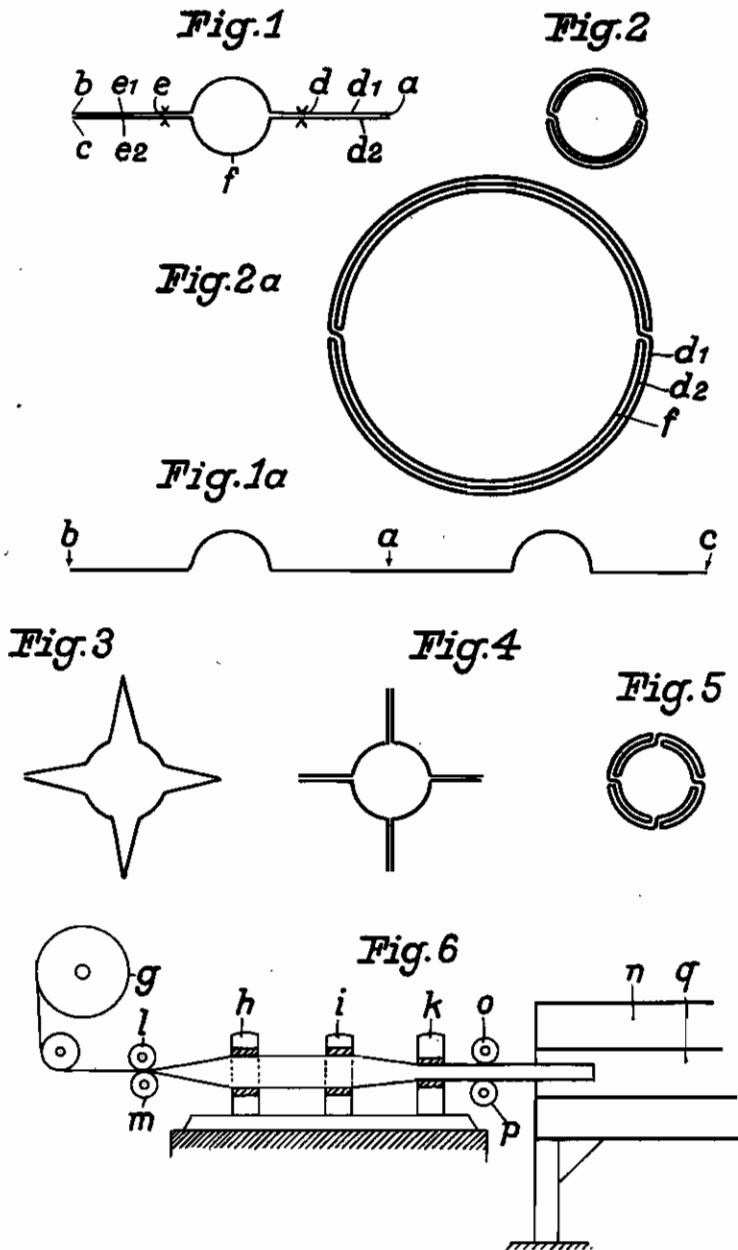


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BY A. P. C.

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LAMINATED TUBES  
Filed June 12, 1940

Serial No.  
340,187  
2 Sheets-Sheet 1



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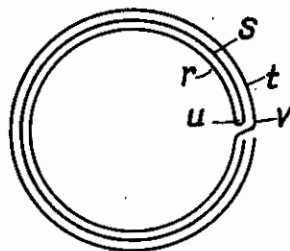
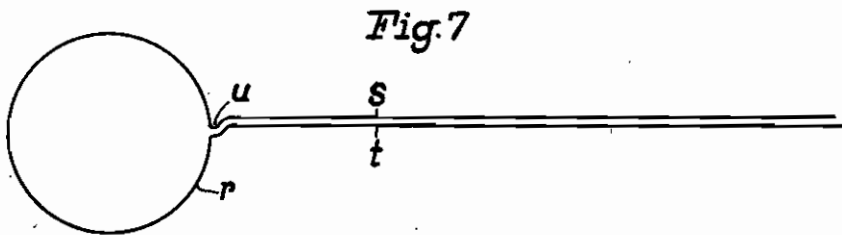


Fig. 8

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# ALIEN PROPERTY CUSTODIAN

## LAMINATED TUBES

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vested in the Alien Property Custodian

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This invention relates to the manufacture of laminated iron or steel tubes made from strip material having its entire surface preliminarily coated with copper or brass by any suitable means such as vulcanizing, plating, or other procedure.

It has already been proposed to manufacture laminated tubes from strip material by rolling the layers together, but tubes made in this way have the disadvantage that there are always exposed sections or joint edges of the sheet metal strip in the interior of the tube, which edges, particularly when plated metal strip is used, are not coated with any corrosion preventing layer and thus present a permanent place of attack to corroding influences.

It is an object of the present invention to overcome this disadvantage. According thereto a strip of sheet steel which has been previously coated with copper or brass is shaped in such a way that three laminations of metal are superposed whereby the wall thickness of the tube is three times the thickness of the metal strip. Since the strip is originally coated with copper or brass, not only is a fine layer of copper or brass provided between all the contact places, but also the copper or brass layer covers all bends and edges and prevents any direct contact between the iron and corrosive materials.

Referring to the drawings:

Figure 1 is a cross-sectional view of a partially worked blank,

Fig. 1a is a cross-sectional view of the blank of Fig. 1 showing a blank worked at a previous stage,

Fig. 2 is a cross-sectional view of a rolled tube,

Fig. 2a is a cross-sectional view of the tube of Fig. 2 on an enlarged scale,

Figs. 3 to 5 are cross sectional views of a modified tube in three stages of manufacture,

Fig. 6 is a diagrammatic view of the apparatus for manufacturing the tube of Figs. 3 to 5,

Fig. 7 is a cross-sectional view of a modified tube at one of its stages of manufacture, and

Fig. 8 is a cross-sectional view of the completely rolled tube of Fig. 7.

In carrying out the invention the steel strip previously coated with copper or brass is shaped in successive dies or sets of rolls in a manner which will be understood from Fig. 1, which shows a blank which is already of tubular form in the middle. This form is reached in stages, the steel strip being first given the shape shown in Fig. 1a, and then bent about the middle point *a* into the shape shown in Fig. 1, having a central tubular portion *f* and wide lateral fins *d*<sup>1</sup>, *d*<sup>2</sup> at one side

and *e*<sup>1</sup>, *e*<sup>2</sup> at the other side. The said fins are of such length that each corresponds to half the circumference of the tube. The two edges *b* and *c* are welded together to complete the blank shown in Fig. 1.

In the next operation the fins *d* and *e* are bent around the tubular portion *f* each in same direction, so as to lie snugly against the outer walls of said tubular portion, thus producing the triple layer tube shown in Fig. 2, and on a larger scale, in Fig. 2a. It will be seen that the interior wall of the tube is everywhere coated with the corrosion resisting layer, particularly at the joint places between parts *d*<sup>1</sup>, *d*<sup>2</sup>, *f* and *e*<sup>1</sup>, *e*<sup>2</sup> and *f*. There is no exposure of the steel of the metal strip anywhere. Instead of having two fins each of semi-circumferential length, three or more fins each of correspondingly shorter length may be used and Figs. 3, 4 and 5 illustrate, for example, the use of four such fins each being of a length corresponding to a quarter of the circumference of the tube.

The manufacture of tubes according to the invention may be carried out in an apparatus which is shown diagrammatically in Fig. 6. The steel strip is drawn from a roll *g* through dies *h* which impart to the strip the form shown in Fig. 3, then through dies *i* which give the blank the form shown in Fig. 4, and finally through dies *k* which give the blank the shape shown in Fig. 5. *l* and *m* are feed rolls located in front of the dies *h* and other feed rolls *o* and *p* are provided behind the dies *k* for feeding the formed tube into a muffle furnace *q*. The tube is passed in a continuous operation through the furnace the temperature of which is held at the fusion temperature of the coating metal. Since the surfaces of the strip are in close contact with each other as a result of the previous operations, the thin metal coating, if desired with addition of flux material flows into the joints and welds or brazes the various layers together. Thus all the laminations are fused together into a unit and form a closed tubular article which is desired may be subjected to further drawing to a tube of smaller diameter.

Another modification is shown in Fig. 7 in which the first formed blank has only a single fin, which fin is of sufficient width to cover the entire circumference of the tubular portion *r* when bent around the same. For this purpose the strip of steel sheet, previously coated with copper or brass, is shaped in a sequence of dies or sets of rolls to the blank form shown in Fig. 7, the center portion of the strip being preshaped into tubular form as shown at *r*. The end portions *s*

and *t* of the strip form the fin extending from the circumference of the tubular part and correspond in length to the circumference of said part. The fin portions *s* and *t* are bent at the point *u* and lapped around the cylindrical portion *r* until the ends of the fin portions arrive at the joint place *v*. In this manner there is formed a triple laminated tube of layers *r*, *s*, *t* with only a single joint at *v*. The ends of the two fin portions are welded

together. It will be seen that the entire inner surface of the tube is devoid of any places where the steel of the sheet metal strip is exposed. The whole inner wall and particularly at the joint place is protected by a coating of copper or brass. Furthermore, it will be noted that the joint edges of the strip material are in the outer wall of the tube.

MATTHÄUS BRAUN.