July 6, 1926. 1,591,116

J. H. DUNBAR

METHOD OF FORMING TUBES

Filed August 27, 1924 2 Sheets-Sheet 1

FIG. 1

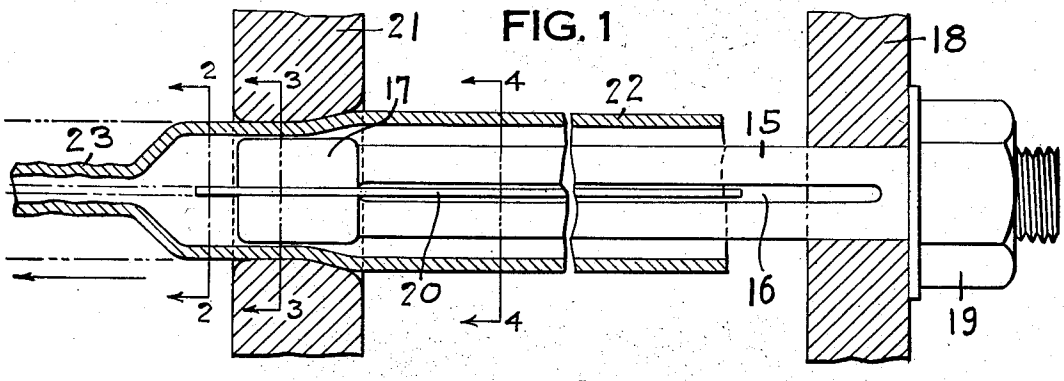


FIG. 2

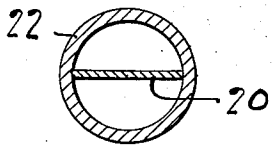


FIG. 3

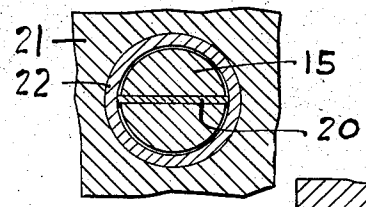


FIG. 4

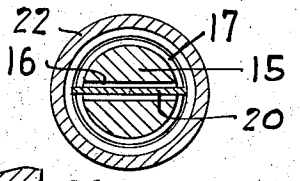


FIG. 5

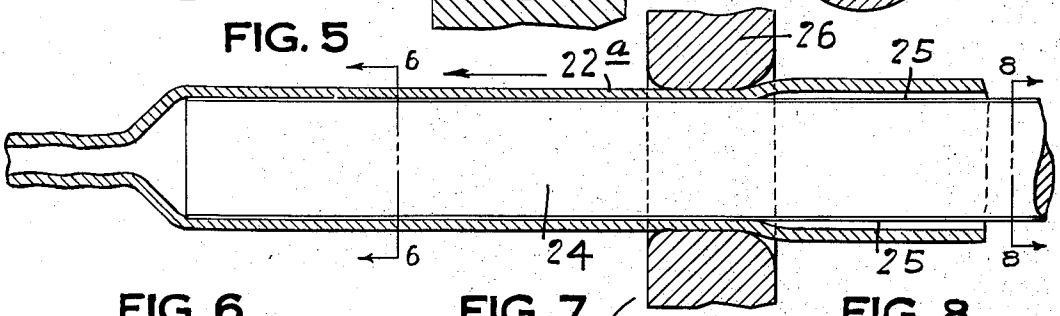


FIG. 6

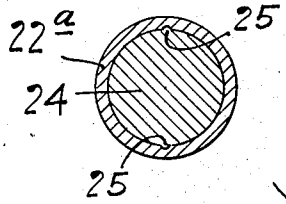


FIG. 7

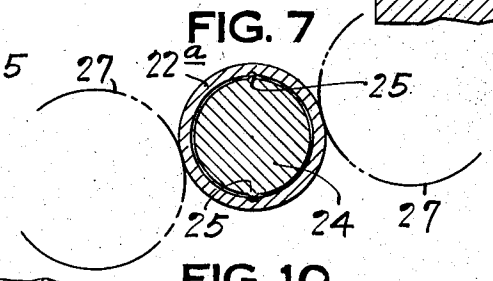


FIG. 8

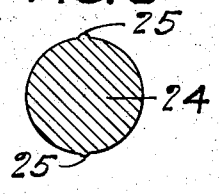


FIG. 10

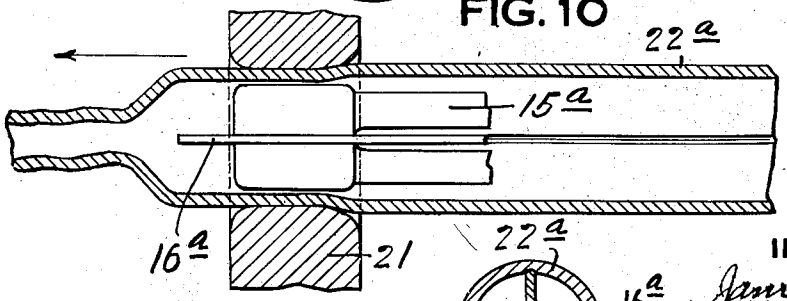


FIG. 9

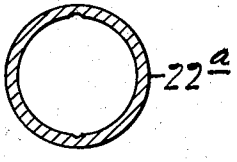
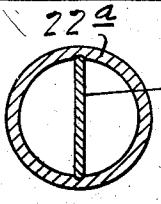


FIG. 11



INVENTOR

James H. Dunbar

by Kay Patten & Martin

attorneys

July 6, 1926. 1,591,116

J. H. DUNBAR

METHOD OF FORMING TUBES

Filed August 27, 1924 2 Sheets-Sheet 2

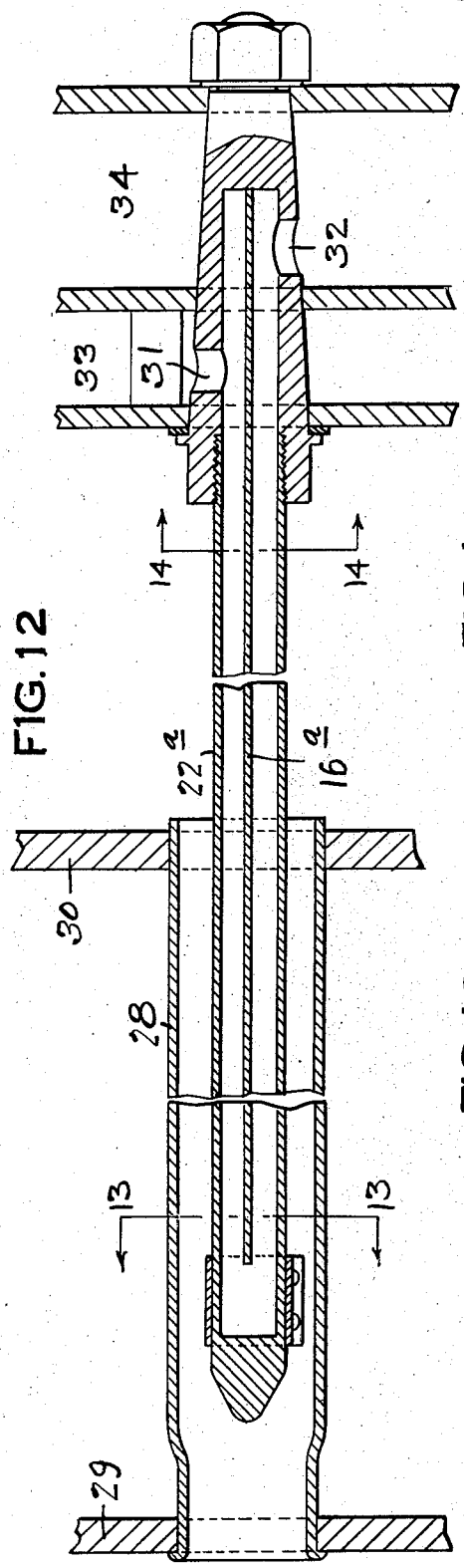


FIG. 12

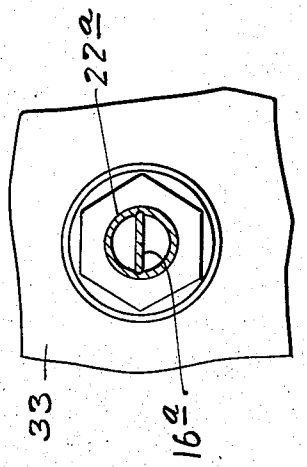


FIG. 14

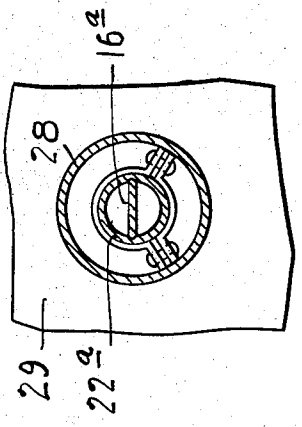


FIG. 13

INVENTOR
James H. Dunbar
by Kay Totten & Martin
Attorneys

Patented July 6, 1926. 1,591,116

UNITED STATES PATENT OFFICE.

JAMES H. DUNBAR, OF BELLEVERNON, PENNSYLVANIA, ASSIGNOR TO PITTSBURGH STEEL PRODUCTS COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

METHOD OF FORMING TUBES.

Application filed August 27, 1924. Serial No. 734,467.

My invention relates to a method of making tubes, and particularly to tubes having dividing walls therein.

One object of my invention is to form a tube having a partition or dividing wall therein whose edges tightly fit the interior of the tube at substantially diametrically opposite points, and one end of which partition may terminate short of the end of the tube so that the tube will be in substance a coil, in that flow may occur therealong in one direction until said end of the wall is reached, whereupon a return flow will be had along the other chamber of the tube, the tube thus functioning as two connected tubes or as a tube which is provided with a return bend.

Another object of my invention is to provide a method whereby an effective seal is procured between the edges of the partition or dividing plate and the inner wall of the tube.

Another object of my invention is to simplify and improve generally the structure of and method for making coil units.

Some of the forms which my invention may take, and some of the ways in which it may be practiced are shown in the accompanying drawings wherein Fig. 1 is a fragmentary view, partially in side elevation and partially in section, showing one manner of practicing my invention; Figs. 2, 3 and 4 are cross sectional views on the lines 2—2, 3—3, and 4—4, respectively, of Fig. 1; Fig. 5 is a view showing the manner in which a preliminary formation is given to the tube preparatory to performing the operation shown in Fig. 1, Fig. 6 is a view taken on the line 6—6 of Fig. 5; Fig. 7 is a view showing the manner in which the mandrel in Fig. 5 may be removed from the tube; Fig. 8 is a view taken on the line 8—8 of Fig. 5; Fig. 9 is a cross sectional view of a tube formed after the method shown in Fig. 5; Fig. 10 is a view similar to that of Fig. 1 but showing completion of a tube that has been preformed as in Fig. 5; Fig. 11 is a cross sectional view of the completed tube of Fig. 10; Fig. 12 is a sectional view showing one manner in which tubes formed in accordance with my invention may be used, and Figs. 13 and 14 are cross sectional views on the lines 13—13 and 14—14, respectively, of Fig. 12.

Referring now more particularly to Fig. 1, I have shown a fragmentary portion of a mandrel 15 which may be of somewhat the usual form but is provided with a slot 16 extending longitudinally thereof, from its forward end to a point adjacent to the rear end thereof. The mandrel 15 is provided at its forward end with a plug 17 that is also slotted, and is supported from a frame 18, being held against forward movement by a nut 19 that has screw-threaded engagement therewith.

The slot 16 is provided for the reception of a flat bar 20 of steel or similar material that is of slightly greater width than the diameter of the mandrel 15. A die block 21 is provided and may be moved out of the way to permit a tube 22 to be slipped into position upon the mandrel, from the forward end thereof and after the partition plate 20 has been positioned in the slot 16. The tube 22 is, at this stage, slightly greater in diameter than the width of the plate 20.

After the plate 20 and the tube 22 have been placed in position upon the mandrel 15, the die block 21 is moved into alignment therewith and the forward end 23 of the tube is grasped by tongs or in any other manner to draw the tube forward as indicated by the arrow. The opening through the die block 21 is of such size that the tube is reduced in diameter as it passes therethrough, thus causing it to tightly engage the edges of the plate 20.

Fig. 4 is a cross sectional view showing the arrangement and spacing of the tube 22, the plate 20 and the mandrel 15 previous to the drawing operation. Fig. 3 is a similar view showing the relation of the parts when the drawing operation is partially completed, and Fig. 2 is a cross sectional view of the completed article.

After completion of the drawing operation just described, the end of the tube may be cut off and capped, the partition plate 20 being of shorter length than the tube so that fluid flowing through the chamber or passage formed at one side of the wall, may pass the end of the dividing plate and have a return flow through the passage at the opposite side of the plate.

In Figs. 5 to 11, I show a modified form of completed tube and a method for forming the same. The tube 22ª of Fig. 5, before

having the dividing wall inserted therein, is first drawn over a mandrel 24 that has ribs 25 (Fig. 8) so that longitudinal grooves will be formed in the tube. The mandrel 24 extends through a die block 26 and moves through the die block 26 with the tube 22^a. Upon completion of this drawing operation the tube 22^a fits the mandrel closely, as shown in cross section in Fig. 6.

In order to loosen the mandrels from the tubes, they are subjected to the operation shown in Fig. 7 wherein they are placed between cross rolls indicated diagrammatically at 27, that are rotated to perform what is known as a "reeling" operation, whereby the tube is enlarged slightly as shown in Fig. 7, to permit withdrawal of the mandrel 24.

The tube 22^a is then ready for an operation similar to that described in connection with Fig. 1, its cross sectional form being indicated in Fig. 9. The mandrel 15^a may be supported in a manner similar to the mandrel 15 and a partition plate 16^a inserted therein, the tube 22^a being so positioned that its longitudinal grooves will lie opposite to or be partially engaged by the edges of the plate 16^a. The drawing operation through die blocks 21 is then performed, to shrink or reduce the tube to a size that will cause the edges of the plate 16^a to be seated snugly within the grooves of the tube as shown in Fig. 11. The grooves not only serve to provide a tight joint as between the edges of the plate 16^a and the tube, but may serve as a means for holding the plate and the tube in proper diametrical relation during the drawing operation. This latter function, however, may be satisfactorily performed by the slot 16 in the mandrel 15 or sand or wax cores inserted between the sides of the plate and the inner wall of the tube.

In Fig. 12 I have shown one manner in which tubes as above described may be employed. The tube 22^a in this case is represented as a superheater tube disposed within a smoke tube 28 that extends from the usual fire box sheet 29 to a front tube sheet 30. The chambers or passages of the tube 22^a at their forward ends have communications through openings 31 and 32 with chambers or headers 33 and 34 of a superheater system. It will be seen that the tube 22^a functions as a pipe having a return bend. If a number of these tubes were joined by connective opening 31 of one tube to opening 32 of an adjacent tube, and so on, a coil-like system would be secured requiring but one-half the number of tubes usually required for a given length of travel.

Various changes in detail of construction and method of operation may be made without departing from the spirit and scope of the invention as defined in the accompanying claims.

I claim as my invention:

1. The method which consists in supporting a partition plate throughout substantially its entire length, placing a tube over said plate and its support, and drawing said tube and plate through a reducing die, to compress said tube against the edges of the plate.

2. The method which consists in forming longitudinal grooves upon the inner wall of a tube, inserting a partition plate in said tube with its edges seating in said grooves, and reducing the diameter of said tube by drawing it longitudinally through a reducing die.

3. The method which consists in forming longitudinal grooves upon the inner wall of a tube, inserting a partition plate in said tube with its edges disposed adjacent to and in parallelism with said grooves, and reducing the diameter of said tube by drawing it longitudinally through a reducing die.

In testimony whereof I the said JAMES H. DUNBAR, have hereunto set my hand.

JAMES H. DUNBAR.