

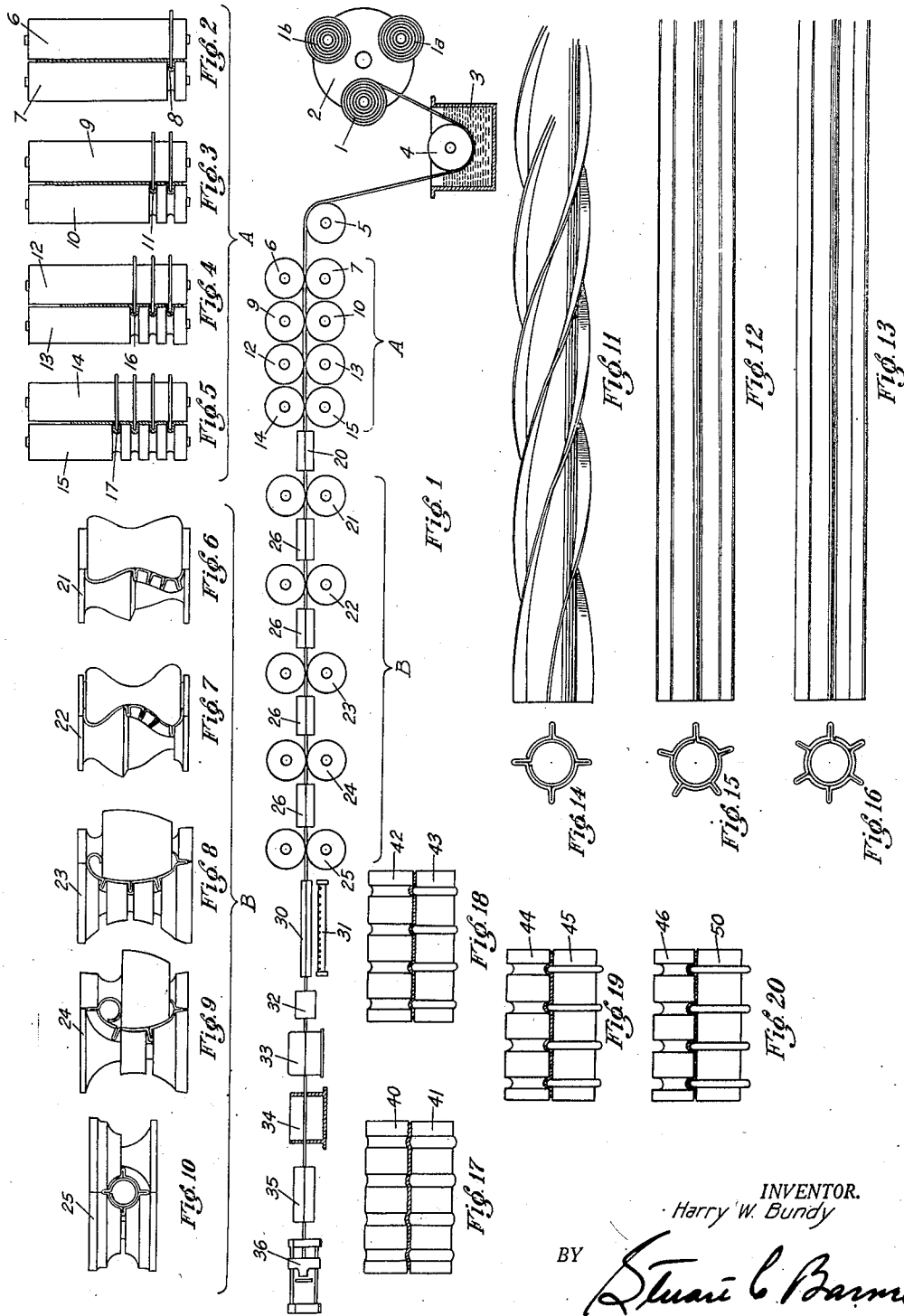
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METHOD OF MAKING FINNED TUBING

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METHOD OF MAKING FINNED TUBING

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This invention relates to finned tubing and it contemplates especially a method of making finned tubing wherein a tube is formed and fins formed on the tube in a single operation.

The method is directed particularly toward the making of a finned tube by shaping flat strip stock, which is drawn from a supply, into the form of the tube. Tubes formed in this manner are old in the art but the present invention aims to provide a method wherein the same stock, which is utilized for the making of the tube, is shaped prior to being formed into the tube so as to provide fins on the tube.

In the accompanying drawing:

Fig. 1 is a diagrammatic assembly view showing how the tube with the fins can be made.

Figs. 2 and 5 inclusive are sectional views taken on correspondingly numbered sectional lines of Fig. 1 showing the set of rollers which initially fold or form pleats in the stock.

Figs. 6 to 10 inclusive are views of rollers which form the stock into a tube, the several views showing the several progressive steps in the forming of the tube taken on correspondingly numbered sectional lines of Fig. 1.

Figs. 17 to 20 inclusive are views of rollers for forming the folds or pleats in the stock in a manner different from the way the rollers shown in Figs. 2 to 5 form the folds or pleats.

Fig. 11 is a side view of one form of the finished tube.

Fig. 12 is a similar view of a different form of finished tube.

Fig. 13 is a side view of a still further form of finished tube.

Fig. 14 is a sectional view through the form of tube shown in Fig. 11, showing a tube with four fins.

Figs. 15 and 16 are sectional views, respectively, through Figs. 12 and 13 showing tubes with five and six fins, respectively.

In the making of the tube, flat strip stock of suitable material, such as copper, is drawn from supply roll 1. This supply roll may be mounted upon a turning disk 2 which also carries other supply rolls 1^a and 1^b so that

upon exhaustion of one roll others can be readily substituted. Preferably, the stock is tinned before being wound onto the supply roll. This tinner stock is first drawn through an acid bath 3 by moving the same over a roller 4, whereupon the stock is drawn over a guide roller 5 and is ready to be acted upon by the fin forming and tube forming mechanism. However, while it is thought to be preferable to use stock previously tinned, the stock may be tinned immediately after being drawn from the roll by merely drawing it through an acid bath, then a bath of molten solder, and then a cooling bath of water. However, either procedure may be used without in any way changing the tube forming method now to be described.

The flat strip stock is now drawn through a battery of rolls, referenced generally, A. The first pair of rollers in the battery, rollers 6 and 7, have a cooperating rib and groove which form a fold or pleat 8 in the stock. In forming this fold or pleat the width of the stock is narrowed to supply the material of the pleat. Following these rollers, are rollers 9 and 10 which form the fold 11 adjacent the fold 8 and which further reduces the width of the stock. Rollers 12 and 13, and rollers 14 and 15 each form another pleat in the stock, referenced 16 and 17, by further drawing in the strip stock at one edge thus decreasing the total width of the stock.

The stock is now provided with four folds or pleats. By forming the pleats in the manner described, namely, by drawing in the stock and making it narrower, very thin stock can be used since there is no drawing or stretching of the stock. All of these rollers are preferably driven by suitable mechanism so as to aid in the movement of the stock.

The stock now advances through a die 20, and preferably, this die has grooves for receiving the folds or pleats and for squeezing the folds or pleats together to form a relatively sharp apex on each fold. From here the stock is moved through a battery of rolls generally referenced B. These are forming rolls for forming the stock into a tube. As shown in the drawing, the stock is rolled into a double ply tube after the manner shown in

my Patent No. 1,476,796, granted December 11, 1923. The first pair of rollers 21 in this set shapes the stock, as shown in Fig. 6; the second set of rollers 22 shapes the stock, as shown in Fig. 7; the third set of rollers 23 shapes the stock, as shown in Fig. 8; the fourth set of rollers 24 shapes the stock, as shown in Fig. 9; and the last set of rollers 25 shapes the stock as shown in Fig. 10, in which form the stock is in substantially its completed form. Between each set of rollers in this battery are dies 26, suitably shaped, for holding and guiding the tube in the form given it by the preceding set of rollers.

It will be noted that an excess of strip stock is left at one side of the pleats, and that this excess of strip stock is first rolled so as to form an inner ply of the tube, whereupon the portion of the stock having the pleats or folds is rolled over this inner ply thus forming the outer ply with the pleats or folds projecting outwardly from the tube to form fins.

After the tube is thus formed, it is moved through a heating die 30, heated by a suitable burner 31. Here the tube is heated and the coating of tin or solder which was originally on the stock is heated to a molten condition and the two plies of the tube are sweated together. The last of the dies, 26, is such as to squeeze the pleats forming the fins together, and solder lying between the two parts of each pleat is heated and the two walls of each fin are thus securely soldered together. After the tube is thus sweated together it may be moved forward with continuous movement through a die 32 and then may be moved through a solder machine 33 where a final coating of solder is applied over the exterior of the tube. However, this step may be included or omitted according to the requirements of use to which the particular tube is to be put. The tube is then drawn through a cooling water bath 34.

If it is found desirable to have spiral fins on the tube, as shown in Fig. 11, the tube may be moved through a die 35 which has spirally disposed grooves for receiving the fins. As the tube is moved forwardly through this die the spiral formation of the grooves in the die gives the completed tubing a twist and forms the same with spiral fins. The strip stock is drawn with continuous movement and the finished tube moves forward with continuous movement and may be cut into desired lengths by a hand operated or an automatic cut-off device 36.

As shown in Figs. 11 and 14, the tube is provided with four fins which may or may not be made spiral, as just described. The four fins are effected by providing the stock with four pleats or folds by the rollers in the battery A. Any number of fins can be made on the stock, and in Figs. 12 and 15 the tube is shown with five fins; Figs. 13 and 16 show a tube with six fins. To make these

tubes, five and six folds or pleats are formed in the strip stock, respectively. The tube with five or six fins thereon can also be run through a die so as to make the fins spiral if the same is desired.

The method just described, wherein the folds for forming the fins are placed in the stock by drawing in the stock and making the same narrower, is desirable where particularly thin stock is used. However, these folds or pleats can be placed in the stock by drawing or stretching the stock without reducing its width, and this may be used where the stock is sufficiently thick for the purpose. Figs. 17 to 20 show a progression of rollers for doing this. In Fig. 17 cooperating rollers 40 and 41 having respectively relatively shallow grooves and low ridges for grooving the stock by drawing the metal. Fig. 18 shows similar rolls 42 and 43 for deepening these grooves by drawing the stock. Fig. 19 shows rollers 44 and 45 for further deepening the grooves, and Fig. 20 shows rollers 46 and 50 for finally forming the pleats. The rollers have been shown in this drawing for forming four fins on the tube; however, it will be readily understood that five or six or any other desired number of grooves can be placed in the stock for forming the fins.

The tube formed by this method has the advantages of a double ply wall which makes for strength, and integral fins which are not liable to become loose. Due to the fact that the fins are integral with the body of the tube, makes for an efficient transference of heat by conduction from the body of the tube to the fins for the dissipation, or vice versa, for the absorption of heat.

In the foregoing description and the following claims the term "roll" or "rolled" has been used as descriptive of the formation of strip stock into tube. It is not the intention to limit the formation of the tube by rollers inasmuch as the tube may be formed by suitable dies or other mechanism instead of the forming rollers. Thus the terms "rolling the tube transversely" is intended to cover the formation of tube from strip stock regardless of the mechanism used for thus forming the tube.

Claims:

1. The method of making fluid conducting finned tubing, which consists in moving a substantially continuous length of tinned strip stock with continuous longitudinal movement, forming one or more longitudinal substantially closed pleats in the stock, rolling the stock after the pleats are formed into tube form with the pleats outside the tube so as to form longitudinal fins on the tube with the interior of the tube clear of obstructions, and then heating the tube to melt the tin and secure the facing portions of the thus formed strip stock and the pleats together.

2. The method of making finned tubing, which consists in forming one or more longitudinal pleats in a continuous length of stock and relatively close to one edge of the stock, forming the portion of the stock having no pleats into tube form, rolling the portion of the stock having pleats around the said tube form of the other portion to form a double wall tube with the pleats outside the tube and forming fins on the tube.

3. The method of making finned tubing which consists in drawing flat strip stock from a supply, forming one or more longitudinal pleats in the stock relatively close to one edge of the stock, forming the portion of the stock having no pleats into tube form, rolling the portion of the stock having pleats around the said tube form of the other portion to form a double wall tube with the pleats outside the tube and forming longitudinal fins on the tube.

4. The method of making finned tubing, which consists in drawing flat strip stock from a supply, forming one or more longitudinal pleats on the stock relatively close to one edge of the stock by drawing or stretching the metal to form the pleats, forming the portion of the stock having no pleats into tube form, rolling the portion of the stock having pleats around the said tube form of the other portion to form a double walled tube with the pleats outside of the tube, which form longitudinal fins on the tube.

5. The method of making finned tubing, which consists in drawing flat strip stock from a supply, forming one or more longitudinal pleats on the stock relatively close to one edge of the stock by drawing or stretching the metal to form the pleats, forming the portion of the stock having no pleats into tube form, rolling the portion of the stock having pleats around the said tube form of the other portion to form a double walled tube with the pleats outside of the tube, which form longitudinal fins on the tube, and then twisting the tube to give the fins a spiral form.

6. The method of making finned tubing, which consists in moving tinned strip stock with continuous longitudinal movement, forming one or more substantially closed longitudinal pleats in the stock, rolling the stock into tube form after the pleats are formed with the pleats outside the tube so as to form longitudinal fins on the tube with the interior of the tube unobstructed, and then heating the tube to melt the tin and secure the facing portions of the thus formed strip stock together, cooling the tube and then severing the tube into lengths.

7. The method of making spiral finned tube which comprises, moving a tube provided with one or more longitudinally extending substantially straight ribs or fins longitudinally, and twisting the tube as it moves by engagement of a stationary die with the ribs

or fins to give the ribs or fins a spiral form on the tube.

8. The method of making finned tubing adapted to conduct a fluid for heat exchange purposes which comprises moving a substantially continuous length of strip stock longitudinally, forming longitudinal pleats in the stock while it is moving, rolling the stock transversely into tube form with the longitudinal pleats outside the tube and with the interior of the tube non-obstructed, and then sealing the tube by the use of molten sealing metal.

9. The method of making finned tubing adapted to conduct a fluid for heat exchange purposes which comprises moving a substantially continuous length of strip stock longitudinally, forming longitudinal pleats in the stock while it is moving, rolling the stock transversely into tube form with the longitudinal pleats outside the tube and with the interior of the tube non-obstructed, and then twisting the tube to give the longitudinal fins a spiral formation during such longitudinal movement of the tube, and while the twisted portion of the tube remains attached to the strip stock.

In testimony whereof I affix my signature.
HARRY W. BUNDY.