March 31, 1936. T. OLSEN 2,035,914

PROCESS FOR MAKING TUBES, FOUNTAIN PEN BARRELS AND THE LIKE

Filed Dec. 7, 1931

Fig. 1.

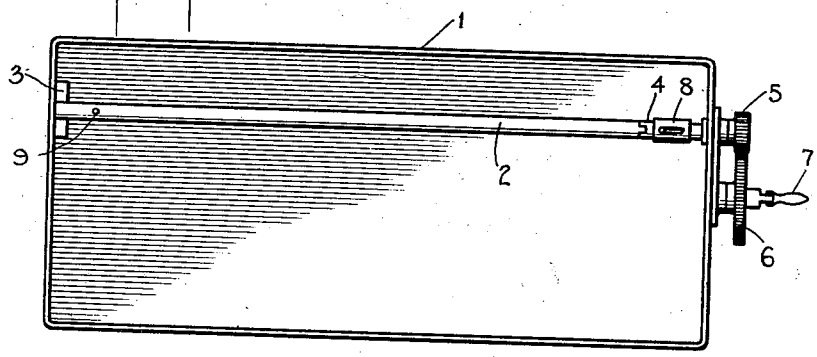


Fig. 2.

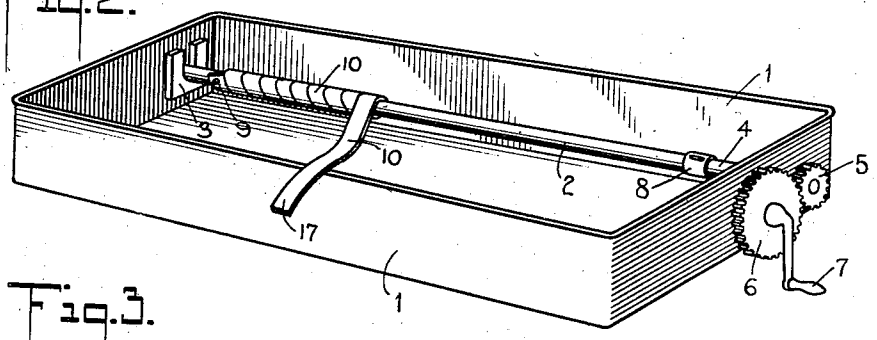


Fig. 3.

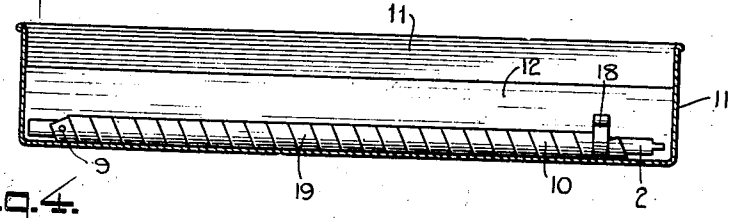


Fig. 4.

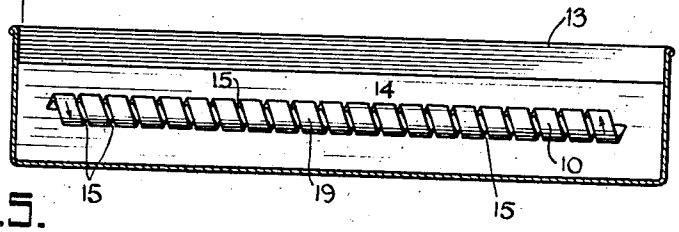


Fig. 5.



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UNITED STATES PATENT OFFICE

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PROCESS FOR MAKING TUBES, FOUNTAIN PEN BARRELS, AND THE LIKE

Thomas Olsen, West Orange, N. J., assignor, by direct and mesne assignments, of one-half to Celluloid Corporation, a corporation of New Jersey, and one-half to Du Pont Viscoloid Company, a corporation of Delaware

Application December 7, 1931, Serial No. 579,554

14 Claims. (Cl. 18—51)

This invention relates to the manufacture of tubes, fountain pen barrels and the like from sheet stock containing derivatives of cellulose.

An object of my invention is to form improved tubes or fountain pen barrels from flat sheet stock of cellulose derivatives such as pyroxylin, cellulose acetate and the like.

Another object of my invention is to manufacture improved tubes and fountain pen barrels from flat strips of cellulose derivative sheet stock by winding the strips helically on a mandrel.

A further object of my invention is to manufacture tubes and/or fountain pen barrels from flat strips of composited cellulose derivative sheet stock, whereby various novel decorative effects may be obtained.

Another object of this invention is to provide a novel method of sealing the edges of the helically wound strip to form a strong unitary structure. Other objects and advantages will appear hereinafter from the detailed description and claims.

Heretofore the manufacture of tubes and fountain pen barrels has been attended with considerable difficulty and waste. While tubes have been successfully produced their cost has been almost prohibitive. Thus for the manufacture of tubes and fountain pen barrels it has been found necessary or advisable to first produce rods of the desired size and then to drill out the central portions of these rods to form the tubes. This procedure is not only wasteful and uneconomical but also expensive and time consuming. Attempts have also been made to mold fountain pen barrels and caps from mottled or patterned pyroxylin or other cellulose derivatives but it has been found that the effects of the patterns are distorted or destroyed in the molding operation.

The winding of preformed sheets or films around a mandrel, in order to build up or form a suitable tube, the sheets or films having first been softened or moistened with a solvent or swelling agent for the cellulose derivative has also been suggested. These processes are objectionable since an inordinate length of time is required to season such tubes or fountain pen barrels in order to remove all traces of solvent or swelling agent before they can be utilized. Also warping frequently results despite the most careful seasoning.

I have now found that these numerous difficulties can be avoided and that tubes, fountain pen barrels and the like presenting any desired effect can be produced in an inexpensive manner and very quickly. According to my invention a comparatively narrow strip of sheet stock of any thermoplastic cellulose derivative of any desired thickness is first softened and while in this condition helically wound under tension on a mandrel so that the edges of the strip are in abutting relationship. The helically wound strip, after being set, is removed from the mandrel. A solvent for the cellulose derivative is introduced between the abutting edges of the helically wound strip by untwisting the coil slightly. The tension on the helical strip is then released and the ends given a slight positive twist to insure good jointing. The tubes are then allowed to dry for a short while, then seasoned until all the solvent is removed when they can be subjected to the usual finishing operations such as grinding, polishing and the like.

The sheets to be wound may comprise a plastic composition containing any suitable derivative of cellulose such as cellulose nitrate or organic derivatives of cellulose such as organic esters of cellulose and cellulose ethers. Examples of such organic esters of cellulose are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate while examples of cellulose ethers are ethyl cellulose, methyl cellulose and benzyl cellulose. Besides the derivative of cellulose the tubes or films may contain suitable plasticizers such as camphor for cellulose nitrate or other well known plasticizers for derivatives of cellulose such as diethyl phthalate, dibutyl phthalate, dibutyl tartrate, triacetin, mono methyl xylene sulfonamid.

The sheets to be wound may be transparent, translucent or opaque and may be colorless or may have any suitable pigment, dye or effect material incorporated therein to produce mottled, variegated or other differential effects or pearl like or nacreous appearance. Instead of using sheet stock entirely of the same material there may be used composited or laminated plastic sheets, making it possible to obtain various artistic effects such as pearl, cloisonné, snakeskin and the like which cannot be obtained in any other manner. This modification also makes it possible to use as base stocks materials which would be unsuitable for surface effects because of color or inferiority of stock, but which by means of overlays, can be made to present an agreeable surface or color.

The composite sheets for use in making tubes in accordance with the present invention may be produced in any suitable manner. For example, a pearl, onyx or any suitably colored or patterned effect is veneered with a sheet of colored or colorless transparent nitrocellulose, cellulose acetate

or other cellulose derivative so that in the subsequent grinding down of the seams or edges the transparent sheet will protect the under-layer containing the patterned or color effect. Also the transparent sheet of about 20 one-thousandths of an inch may be composited over a fabric containing a design and as a base sheet a sheet of material of any color to make up a total thickness of 60 one-thousandths of an inch. The fabric may be replaced by a lithographed thin sheet or by a celluloid or similar sheet previously impressed with a finish such as morocco or snakeskin.

In accordance with my invention the celluloid sheet, single or laminated, is cut into strips of appropriate width, for example about $\frac{13}{16}$" by suitable means. The strips thus formed are then immersed in a hot water bath maintained near the boiling temperature and after immersion for 5 to 10 minutes are ready for the winding operation. This winding is carried out on a mandrel which is also submerged in the bath. One end of the comparatively narrow strip of celluloid is attached to one end of the mandrel which is adapted to be rotated and the other end of the strip is grasped or held in such a manner that the strip is helically wound under tension around the mandrel. During this operation the windings on the mandrel are guided or forced together so that the edges of the strip are in abutting relationship. After the strip is completely wound, the rolled up end is clinched or clipped to the mandrel rod in any suitable manner. The tension imparted to the celluloid strip will depend, in a large measure, on the pitch of the windings, the gauge or thickness of the sheet stock and the pressure used in guiding or forcing the windings into abutting relationship.

After the strip is rolled up and clinched or attached to the rod, the rod is lifted from the bath and immediately immersed in a cold water bath, which serves to set the strip in its helically wound condition. After cooling the coil is removed from the rod and allowed to dry. The coil is now ready for the cementing operation which is carried out in the following manner. The coil is untwisted until there is a space of approximately $\frac{1}{16}$" between the edges and while in this condition the coil is immersed in a bath of acetone or other suitable solvent. The coil is maintained in this bath for 15 to 20 seconds or more, the exact time being dependent on the nature of the stock, the temperature of the bath and the solvent composition. The tension or torque on the coil is then released and the ends of the coil are given a slight positive twist to insure good jointing. The jointed coil is now removed from the bath and allowed to dry for one half hour or so when it is in suitable condition for handling. If deemed necessary or advisable the tubing may be seasoned at approximately 110° F. for 1 to 3 days or more, when it may be worked up in the usual manner.

After the usual finishing operations such as polishing, grinding and the like, the tubing presents a smooth and continuous surface. The windings of the coil are not visible and the tube presents a pleasing appearance. Where the sheet stock contained a pattern or design, the finished tubing faithfully retains the same, there being no distortion or marring of the design. This is especially true where a composited sheet having a clear top sheet overlays the patterned sheet.

It will thus be seen that my invention makes it possible to produce tubing in cellulose derivative stock of any desired diameter with any desired wall thickness in an expeditious and economical manner. Also it obviates the use of elevated temperatures with their detrimental effects such as are necessary in the production of tubing by molding processes. Also since, there is practically no waste of stock in the present process, my invention makes it possible to produce tubing in a more economical manner than it is possible to form tubes from rods where it is necessary to drill out the central portion of the rods.

In the accompanying drawing which illustrates one manner of carrying out my invention,

Fig. 1 is a plan view of a tank containing a mandrel therein;

Fig. 2 is a perspective view of the apparatus of Fig. 1 showing a strip of sheet stock partially wound on the mandrel;

Fig. 3 is a vertical section through the setting bath;

Fig. 4 is a vertical section through the sealing bath, showing the coil slightly untwisted; and

Fig. 5 is a perspective view of a finished tube.

In the drawing 1 represents a tank of a suitable construction provided with a mandrel rod 2, which is supported at one end in a bracket 3 which is attached to one of the end walls of the tank and at the other end is adapted to engage with a shaft 4 which in turn is in driving engagement with a gear wheel 5 on the outside of the tank. The gear wheel 5 is driven through the gear wheel 6 which meshes therewith, the driving gear 6 being rotated manually by the handle 7 or by any suitable power-driven means (not shown). The driving shaft 4 is provided with a sleeve 8 which is adapted to keep the mandrel 2 and the shaft 4 in operative engagement. The mandrel rod is provided at one end thereof with an upstanding pin 9 on which one end of the plastic strip 10 is adapted to be fastened.

The tank 11 is provided to contain cold water 12, into which the mandrel rod with the helically wound strip thereon is adapted to be immersed. Another tank 13 is provided to contain a solvent bath 14 into which the helically wound coil is introduced with the windings slightly spaced as shown at 15. The finished tube is shown at 16.

In carrying out my invention the tank 1 is filled with water which is maintained at or near the boiling temperature in any suitable manner, the water being of sufficient depth to submerge the mandrel. Into this hot water bath strips of the cellulose derivative sheets of appropriate width and length are introduced and maintained for 5 to 10 minutes until they are suitably softened. One end of the strip is formed with a small hole which is fitted over and held by the pin 9 and the mandrel rod 2 is rotated by means of the gear wheels 5, 6 and the handle 7. The free end 17 of the celluloid strip is firmly held in such a manner that the strip is helically wound on to the mandrel under tension, care being taken that the adjacent windings are in close abutting relationship. When the strip is fully wound the free end is clinched or clipped around the mandrel as at 18.

After the strip is completely wound and clamped to the mandrel, the latter is removed from the hot water bath and immediately immersed in the cold water in tank 11 to set the strip in its helically wound condition. After complete cooling the helically wound coil 19 is removed from the mandrel rod and the bath and

dried. The dried coil is then untwisted slightly until there is a space of approximately 1/8" between the windings and while in this condition the coil is immersed in the bath of acetone or other solvent for the cellulose derivative in the tank 13 for a period of 15 to 20 seconds. The tension on the coil is then released and the ends of the coil given a slight positive twist to insure good jointing. The jointed coil is then removed from the bath, allowed to dry and then, if deemed necessary, seasoned for 1 to 3 days, when it may be worked up and finished in the usual manner. The final product is a smooth continuous tube as shown at 16.

Although a particular apparatus has been described for carrying out my invention, the process may be carried out in any suitable apparatus. In carrying out this invention, sheet stock of any desirable thickness may be employed. The gauge selected will naturally depend upon the particular use to which the tubing is to be put. Excellent results have been obtained with sheet stock of 40 to 70 one-thousandths of an inch gauge but thinner or thicker stock may be utilized. For fountain pen barrels and caps 55 one-thousandths of an inch stock is preferred. In like manner the width of the strips used for winding on the mandrel may be varied at will.

Where desirable the use of a hot water bath to soften the strips of the cellulose derivative sheet stock may be dispensed with and the strips softened by the use of heat alone. When working with very hard cellulose derivative stock or stock which is stubborn to the action of heat there may be introduced into the hot water bath some water-soluble solvents for the cellulose derivative such as cellosolve, methyl cellosolve, cellosolve acetate, diacetone alcohol, etc. These substances serve to accentuate the softening effect of the hot water bath.

Other solvents for the cellulose derivative stock may be utilized in place of acetone as the cementing medium. Where advantageous a softening agent may be employed instead of a solvent or the solvent may be diluted with a nonsolvent. The cementing medium employed should preferably be quick acting and one which is readily removable from the finished tubing.

The tubes manufactured in accordance with this invention may be of any desired diameter and may be used for purposes other than the manufacture of fountain pen barrels and caps. By using composited strips decorative tubes can be obtained which are suitable for veneering towel bars, bed stands, umbrella handles and the like. Also these tubes can be utilized for stretching and blowing into all manner of objects such as puff boxes, shaving brush handles and similar articles where decorative effects are desired:

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. Method of manufacturing tubing which comprises helically winding strips of cellulose derivative sheet stock on a mandrel while said stock is in a softened condition so that the edges of the windings are in abutting relationship, introducing a solvent for the cellulose derivative between the edges of the strips, whereby the coil is converted into a tube with solid continuous walls.

2. Method of manufacturing tubing which comprises heating a strip of cellulose derivative sheet stock to soften the same, helically winding said softened strip on a mandrel so that the edges of the windings are in abutting relationship, introducing a solvent for the cellulose derivative between the edges of the wound strip to join the same and forming an integral continuous wall.

3. Method of manufacturing tubing which comprises immersing a strip of cellulose derivative sheet stock in a hot water bath, helically winding said strip on a mandrel in said bath so that the edges of the windings are in abutting relationship, introducing a solvent for the cellulose derivative between the edges of the wound strip to join the same and form an integral continuous wall.

4. Method of manufacturing tubing which comprises immersing a strip of cellulose derivative sheet stock in a hot water bath, helically winding said strip on a mandrel in said bath so that the edges of the windings are in abutting relationship, introducing the same into a cold water bath, removing the coil from the cold water bath, introducing a solvent for the cellulose derivative between the edges of the wound strip to join the same and form an integral continuous wall.

5. Method of manufacturing tubing which comprises immersing a strip of cellulose acetate sheet stock in a hot water bath, helically winding said strip under tension on a mandrel in said bath so that the edges of the windings are in abutting relationship, introducing the same into a cold water bath, removing the coil from the cold water bath, introducing acetone between the edges of the wound strip to join the same and form an integral continuous wall.

6. Method of manufacturing tubing which comprises immersing a strip of pyroxylin sheet stock in a hot water bath, helically winding said strip under tension on a mandrel in said bath so that the edges of the windings are in abutting relationship, introducing the same into a cold water bath, removing the coil from the cold water bath, introducing acetone between the edges of the wound strip to join the same and form an integral continuous wall.

7. Method of manufacturing tubing which comprises helically winding strips of cellulose derivative sheet stock on a mandrel while said stock is in a softened condition so that the edges of the windings are in abutting relationship, introducing a solvent for the cellulose derivative between the edges of the strips, and imparting twist to the windings to cause intimate and close contact between the adjacent edges whereby the coil is converted into a tube with solid continuous walls.

8. Method of manufacturing tubing which comprises heating a strip of cellulose derivative sheet stock to soften the same, helically winding said softened strip on a mandrel so that the edges of the windings are in abutting relationship, cooling to set the same, introducing a solvent for the cellulose derivative between the edges of the wound strip and imparting twist to the windings to cause intimate and close contact between the adjacent edges to join the same and form an integral continuous wall.

9. Method of manufacturing tubing which comprises immersing a strip of cellulose derivative sheet stock in a hot aqueous bath, helically winding said strip on a mandrel in said bath so that the edges of the windings are in abutting relationship, introducing the same into cold water, removing the coil from the cold water, separating the adjacent edges of the windings, introducing a solvent for the cellulose derivative between the edges of the windings, and then

bringing said edges in close contact to join the same and form an integral wall.

10. In the production of tubing by that method that comprises spirally winding a strip of thermoplastic material about a temporary mandrel unattached to the strip and cementing the edges of the wound strip together to form the tube, the steps of heating the material and cooling the wound heated strip whereby to set the strip in spiral form to prepare it for cementing, and then cementing the strip while in its cold, spiral-set condition.

11. In the production of tubing by that method that comprises spirally winding a strip of thermoplastic material about a temporary mandrel unattached to the strip, and cementing the edges of the wound strip together to form the tube, the steps of heating the material and cooling the wound heated strip whereby to set the strip in spiral form to prepare it for uniting, and then uniting the strip by means of solvent while in its cold, spiral-set condition.

12. In the production of tubing by that method that comprises spirally winding a strip of thermoplastic material about a temporary mandrel unattached to the strip and cementing the edges of the wound strip together to form the tube, the steps of heating the material and cooling the wound heated strip whereby to set the strip in spiral form to prepare it for uniting, and then uniting the strip by means of acetone while in its cold, spiral-set condition.

13. In the production of tubing by that method that comprises spirally winding a strip of cellulose derivative plastic material about a temporary mandrel unattached to the strip and cementing the edges of the wound strip together forming a tube, the steps of cooling the wound heated strip whereby to set the strip in spiral form to prepare it for cementing and then cementing the strip while in its cold spiral-set condition.

14. In the production of tubing by that method that comprises spirally winding a strip of pyroxylin material about a temporary mandrel unattached to the strip and cementing the edges of the wound strip together forming a tube, the steps of cooling the wound heated strip whereby to set the strip in spiral form to prepare it for cementing and then cementing the strip while in its cold spiral-set condition.

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