

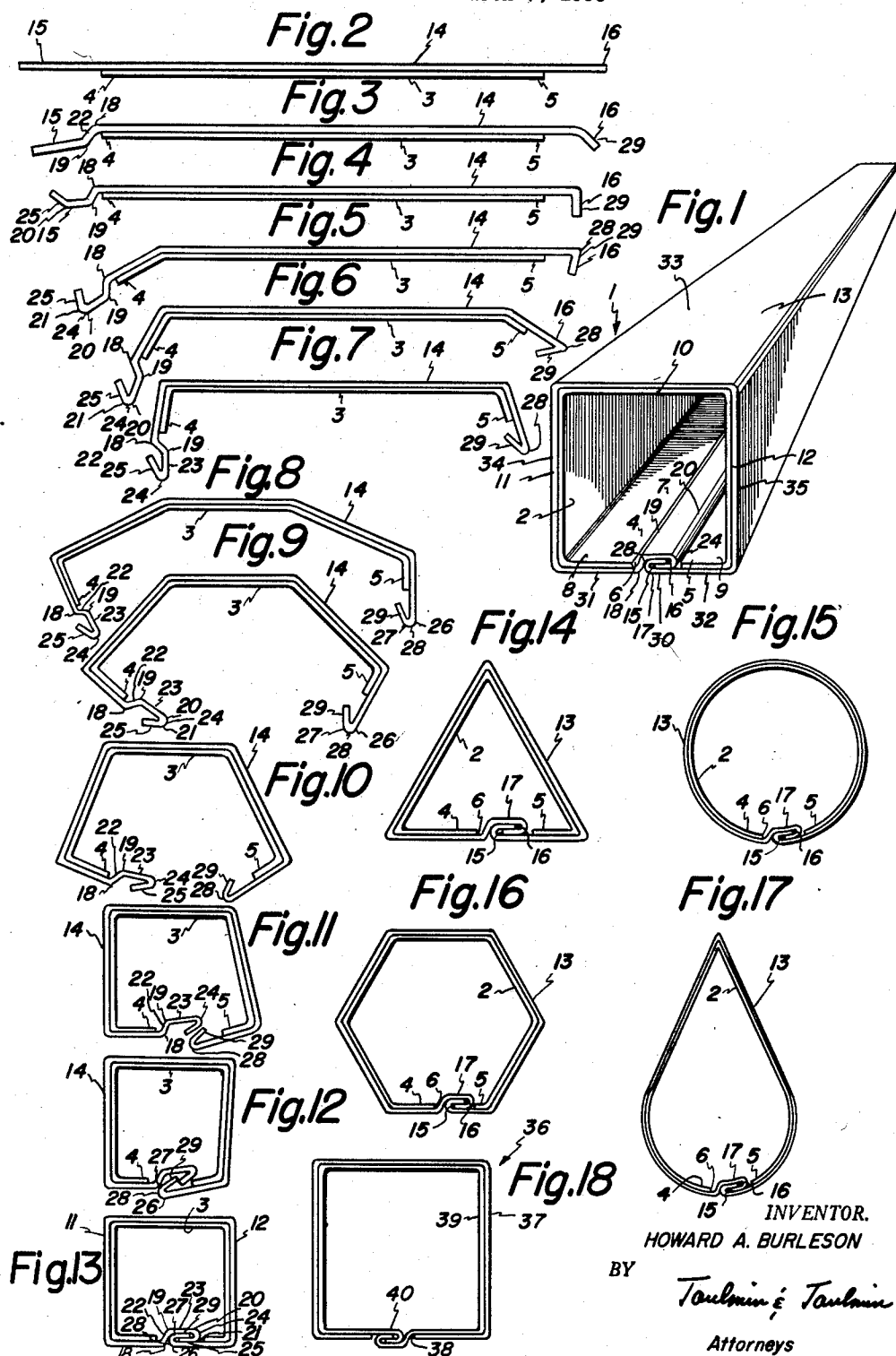
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LOCK SEAM TUBING WITH MULTIPLE INDEPENDENT PLIES

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## LOCK SEAM TUBING WITH MULTIPLE INDEPENDENT PLIES

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The present invention relates to multi-ply tubing, more particularly, to a composite tube with the outer of two concentric tubes being tightly secured around an inner supporting tube, but being independent therefrom, and the method of forming the same.

It is the principal object of this invention to provide multi-ply tubing comprising concentric tubes and having a simplified seam which effects a saving of material.

It is another object of this invention to provide a multi-ply tube wherein the outer ply is independent of the inner ply but is tightly secured there-around.

It is a further object of this invention to provide a multi-ply tube wherein the ends of the material forming the outer ply are joined by a locked seam which does not interlock with any portion of the inner ply.

It is an additional object of this invention to provide a multi-ply tube wherein the diverse expansion and contraction of the plies can occur without injury to the tubes.

It is still another object of this invention to provide a method of manufacturing a multi-ply tube which comprises simultaneously forming the concentric component tubes.

It is still a further object of this invention to provide a method of forming a multi-ply tube from two strips of material positioned in face to face engagement with each other.

It is still an additional object of this invention to provide a method of forming a multi-ply tube wherein the edges of the strip comprising the inner tube are spaced and the edges of the strip forming the outer tube are interlocked to form a locked seam which is positioned between the spaced edges of the inner tube.

Other objects and advantages of this invention will become apparent upon reference to the accompanying description when taken in conjunction with the following drawings, wherein:

Fig. 1 is an end perspective view of the multi-ply tube of this invention;

Figs. 2 through 13 are end views of the material comprising the multi-ply tube showing the various stages during fabrication of the tube;

Figs. 14 through 18 are end views of various shaped hollow tubes which may be made in accordance with this invention.

The present invention essentially comprises an inner supporting tube formed from a strip of material having its edges spaced from each other to form a slot and a cover tube which completely encloses the inner supporting tube and has its free ends interlocked entirely independently of the supporting tube to form a lock seam which projects into the slot of the support tube, but does not engage the edges thereof.

The method of this invention discloses the forming of both tubes simultaneously by passing two strips of material in face to face engagement through a series of cooperating roller dies or the like so that the strips are

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formed into the concentric tubes, each of which is independent of each other.

Returning now to the drawings, more particularly to Fig. 1, wherein like reference symbols indicate the same parts of the various views, 1 indicates generally a multi-ply tube formed in accordance with this invention. The multi-ply tube 1 comprises an inner supporting tube 2, which is formed from a strip of material 3, having edges or ends 4 and 5. The edges 4 and 5 are spaced to form a longitudinally extending slot 6. The slot 6 is off center with respect to the wall of the tube. Tube 1 is shown to be square in cross section, but it is to be understood, as will be later explained, that tubes of varying cross sections may be readily formed employing the principles of this invention.

The inner tube 2 comprises a slotted wall 7 which comprises the unequal wall portions 8 and 9. The remaining walls of the inner tube 2 are designated as the top wall 10 which is opposed from the slotted wall and the side walls 11 and 12 which interconnect the top and slotted walls.

Closely surrounding the inner tube 2 but independent thereof is an outer cover or supplemental tube 13. The cover tube 13 is similarly formed from a single strip of material 14 having edges or ends 15 and 16. The edges 15 and 16 are interlocked to form a lock seam 17 which is essentially a double seam joint. The lock seam 17 is positioned in the slot 6 of the inner tube 2 whereby the outer surface of the cover tube 13 presents a smooth and pleasing appearance.

The lock seam 17 is formed by making a series of four bends 18, 19, 20 and 21 in the edge 15 so as to form a connecting leg 22, and outer fold 23, a second U-shaped connecting leg 24 and an inner fold 25. The outer edge 16 of the cover tube strip 14 has two bends 26 and 27 therein which form a connecting leg 28 and a fold 29 which is reversely directed with respect to the cover tube strip. The fold 29 is tightly received between the outer and inner folds 23 and 25 to interlock to form a seam which has no external protuberances.

The cover tube 13 similarly comprises a seam wall 30, which comprises unequal portions 31 and 32. Opposed from the seam wall 30 is a top wall 33, which is interconnected with the seam wall by side walls 34 and 35.

To form the multi-ply tube 1 of this invention, the strips 14 and 3 which are of unequal width as may be seen in Fig. 2 are superimposed upon each other in face to face engagement. The marginal edges 15 and 16 of the strip 14 project beyond the corresponding edges 4 and 5 of the strip 3. The superimposed strips are then progressively formed by passing them through a series of roller dies or the like. The various steps during the formation of the tube 1 are successively illustrated in Figs. 3 through 13.

During the initial stages of the forming of the square multi-ply tube 1, the outer cover strip edges 15 and 16 are first formed into their respective folds. After the portions of the slotted wall have been formed, the top and side walls are shaped. During the final stages of the fabricating process, the ultimate shape of the tube is approached and the formed edges 15 and 16 are urged into locking position, as illustrated in Fig. 12. The interlocked edges 15 and 16 are then formed into a lock seam by simultaneously pressing the outer portion of the locked seam inwardly and urging the locked seam outwardly from within the tube by means of a serrated idler or the like. The idler may be mounted upon a mandrel extending within the tube.

The lock seam 17 is formed entirely from the marginal edges of the outer cover strip 14 which project beyond the edges of the inner cover strip 3. The edges 4 and 5

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of the inner strip 3 are spaced from each other and are independent of the lock seam.

Figs. 14 through 18 are examples of other shapes into which the composite tube of this invention may be fabricated. In each of Figs. 14 through 17 the inner tube forms the supporting member and has a longitudinally extending slot therein to accommodate the lock seam formed by the edges of the outer cover strip.

For some purposes it may be desirable to have the lock seam tube forming the inner ply of the multi-ply tubing. By way of example, when it is desired to utilize the tubing to carry corrosive liquids the inner ply of the tubing may be made of corrosive resistant material.

In the embodiment illustrated in Fig. 18, the composite tube indicated at 36 has an outer supporting tube 37, which has a longitudinally extending slot 38 therein. The inner ply of the composite tube 36 is formed from a tube 39 of which the edges thereof are interlocked to form a locked seam 40 which is positioned in the slot 38. By positioning the lock seam 40 in this manner, the inner surface of the multi-ply tube 36 is free from any protuberance of the seam. The composite tube 36 may be similarly formed by following the steps illustrated in Figs. 2 through 13.

Thus it can be seen that the present invention discloses a multi-ply tube formed of concentric tubes tightly secured together but independent from each other. By utilizing this tube construction a saving in material of about 10% may be effected. This saving of material is made possible by spacing the ends of the inner supporting tube and making the ends of the inner supporting tube independent of the lock seam.

The outstanding advantage of the multi-ply tube of this invention is that the end product is economical since it is possible to utilize light gauge expensive material over heavier gauge cheaper material, with the edges of the cheaper material coming up to the locked seam of the outer material to support the inner tube and give additional strength to the entire tube.

The nature of the material used for either the concentric tubes is immaterial and may vary according to the ultimate use of the tubing. By way of example, stainless steel, copper, aluminum, nickel, or any other alloy may be used for either the outside cover or the inside core. In addition, mild steels, hot or cold rolled, plain, painted or plated, or any other material may be used on the inside.

Similarly, the gauge of the material used varies considerably. The gauge can vary from .003 inch or less in brass or copper, or from .003 inch in stainless steel and the like to increasing thicknesses, whichever would be the most desirable dimensions in the end product. This variation in the gauge of materials applies equally to the inner supporting tube, as well as the outer covering tube.

Savings may also be made in the finishing cost of the end product since the lighter gauge materials used for

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the covering tube may be more easily formed. Further, savings may also be achieved through the elimination of plating, painting, anodizing or other similar finishing operations.

The multi-ply tube of this invention may be made pleasing to the eye, and decorative by the proper selection of the outer cover tube materials. However, there is no sacrifice of any structural strength because of the inner supporting tube upon which the outer cover tube is to be secured.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions, and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What is claimed in this invention is:

1. A double-ply metallic tube comprising an outer tube formed from a strip of sheet metal with the longitudinal edges of said strip being provided with interlocked hooked portions forming a lock seam and an inner tube fitting snugly within said outer tube to eliminate any relative movement therebetween and formed from metal plate having straight longitudinal edges separated from each other and dimensioned to receive therebetween the outer tube lock seam, the distance between said separated longitudinal edges of said inner tube being greater than the width of said lock seam so that said lock seam is independent of said inner tube.

2. A double-ply metallic tube comprising an outer tube formed from a strip of sheet metal with the longitudinal edges of said strip being provided with interlocked hook portions forming a lock seam and an inner tube fitting snugly within said outer tube to eliminate any relative movement therebetween and formed from metal plate having straight longitudinal edges separated from each other and dimensioned to receive therebetween the outer tube lock seam, the distance between said separated longitudinal edges of said inner tube being greater than the width of said lock seam so that said lock seam is independent of said inner tube, the said lock seam projecting into the separated longitudinal edges of the inner tube.

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