

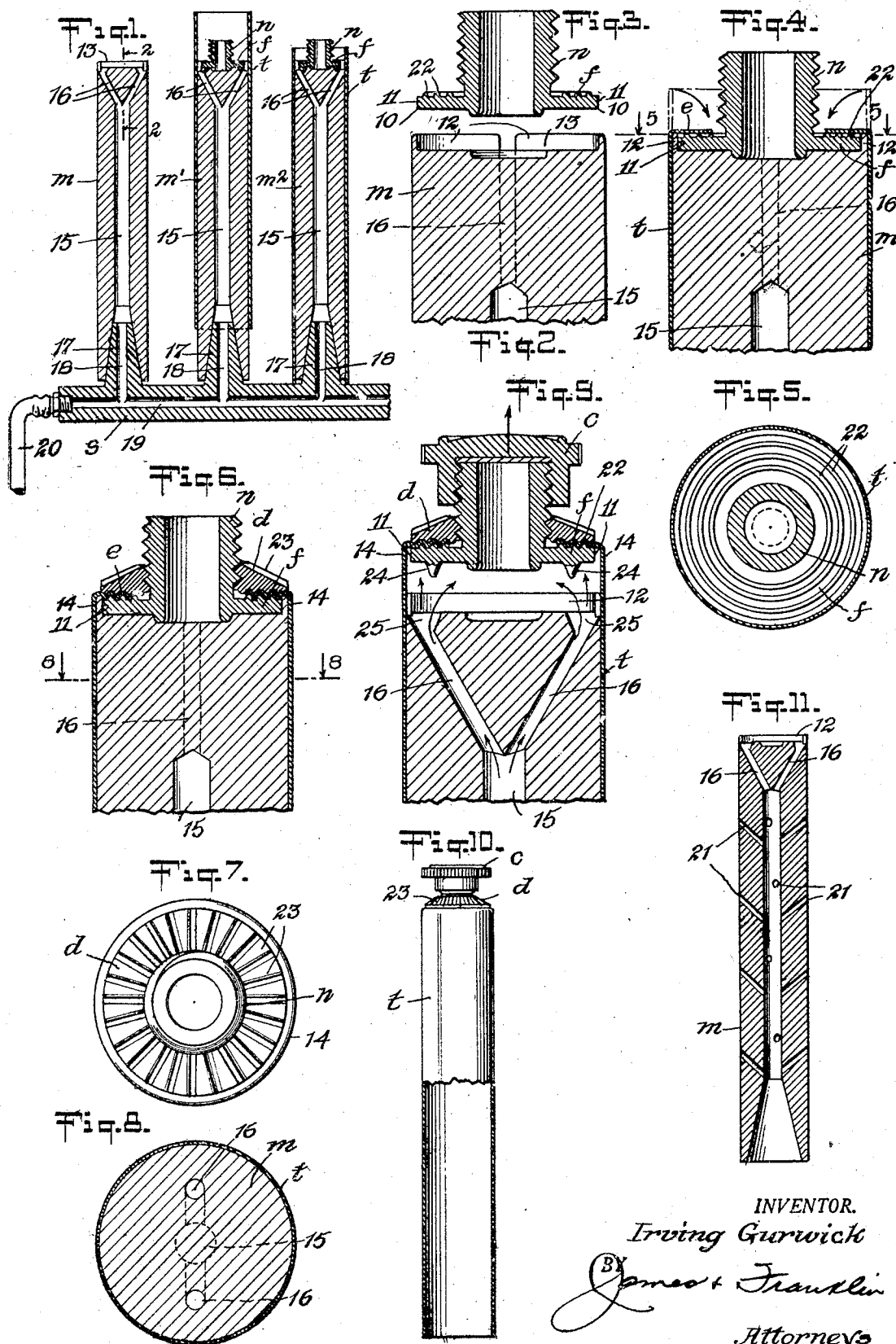
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NONMETALLIC COLLAPSIBLE DISPENSING TUBE AND MANUFACTURE THEREOF

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NONMETALLIC COLLAPSIBLE DISPENSING
TUBE AND MANUFACTURE THEREOF

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This invention relates to the manufacture of non-metallic collapsible dispensing tubes.

Non-metallic collapsible dispensing tubes or containers have been made consisting of a tube of a material such as regenerated cellulose or other similar material having the property of being swollen when wet and shrinking when dried, and a dispensing closure, which may also be made of a non-metallic material such as a molded plastic, attached to and sealing one end of the tube. Such a dispensing tube is made by assembling on a mandrel the dispensing nipple of the closure and the collapsible tube in the wet and swollen state, an extension end of the tube projecting freely beyond (above) the flange of the closure nipple. The collapsible tube is then permitted to dry. In drying, the tube contracts and shrinks onto and closely conforms to the shape of the mandrel, and the tube extension end in contracting bends over and shrinks onto the outer surfaces of the nipple such as the rim and top wall of the nipple flange, closely conforming to these surfaces and adhering thereto. In some structures the adhering tube extension end is additionally mechanically clamped to the nipple flange. The assembly is then removed or withdrawn from the mandrel and the dispensing tube is ready for filling and for bottom end sealing.

These dispensing tubes, however, develop a serious defect and drawback, after being withdrawn or removed from the mandrel. The regenerated cellulose (viscose) material of the tube continues to shrink. The difficulty is that the material of the tube with this subsequent shrinkage contracts only where it is free to do so; and therefore the diameter of the collapsible part of the tube is reduced while the tube material adhering to the rim of the nipple flange is not, being restrained from contracting diametrically. The result is that the material is tensioned at the lower rim edge of the nipple flange causing a severe strain to be set up and resulting in the material fracturing in this region. Where the nipples are made of a molded material, the rim edges are oftentimes rough due to burrs, etc., and this aggravates the condition by puncturing the tensioned material at this region. When such fracturing or puncturing occurs after the tube is filled with its contents, leakage and spoilage takes place.

The prime object of the present invention centers about the provision of an improved manufacture of these non-metallic collapsible dispensing tubes in which the stated defect is eliminated, and the production of dispensing tubes of

this character in which the subsequent shrinkage may take place without the developing of any tensioned regions, thereby preventing tube fracture, puncturing and leakage.

To the accomplishment of this object and such other objects as may hereinafter appear, my invention relates to the method, devices used in the method and the product of the method, all as hereinafter sought to be defined in the claims and described in the following specification taken together with the appended drawing, in which:

Fig. 1 is a vertical cross-sectional view of the apparatus preferred to be used in the practice of the method of the present invention and depicting the initial steps in the practice of said method;

Fig. 2 is a view of an essential part of the mandrels of such apparatus shown on an enlarged scale and taken in cross-section in the plane of the line 2—2 of Fig. 1;

Fig. 3 is a vertical cross-sectional view of a closure nipple showing the same about to be mounted on the mandrel of Fig. 2 of the drawing;

Fig. 4 is a vertical view taken in cross-section corresponding to the assembling of the mandrel and nipple of Figs. 2 and 3 of the drawing, and showing a step in the manufacture of the collapsible dispensing tube according to the practice of the present invention;

Fig. 5 is a plan view of Fig. 4 taken in cross-section in the plane of the line 5—5 of Fig. 4;

Fig. 6 is a view corresponding to that of Fig. 4 of the drawing, and showing a subsequent step in the manufacture of the dispensing tube;

Fig. 7 is a top plan view of Fig. 6;

Fig. 8 is a view of Fig. 6 taken in cross-section in the plane of the line 8—8 of Fig. 6;

Fig. 9 is a vertical cross-sectional view of the assembly shown in Fig. 6 at a subsequent step of the manufacturing method, the assembly being shown in cross-section in a plane normal to the plane depicted in Fig. 6 of the drawing;

Fig. 10 is a vertical elevational view with a part shown in section of the collapsible dispensing tube as made by the method of the present invention; and

Fig. 11 is a vertical cross-sectional view of a modified form of mandrel which may be used in the method and apparatus of the invention.

The general method of making the collapsible dispensing tubes to which the present invention applies may be first described by reference to Figs. 1 to 4 of the drawing. One or more and preferably a plurality of mandrels m , m' and m''

(a battery or gang of such mandrels may be used) are mounted on a support *s*, each mandrel being adapted to receive at its upper end a closure nipple *n*, the body of each mandrel being appropriately contoured for receiving a wet or moist tube *t* of a material having the property of being swollen when wet and shrinking when dried, such as regenerated cellulose (viscose) or other similar material, for example cellulose acetate or cellulose nitrate. When in the wet or moist state, the swollen viscose tube is more or less freely received by and, therefore, may be slipped over the mandrel as is best depicted in Fig. 1 of the drawing, and this operation may be assisted by the action of an air jet in a manner to be described hereinafter. In this operation, the collapsible tube *t* and the nipple *n* are assembled on the mandrel in a manner shown in connection with the mandrel *m*² shown in Fig. 1 of the drawing. In this assembly, the collapsible tube *t* has an end extension *e* which projects freely beyond (above) a flange portion *f* of the closure nipple *n*. The collapsible tube *t* is then permitted to dry. In drying, the body of the tube contracts and shrinks on to the mandrel *m* and closely conforms to the shape of the mandrel, and the tube extension end *e*, in shrinking, contracts and bends over the top of the nipple flange *f* in the manner clearly indicated in Fig. 4 of the drawing, the shrinking and contraction being in the direction shown by the arrows in this figure from the dot-and-dash line position to the full-line position shown in this figure. The wet regenerated cellulose material in shrinking closely follows the contour of the form on which the shrinking takes place, and the turned-over end extension *e* may thus be made to adhere to the surface of the nipple *n*. However, in some structures and in the structure disclosed herein, the adhering tube extension end *e* is additionally mechanically clamped to the nipple flange. The assembly is then removed or withdrawn from the mandrel and the dispensing tube is ready for filling and for sealing the bottom end thereof.

As set forth above, the regenerated cellulose or similar material of the tube continues to shrink after the assembly is removed from the mandrel, the result being that the tube material is tensioned at the lower rim edge 16 of the nipple flange *f* (see Fig. 3) causing normally a severe strain to be set up at this edge, with the result that the material of the tube *t* tends to fracture or may be punctured in this region. When such fracturing or puncturing occurs after the tube is filled with its contents, leakage and spoilage takes place.

I have found that this defect may be completely obviated by arranging or positioning a displaceable body between the rim face 11 of the nipple flange *f* and the immediately opposed part of the wall of the tube *t* (the part immediately continuous with the extension *e*), and then permitting the tube to dry whereby the extension *e* in shrinking and contracting first bends over the top of said body and then on to the top wall of the flange *f* so that when the said body is later withdrawn, the resulting tube end is spaced away from the rim 11 of the nipple flange. Thereafter, when subsequent drying takes place (drying to a bone-dry condition or aging), the reduction in the diameter of the tube *t* takes place over the full length of the tube (including that immediately opposed to the rim of the nipple flange), and thus no rupturing strains in the material at the tube end (the nipple flange) can take place,

This body is preferably made a part of the mandrel; and the mandrels *m*, *m'* and *m*², etc. are each, therefore, fashioned at its top end to provide this displaceable body.

Referring now to Figs. 3 and 4 of the drawing, the mandrel *m*, which is shown cylindrical in body (for the making of cylindrical collapsible tubes), is provided at its upper end with an annular or generally ring-shaped body 12 which, as shown in Fig. 4 of the drawing, is interposed between the rim face 11 of the nipple flange *f* and that part of the wall of the tube *t* which ultimately forms the upper end of the tube body. This body 12 is produced by forming in the upper end of the mandrel *m* a recess 13 deep enough to receive the flange *f* of the nipple *n*, as is best shown in Figs. 3 and 4 of the drawing. The flange receiving recess 13 is, therefore, bounded circumferentially by the annular top body 12 of the mandrel. Also, as best shown in Fig. 4, the top face of the body 12 is generally flush with the top wall of the nipple flange *f*, the depth of the recess 13 being, therefore, substantially equal to the thickness of the nipple flange *f*. The result is, as indicated above, that in the drying step, the tube extension *e*, in contracting, shrinks first over the top of the body 12 and then over the top wall of the flange *f*, so that in the final structure when the assembly is removed or withdrawn from the mandrel, the resulting tube end 14 (see particularly Figs. 6 and 9) is spaced away from the rim 11 of the nipple flange. The thickness of the annular body 12 and, therefore, the width of the said space between the tube end 14 and the flange rim face 11, is such that subsequent contraction and shrinkage may take place uniformly along the whole length of the tube *t*, the shrinking at the nipple tube end being to a relaxed final condition without the introduction of any strains in the material.

In the preferred construction of the dispensing tube, the tube end extension *e* is clamped to the nipple flange *f*. This is done by providing a clamping disc *d*, as best shown in Figs. 6 and 9 of the drawing, which is threadably receivable by the threads of the tubular section of the nipple *n* and which may be screwed down into position to clamp the tube extension *e* between the disc and the nipple flange *f*, as is best depicted in said Figs. 6 and 9 of the drawing. After this is done, the closure cap *c* may be applied to the assembly.

The mandrels *m*, *m'*, etc., may be of a collapsible type, but I prefer to employ non-collapsible mandrels constructed with passages and orifices to permit the use of air jets to assist in the assembling of the parts and in the removing of the finished assembly. Each mandrel is, therefore, provided medially and longitudinally thereof with an air passage 15 having the upper terminal branches 16, 16 which open into the mandrel recess 13. These mandrels may be each mounted on the tapered stems 17, 17 formed or provided in the support *s*, the stems being orificed to provide the air passages 18, 18 which connect the air passages of the mandrels with a manifold passage 19 in the support *s* connectable to an airline 20. Preferably, the branch air passages 16, 16 terminate at their upper ends in the annular body 12 of the mandrel so that this body is interrupted or broken at the terminals of these passages, as is best seen in Fig. 2 of the drawing.

By means of this last recited construction, the wet tubes *t* may be slipped more readily on to the mandrels and the finished assemblies may be more readily withdrawn. When mounting a wet

or moist tube *t* over a mandrel, the user's hand is placed over the top open end of the tube *t* and the airline 20 is opened to permit a jet of air to pass gently through the air passages of the mandrel, exiting into the space between the mandrel and the interior wall of the wet tube. The wet tube is thereby gently urged to blown-out or distended condition, thereby enabling the same to be more readily slipped over the mandrel. In the drying operation, the tube, of course, shrinks and closely adheres to the surface of the mandrel. To remove or withdraw a finished assembly, the airline is again opened and the air passes upwardly through the mandrel passages and orifices as shown particularly by the wavy arrows in Fig. 9 of the drawing, causing the assembly to move upwardly as indicated by the linear arrow in this figure, until the assembly is completely withdrawn from the mandrel. To carry out these assisting operations with maximum ease, the mandrel may be constructed in the manner shown in Fig. 11 of the drawing. Here the mandrel *m*, in addition to being provided with the main medial air passage 15 and the top branch passages 16, 16, is provided along the body thereof with orifices 21, 21 leading from the main passage 15 to the outside cylindrical face of the mandrel. By means of these additional orifices, the wet or moist tube may be held in distended condition more efficiently and the entire assembly may be withdrawn with greater ease.

If desired, the top face of the flange *f* may be corrugated by the provision of the circular ridges 22, 22 and the underneath face of the disc *d* may be similarly corrugated so that the tube extension *e* may be the more securely clamped in position, as is best shown in Figs. 6 and 9 of the drawing. Also to assist the screwing down of the disc *d*, the top wall thereof may be knurled or ribbed as at 23. Also to prevent the nipple from rotating while either the disc *d* or the cap *c* is applied, the flange *f* may be provided at its underneath face with the teats 24, 24 which are adapted to take into or be seated in the upper terminal ends 25, 25 of the branch passages 16, 16 (see Fig. 9).

The method of making the dispensing tube of the present invention, the apparatus thereof, and the resulting dispensing tube structure and the various advantages thereof, will all in the main be fully apparent from the above detailed description thereof. The essential feature in the improvement in the method and apparatus resides in the provision of the displaceable body 12 between the rim face of the nipple flange and the immediately opposed part of the tube wall whereby, after the tube is dried on the mandrel and withdrawn therefrom, an annular space of sufficient width or radial depth is left between the upper tube end and the rim face of the nipple flange, as is most clearly depicted in Fig. 9 of the drawing, so that upon subsequent drying or aging of the assembly, the tube will maintain its cylindrical shape throughout the entire length of the structure, as is best shown in Fig. 10 of the drawing. Thereby a subsequent shrinkage may take place without the developing of any tensioned region at the nipple end of the tube, thus obviating tube fracture or puncture at this region and consequent spoilage and leakage. The resulting tube assembly depicted in Fig. 10 of the drawing may then be filled and sealed at the bottom in the usual way. By making the said displaceable body an integral part

of the mandrel form, a very desirable apparatus is produced which lends itself to the practicing of the method in the facile manner above described.

While I have described the method, apparatus and product of the invention in the preferred way and form, it will be understood that many changes may be made therein without departing from the spirit of the invention defined in the following claims.

I claim:

1. The method of making a non-metallic collapsible dispensing tube in which the tube is of a material which is swollen when wet and shrinks when dried and in which an end extension of the tube is attached to a dispensing nipple by being shrunk over the flange of the nipple during the drying of the tube, which consists in assembling the dispensing nipple and the wet and swollen tube with a displaceable body surrounding the nipple flange and disposed between the rim face of the nipple flange and the opposed part of the tube wall, the tube end extension projecting freely beyond said body and nipple flange, permitting the tube to dry during which the tube end extension shrinks bending over said body and the top wall of the flange for attachment to the flange, and in then withdrawing said body whereby the resulting tube end is spaced away from the rim of said nipple flange.

2. The method of making a non-metallic collapsible dispensing tube in which the tube is of a material which is swollen when wet and shrinks when dried and in which an end extension of the tube is attached to a dispensing nipple by being shrunk over the flange of the nipple during the drying of the tube, which consists in assembling the dispensing nipple and the wet and swollen tube with a displaceable body surrounding the nipple flange and disposed between the rim face of the nipple flange and the opposed part of the tube wall, the top face of said body being generally flush with the top wall of said flange, and the tube end extension projecting freely beyond said body and nipple flange, permitting the tube to dry during which the tube end extension shrinks bending over the top of said body and the top wall of the flange for attachment to the flange, and in then withdrawing said body whereby the resulting tube end is spaced away from the rim of said nipple flange.

3. The method of making a non-metallic collapsible dispensing tube in which the tube is of a material which is swollen when wet and shrinks when dried and in which an end extension of the tube is attached to a dispensing nipple by being shrunk over the flange of the nipple during the drying of the tube, which consists in assembling the dispensing nipple and the wet and swollen tube on a mandrel provided at its top with an annular body which fits between the rim face of the nipple flange and the opposed part of the tube wall, the tube end extension projecting freely beyond said body and nipple flange, permitting the tube to dry during which the tube shrinks onto the mandrel and the tube end extension shrinks bending over the top of said body and the top wall of the flange for attachment to the flange, and in then removing the assembly from the mandrel whereby the resulting tube end is spaced away from the rim of said nipple flange.

4. The method of making a non-metallic collapsible dispensing tube in which the tube is of a material which is swollen when wet and shrinks when dried and in which an end extension of the

tube is attached to a dispensing nipple by being shrunk over the flange of the nipple during the drying of the tube, which consists in assembling the dispensing nipple and the wet and swollen tube with a displaceable body arranged circumferentially between the rim face of the nipple flange and the opposed part of the tube wall, the tube end extension projecting freely beyond said body and nipple flange, permitting the tube to dry during which the tube end extension shrinks bending over the top of said body and the top wall of the flange for attachment to the flange, in then attaching the shrunk over extension to the nipple flange, and in then withdrawing said body whereby the resulting tube end is spaced away from the rim of said nipple flange.

5. A non-metallic collapsible dispensing tube comprising a tube of a material which is swollen when wet and shrinks when dried, a dispensing closure for said tube including a flanged nipple, the said tube in its dried condition having a main vertical wall and having an extension end which is bent horizontally over the top wall of the nipple flange and attached thereto, the end of the vertical wall of the tube immediately continuous with said bent over end extension being spaced away horizontally from the rim of the said nipple flange a distance to permit radial contraction and shrinkage of said end of the vertical wall of the tube to take place.

6. A non-metallic collapsible dispensing tube

comprising a tube of a material which is swollen when wet and shrinks when dried, a molded plastic dispensing closure for said tube including a flanged nipple, a clamping disc and a cap closure, the said tube in its dried condition having a main vertical wall and having an extension end which is bent horizontally over the top wall of the nipple flange and clamped between the flange and the said clamping disc, the end of the vertical wall of the tube immediately continuous with said bent over extension being spaced away horizontally from the rim of the said nipple flange a distance to permit radial contraction and shrinkage of said end of the vertical wall of the tube to take place.

7. A non-metallic collapsible dispensing tube comprising a tube of viscose material, said material being swollen when wet and shrinking when dried, a molded plastic dispensing closure for said tube including a flanged nipple and a clamping disc, the said tube in its dried condition having a main vertical wall and having an extension end which is bent horizontally over the top wall of the nipple flange and clamped between the flange and the clamping disc, the end of the vertical wall of the tube immediately continuous with said bent over extension being spaced horizontally away from the rim of the said nipple flange a distance to permit radial contraction and shrinkage of said end of the vertical wall of the tube to take place.

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