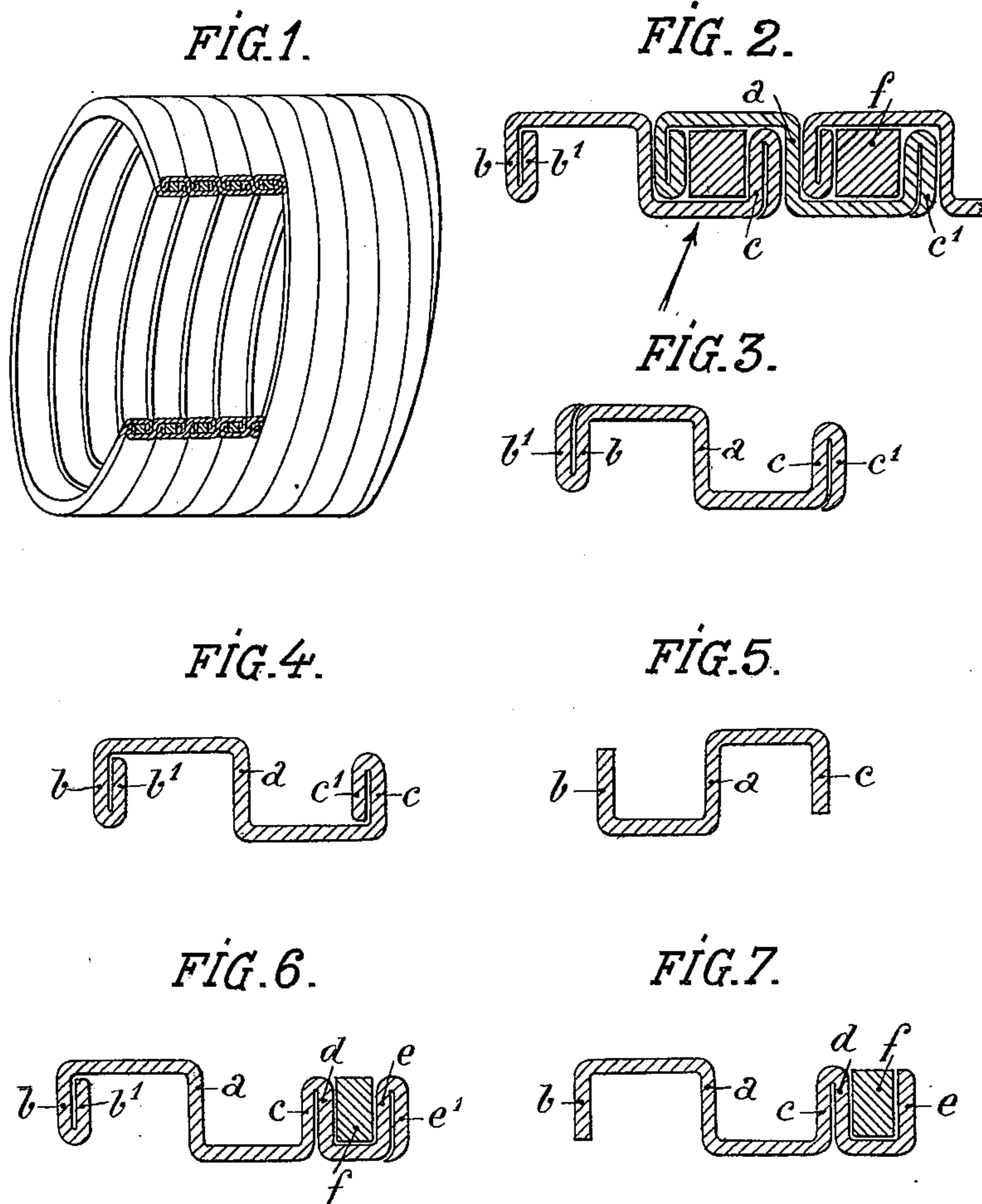
No. 653,487.

Patented July 10, 1900.

C. RUDOLPH.  
FLEXIBLE METALLIC TUBING.

(Application filed Feb. 8, 1900.)

(No Model.)



Witnesses

*G. J. C. Moore*  
*A. P. Hollingsworth*

Inventor

*Charles Rudolph*  
*By P. T. Dodge*  
*Att.*



# UNITED STATES PATENT OFFICE.

CHARLES RUDOLPH, OF PARIS, FRANCE.

## FLEXIBLE METALLIC TUBING.

SPECIFICATION forming part of Letters Patent No. 653,487, dated July 10, 1900.

Application filed February 8, 1900. Serial No. 4,478. (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, France, (whose post-office address is 66 Rue du Théâtre, Paris, France,) have invented certain new and useful Improvements in Flexible Metallic Tubing, (for which applications for patent were made in France on the 28th day of September, 1899; in England on the 5th day of October, 1899, No. 20,004; in Belgium on the 15th day of January, 1900; in Denmark on the 15th day of January, 1900; in Italy on the 15th day of January, 1900; in Germany on the 16th day of January, 1900; in Spain on the 16th day of January, 1900, and in Norway on the 19th day of January, 1900,) of which the following is a specification.

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

My invention has for its object to provide means for reinforcing 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 with reference to the accompanying drawings, in which—

Figure 1 is a view in perspective and partly in section of a pipe formed by spirally winding a corrugated band or strip in accordance with my invention. Fig. 2 is a section, on an enlarged scale, of the corrugated metallic band of my invention. Figs. 3 and 4 are sections of modifications of the same profile. Fig. 5 is a section of the shape (profile) at present employed which is not provided with the improvement of my invention. Fig. 6 shows the application of my improvement to a profile already existing, shown in Fig. 7.

It is known, more particularly by English Patent No. 9,478, of August 8, 1885, that flexible tubes may be made by winding in a spiral manner a corrugated strip or band, the corrugations of which have the form of the letter *o*, as may be seen in Fig. 5, 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 band in a helix the 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, and thus the tightness of the joint is insured. These tubes or pipes 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 the winding of 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. By the improvement which forms the object of my invention I remedy the oxidation, and consequently the wearing away of the internal edge *c*, in the following manner, which is shown in Fig. 2. It may be seen in this figure that the interior of the tube being on the side 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 *e*. In consequence of 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 first worn. It is therefore important that this bending back be made toward the outside, because if it were made toward the interior the side *c* would wear away first, and with this side worn out and detached from the rest of the band the bent-back part *c'* would no longer serve for anything. Further, the lower part of the bent-back edge *c'* is slightly turned back or beveled off against the part *c* in order to prevent water passing between the edges *c* and *c'* and oxidizing the part *c*.

Fig. 1 is a view in perspective and partly in section showing how the band is wound in a spiral to form a pipe, and the profile of the band is that shown on an enlarged scale in Fig. 2. 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*, as shown in Fig. 2. The edge *b'* then serves to  
 5 strengthen the tube against pressure coming from the inside. Fig. 3 shows a profile in which the parts *b'* and *c'* are both bent back on the outer sides of the ends *b* and *c*. In the profile shown in Fig. 4, on the contrary,  
 10 the parts *b'* and *c'* are both shown bent down on the inner faces of the sides *b* and *c*, the peculiar circumstances under which these tubes are employed rendering preferable one of the arrangements described intended  
 15 either for protecting the pipes against oxidation or for strengthening them.

It must of course be understood that I do not limit my invention—that is to say, the addition of bent-back edges on the outer sides—  
 20 to the particular profile that I have shown; but I may advantageously apply it to the profile shown in Fig. 7, which forms the subject of my United States Patent No. 605,587, dated June 14, 1898. This profile is characterized by the arrangement that the packing  
 25 *f* is not placed in the channels which engage one with the other, but is located in a large special channel contained in the roll toward the interior of the tube and the bottom of  
 30 which is at the same level as that of the adjacent channel. The characteristic point of this arrangement consists in that it allows

the corrugated band to be wound on a mandrel, which cannot be done with the profile shown unless the bottom of the channel in  
 35 which the packing is located is at the same level as that of the adjacent channel, so that both find a point of support on the mandrel.

Fig. 6 shows how I apply my improvement to the profile shown in Fig. 7. 40

On the interior of the tube the edge *e* is protected against oxidation by the bending down of the band *e'* against the external face of the band *e*, and the edge *b* is strengthened, in order to oppose more resistance to pressure  
 45 arising from the interior of the tube, by means of a band *b'*, bent back on the internal face of the edge *b*.

I declare that what I claim is—

In flexible metallic tubes formed by winding in a spiral manner a corrugated (profiled) metallic band: the combination with the outer edges such as *b* and *c* of the corrugated band of other edges such as *b'* and *c'* bent back on themselves in order to protect the former  
 55 edges against oxidation and give more rigidity to the tube substantially as described.

In witness whereof I have hereunto signed my name, this 22d day of January, 1900, in the presence of two subscribing witnesses. 60

CHARLES RUDOLPH.

Witnesses:

AUGUSTE FOURNOL,  
 VICTOR DE MARENDOWSKI.