Dec. 6, 1932. A. O. ELTING 1,890,077

METHOD OF MAKING TUBING

Filed June 27, 1928 2 Sheets-Sheet 1

Fig. 1.

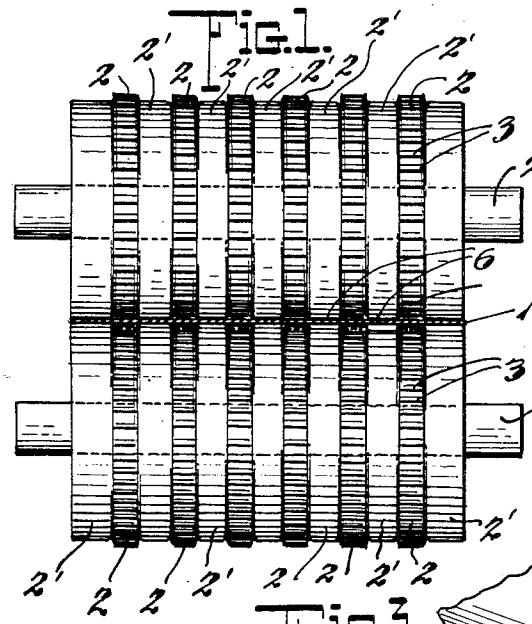


Fig. 2.

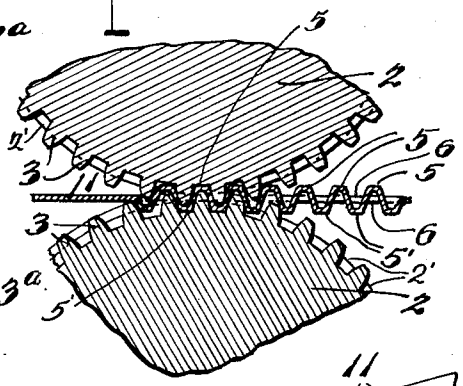


Fig. 3.

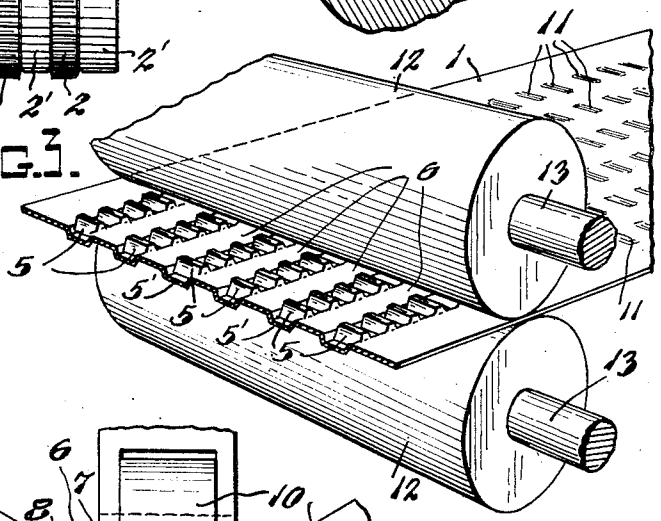


Fig. 4.

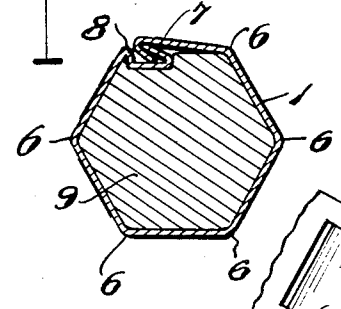
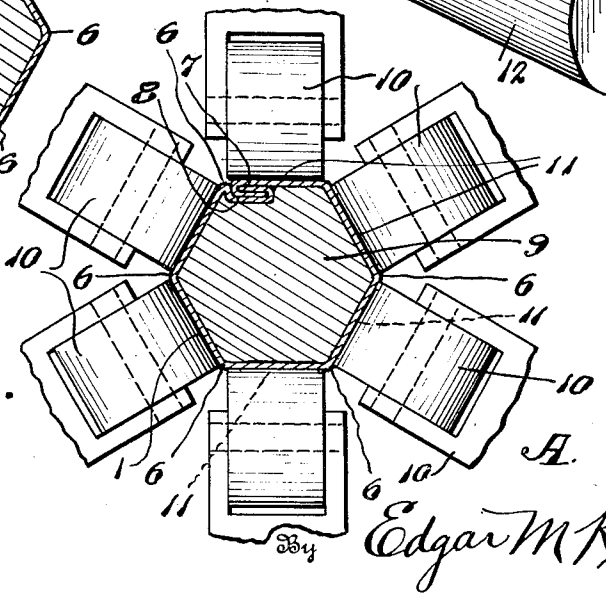


Fig. 5.



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METHOD OF MAKING TUBING

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Fig. 6.

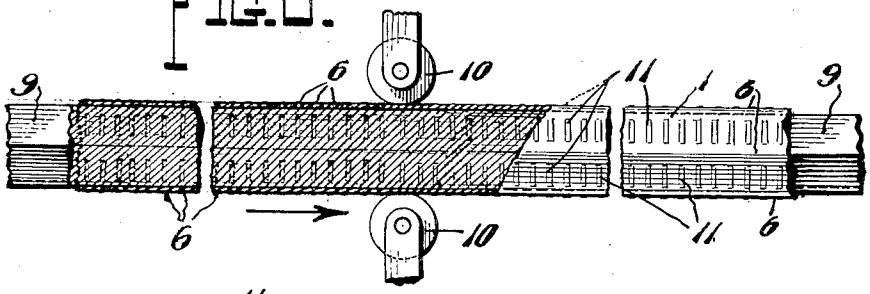


Fig. 7

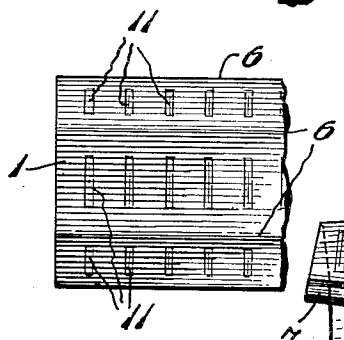


Fig. 8.

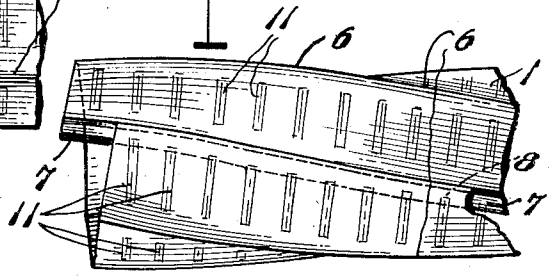


Fig. 9.

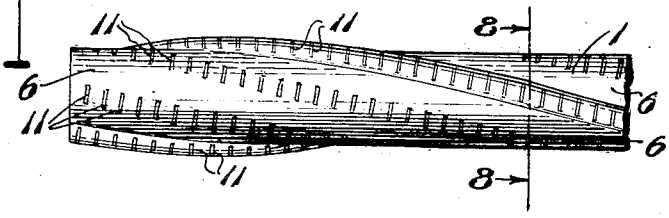


Fig. 10.

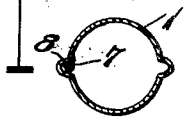


Fig. 11.

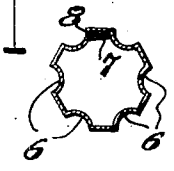


Fig. 12.

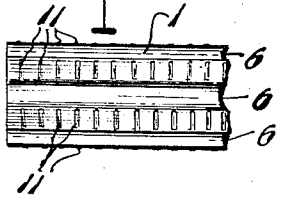
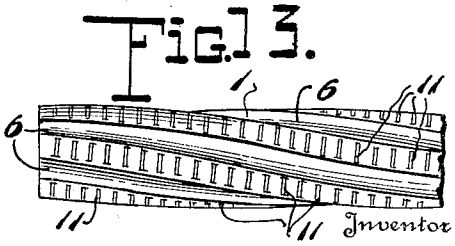


Fig. 13.



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Patented Dec. 6, 1932

1,890,077

UNITED STATES PATENT OFFICE

AUGUST O. ELTING, OF CHICAGO, ILLINOIS

METHOD OF MAKING TUBING

Application filed June 27, 1928. Serial No. 288,698.

This invention relates to improvements in the art of tube construction and the product thereof, and more particularly to the stabilizing of ligher gauges of material and the improving of the appearance of the tubing.

An object in view is the production of tubing of relatively light gauge having the stability of thicker walled tubing, and a further object is the enhancing of the decorative effect of such tubing while producing the increased stability.

With these and further objects in view as will in part hereinafter become apparent and in part be stated, the invention comprises certain novel steps in the production of tubing and certain novel constructions, combinations and arrangements of parts of tubing as will hereinafter become apparent and subsequently be set forth in the appended claims.

In the accompanying drawings,—

Figure 1 is a front elevation of the set of milling rolls preferably employed in the carrying out of the art and the producing of the product comprising the present invention, a piece of work being seen in cross section therein, and the parts being shown on a scale slightly larger than the normal size of popular sized products.

Figure 2 is a further enlarged, detailed, transverse section through the parts seen in Figure 1.

Figure 3 is a perspective view of the crushing or straightening rolls, parts being broken away for the saving of space and a fragmentary piece of work being shown.

Figure 4 is a transverse section through the work and the mandrel on which it is shaped after first assemblage on the mandrel.

Figure 5 is a view similar to Figure 4 with rolling apparatus seen in elevation in the course of completing the formation of the tubing on the mandrel.

Figure 6 is a fragmentary, sectional elevation of the parts seen in Figure 5.

Figure 7 is a further enlarged fragmentary elevation of the product finished to the point prior to twisting.

Figure 8 is a similar view of the same after the twisting operation.

Figure 9 is a view similar to Figure 8 of a slightly modified contour of tubing and with the finished end cut straight.

Figure 10 is a transverse section taken on the plane indicated by line 8—8 of Figure 9.

Figures 11 and 13 are views similar, respectively, to Figures 10 and 9 of a further modified contour of tubing.

Figure 12 is a view similar to Figure 7 of the contour of tubing seen in Figure 11.

In the art of tube construction, it has been common for many years to wrap a sheet or strip of metal about a mandrel and to interlock the edges of the strip into the form of a lock joint, and roll the said strip snugly down against the mandrel to produce a configuration of the tubing corresponding in transverse section to the cross section of the mandrel. This is shown in a number of expired U. S. Letters Patent, such as those to S. R. Wilmot, No. 137,991, dated April 15, 1873; E. H. Fickinger, No. 531,170, dated December 18, 1894; E. R. Stasch, No. 841,277, dated January 15, 1907, and C. D. Pruden, No. 489,498, dated January 10, 1893. Also, it has been long well known that tubing so made with a lock seam extending throughout the length of the tubing may be twisted to present the appearance of a spiral. To obtain this result, as has been long well known, it is only necessary to grasp the end portions of the tubing and turn them in opposite directions. As the tubing possesses naturally a degree of resilience, the twisting action must be carried somewhat further than the final spiral set which the tubing is expected to assume, and then the tubing may be released and will return from resiliency to the desired finally set twisted or spiral location. In the accomplishing of this result, the parts of the seam slip with respect to each other as one edge travels in one direction and the other edge travels in the other direction, so that each end of the piece of tubing after twisting presents a short helix or irregular portions which must be cut off if straight ends are desired for the tubing. All of this is common and well known and has been known for many years as indicated by the expired U. S. Letters Patent to C. L. Hart, No. 435,419,

dated September 2, 1890, and to S. R. Wilmot, No. 159,007, dated January 19, 1875.

In the practicing of the present invention, I have taken advantage of the principles of tube construction disclosed in all of said patents and have obtained superior results by the mode of production employed, it being characteristic of my invention that instead of using a heavy gauge of sheet metal to provide the requisite stiffness and strength, I manipulate the material of thinner sheets than could otherwise be successfully employed for the purpose. To render the invention readily clear, reference is had to the accompanying drawings in which 1 indicates a blank sheet of material, such as a sheet of brass, or other sheet metal. Sheet 1 is first fed through a pair of fluting rolls or milling dies. The preferred form of such dies is shown in Figures 1 and 2 of the drawings and consists of intermeshing gearlike milling discs 2, 2, whose milling teeth 3 are properly spaced, as clearly seen in Figure 2, to receive therebetween material of the sheet 1 and to draw the same to produce upstanding flutings 5 and correspondingly downwardly extending flutings 5′ at the respective opposite faces of the sheet 1. The milling discs 2 are spaced apart by appropriate shims 2′, there being a set or group of the milling discs and shims mounted on one shaft or axle 2*a* at one side of the sheet 1 while a similar set is mounted on the shaft or axle 3*a* at the other side of the sheet 1. The shims 2′ are of sufficiently less diameter than the maximum diameter of the teeth 3 to permit the requisite action of the teeth on the sheet 1. However, as seen in Figure 2, the shims 2′ are of sufficient diameter to partially shroud the teeth 3 and have their peripheries lying approximately along the pitch line of said teeth, so that the milling action on the sheet 1 may be accomplished without breaking or severing the material of the sheet 1 while it is being drawn to the fluted condition. The shims 2′ also function to preserve strip areas 6 of unfluted material of sheet 1, so that the finished, fluted sheet presents the appearance indicated at the lefthand side of the rolls seen in Figure 3, the edges or margins of the flutes being integral with and not severed from the body of the sheet 1. Thus, the flutings are produced in a condition marginally integral with and outstanding from sheet 1 at alternately opposite sides. It is to be observed that in addition to the strips or smooth areas 6 the marginal portions of the sheet 1 are also left smooth.

When the sheet 1, which will be of any appropriate width and length according to the section of tube to be produced, has passed through the milling rolls, so that the fluting is completed, it is then passed through a pair of pressure rolls 12, 12, appropriately maintained by journals 13, 13, sustained by bearings not illustrated. The rolls 12 are smooth and retained sufficiently contiguous during operation on the sheet 1 to crush the flutings 5 and 5′ and to return the material of the sheet 1 substantially to its normal condition. But, the kneading of the material of the sheet, consisting of the folding of the material in the stamping action of the knurling dies and again the folding of the material in being crushed back to its initial position leaves imprints, indicated at 11, 11, in the way of slight indentations or cross markings. These cross markings are not severed but are imprinted in and integral with sheet 1. Of course, the crushing or return movement of the material from the condition of flutings 5 and 5′ to the condition of the cross markings 11 may be accomplished by compression of other means than crushing rolls, as, for instance, a crushing roller operating relative to a fixed mandrel. In fact, the mechanism employed is susceptible of a wide range of variation, and known devices common in the industry are preferably employed for obtaining the results stated.

After sheet 1 has passed the rolls 12, the margins of the sheet are formed up, as seen in Figure 4, by well known seaming devices to produce a grooved portion 7 along one margin of the sheet 1 and a return flange 8 along the other to correspond, co-operate, and interlock with the groove portion 7 after the manner indicated in Figure 4. After the formation of the said interlocking marginal portions, the sheet 1 is folded about a mandrel 9 of such transverse contour as required for the particular tubing to be produced, it being understood, of course, that the mandrel 9 will present longitudinal angles along lines corresponding with the median lines of the flat areas or strips 6 between the rows of markings 11. Thus, the parts are brought to the position shown in Figure 4. Thereupon, the sheet thus assembled on the mandrel is subjected to the rolling pressure of rollers, as by being treated with apparatus such as illustrated in Figures 5 and 6, or such as shown in any of the several patents above referred to. Such apparatus includes appropriate rollers 10, 10 located to travel relatively with respect to the mandrel 9 and tubing thereon for finishing the tubing on the mandrel and for forcing the parts 7 and 8 into the finished, interlocking position, after the manner seen in Figure 5. It will be understood, of course, that the travel of the parts is relative and may consist of the advance of the rollers 10 along the mandrel and tubing or the thrust of the tubing and mandrel through the rollers, the former operation being preferred.

It is important to note that the result of the kneading action of the metal of sheet 1 by first stamping flutings therein and then crushing or rolling them down is to cause the

fiber or grain of the metal to become more compact and proportionally stiffer. In addition to this stiffening, and, therefore, stabilizing action which enables the use of a light gauge metal to do the work otherwise requiring heavy gauges of metal, the impracticability of a complete return of the flutings to a smooth, flat condition, so that the slight grooves or indentations referred to as cross markings 11 are left, affords the further advantage of improving the appearance of the finished product. The cross markings 11 somewhat simulate knurling in general appearance and add materially to the attractiveness and beauty of the finished tubing. Also, as the cross markings 11 are in the form of abrasions or indentations, they possess the further utility and advantage of affording anchorage for coloring material, so that the operator may coat the exterior of the finished tubing with pigment, and then, by the use of a cloth, wipe the tubing while the pigment is still moist. The wiping action will remove the pigment from all of the smooth surfaces, that is from practically all of the tube except the cross markings 11 which then stand out as possessed of the color of the pigment applied. This application of pigment may be utilized whether the tubing is subjected to further treatment after passing the rollers 10 or not, and either before or after such subsequent treatment.

The treatment when employed after passing the rollers 10 consists of utilizing the mode of rendering the tubing spiral by twisting the same after the manner set forth in the patent to C. L. Hart, above cited, to produce the result shown in Figure 8 of the drawings of this application. The actual twisting operation is preferably accomplished by gripping the ends of the tube, as seen in Figure 7, after it has passed the rolls 10 and has been removed from the mandrel 9. The gripping instrumentalities are preferably rotatably mounted chucks so arranged as to grip the tubing against angular or rotary slipping but not against relative longitudinal movement. Such chucks are then rotated in opposite directions either manually or otherwise until the tubing is brought to the twisted condition seen in Figure 8. In fact, in the preferred manner of operation, the twisting is carried to an extent somewhat greater than that indicated in Figure 8, so that, when the grip of the chucks is relaxed, and the resiliency of the material of the tubing causes a certain amount of retrograde movement, the final position or set of the twisted or spiral tube will be that desired. During such twisting movement, as clearly shown in the Hart patent last above mentioned, the lock seam slips and the marginal portions of the sheet of which the tube is made move relatively to each other in opposite directions producing longitudinal movement of the respective parts of the joint. After the twisting action has been completed, the resulting spiraled ends of the tubing may be cut away to leave a straight end section.

In Figures 9, 10, 11, 12, and 13 are illustrated tubings exactly the same as that above described and produced in the same way except that mandrels of different shapes were employed in their production, to produce the transverse contours shown, so that the same reference numerals have been applied and the same description will apply. It should also be understood that the invention is applicable to innumerable shapes of tubing, the variation in cross sectional design requiring only corresponding variation in the shape of mandrel and character of rollers for producing the result desired.

It is important to observe that the present invention is applicable to the tubing whether twisted or not. The increased stability effected by the kneading of the material incident to the production of flutings and compression of the same does not prevent or interfere with the twisting action and effects the same only slightly by decreasing the extent of return or reflex action after the twisting operation.

What I claim is:—

1. The art of constructing sheet metal tubing comprising kneading parts of the material of a sheet to be formed into tubing while preserving the sheet in a straight condition, and then shaping the sheet into tubing.

2. The art of constructing sheet metal tubing comprising kneading parts of the material of a sheet to be formed into tubing while preserving the sheet in a straight condition, and then shaping the sheet into tubing, said kneading being sufficient for leaving markings on the finished tubing.

3. The art of constructing sheet metal tubing comprising kneading parts of the material of a sheet to be formed into tubing, and shaping the sheet into tubing by bending those portions of the sheet only not subjected to the kneading action.

4. The art of constructing sheet metal tubing comprising kneading parts of the material of a sheet to be formed into tubing, and shaping the sheet into tubing by bending those portions of the sheet only not subjected to the kneading action, the kneading action being sufficient for leaving markings on the finished tubing.

5. The art of constructing tubing comprising forming spaced rows of outstanding flutings in a sheet of material, depressing the outstanding flutings, and bending the material into the contour of a tube, the bending being done along those portions of the sheet between the places formerly occupied by the flutings.

6. The art of constructing tubing comprising forming spaced rows of outstanding flut-

ings in a sheet of material, depressing the outstanding flutings, bending the material into the contour of a tube, the bending being done along those portions of the sheet between the places formerly occupied by the flutings, and twisting the tube to present the appearance of a spiral.

7. The art of constructing tubing comprising forming rows of flutings in a sheet with intervening smooth areas and with smooth areas along the marginal portions of the sheet, compressing the flutings to substantially extinguish the same, and folding the sheet into an interlocking joint along said margins.

8. The art of constructing tubing comprising forming rows of flutings in a sheet with intervening smooth areas and with smooth areas along the marginal portions of the sheet, compressing the flutings to substantially extinguish the same, and folding the sheet along the smooth areas between the places of the rows of flutings to angles producing tubing, and folding the sheet into an interlocking joint along said margins.

9. The art of constructing tubing comprising forming rows of flutings in a sheet with intervening smooth areas and with smooth areas along the marginal portions of the sheet, compressing the flutings to substantially extinguish the same, folding the sheet into an interlocking joint along said marginal portions, and twisting the resulting tubing sufficiently for causing the parts of the interlocking joint to slip relative to each other and the parts of the sheet to assume a permanent set in a spiral condition.

10. In the art of treating sheet metal material for tubing construction, displacing portions thereof laterally of the sheet while retaining such portions integral with the sheet, and then returning the displaced material substantially to its original location while preserving the sheet in a straight condition.

11. In the art of treating sheet metal material for tubing construction, displacing portions of the sheet laterally thereof into flutings while retaining the flutings marginally integral with the sheet, and subsequently flattening the flutings, all while preserving the sheet in a straight condition.

12. In the art of treating sheet metal material for tubing construction, displacing portions of the sheet of metal laterally while the sheet remains cold and while retaining such portions integral with the sheet, and then returning the displaced portions to substantially the original location, all while preserving the sheet in a straight condition.

In testimony whereof I affix my signature.

AUGUST O. ELTING.