July 2, 1946. B. BOGOSLOWSKY 2,403,042

APPARATUS FOR MAKING COLLAPSIBLE TUBES

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Fig. 1.

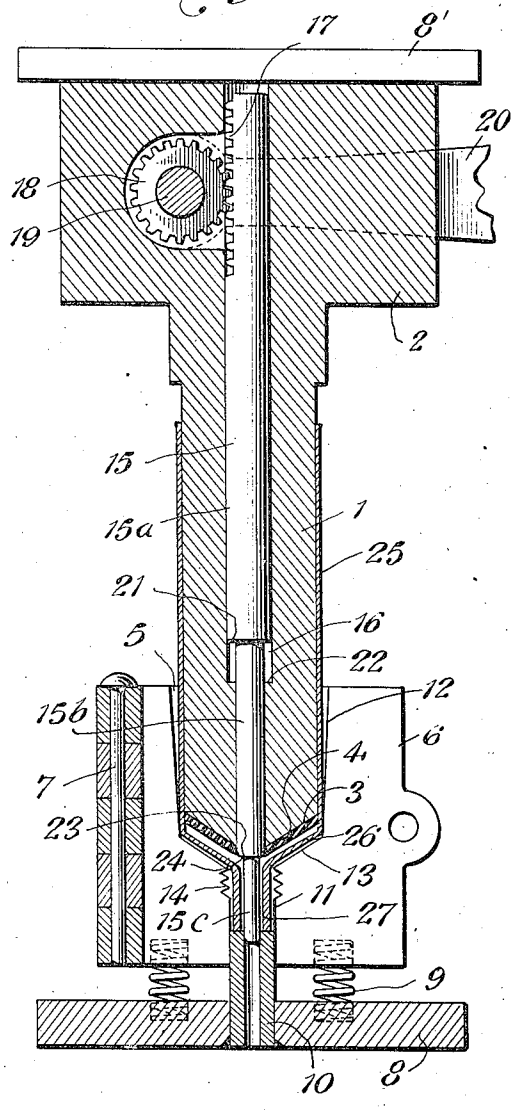
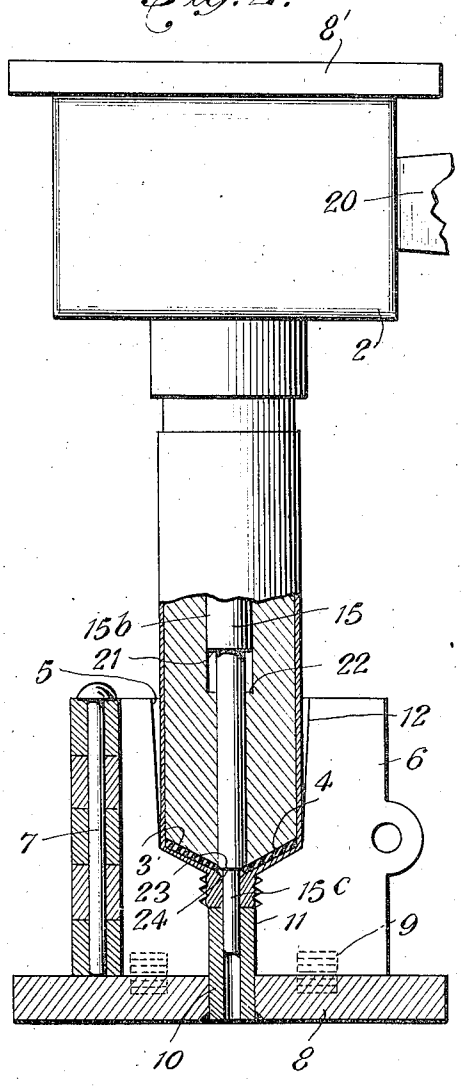


Fig. 2.



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Fig. 3.

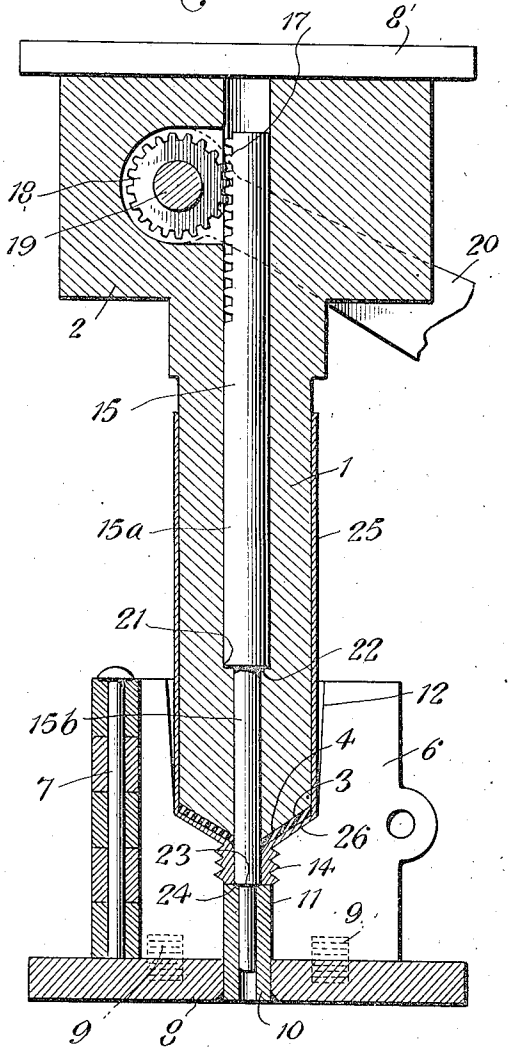


Fig. 4.

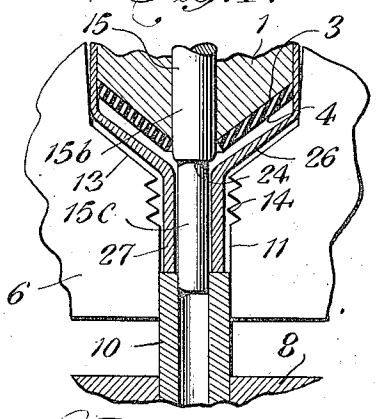


Fig. 5.

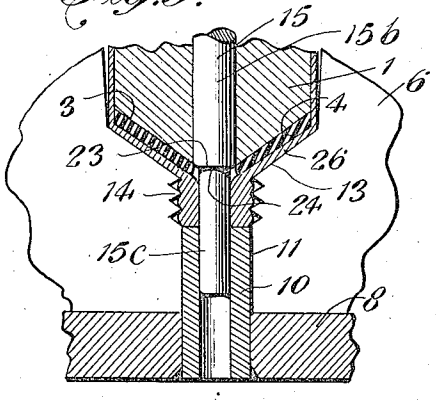
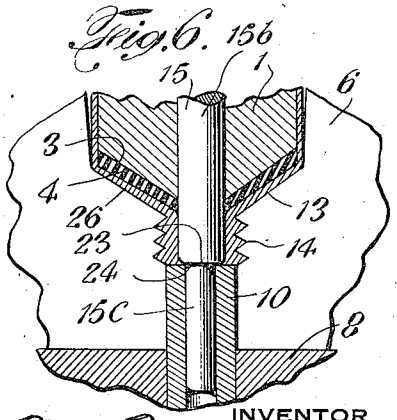


Fig. 6.



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APPARATUS FOR MAKING COLLAPSIBLE TUBES

Boris Bogoslowsky, Jackson Heights, N. Y.

Application August 10, 1944, Serial No. 548,895

8 Claims. (Cl. 93—36)

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This invention relates to methods and apparatus for making collapsible tubes.

In my copending application, Serial No. 473,322, filed January 23, 1943, I have described a method of making collapsible tubes in which a tubular blank is shaped to form an embryo tube having a shoulder and elongated neck integral with the tubular body, and in which the neck of the embryo tube is thereafter compressed to form a finished tube having a shortened, thickened neck of substantial strength and rigidity.

It is an object of the present invention to provide an improved method and apparatus for compressing the neck of an embryo tube to form a finished tube having a shortened, thickened neck of substantial strength and rigidity. The invention is particularly well adapted for use in cases where the neck is externally threaded to receive the customary threaded closure cap.

Other objects and advantages of the invention will appear hereinafter.

A preferred embodiment of the invention selected for purposes of illustration is shown in the accompanying drawings, in which,

Figures 1, 2 and 3 are similar front elevations, partly in section, showing successive stages of the method, Figure 1 showing the embryo tube placed in the forming apparatus, Figure 2 showing the first stage of the forming operation and Figure 3 showing the final stage.

Figures 4, 5 and 6 are enlarged fragmentary sectional views, showing the stages of Figures 1, 2 and 3, respectively, in somewhat greater detail.

Referring to the drawings, the apparatus comprises a cylindrical mandrel 1 having an enlarged upper portion 2 and a conical end surface 3, which said end surface is preferably covered by a gasket 4 of elastic material such as rubber. As shown in operating position, the mandrel projects into the cavity 5 in the die 6. In the preferred embodiment said die consists of two matching parts hinged together at 7, but only one of said parts is shown in the drawings.

The mandrel 1 and die 6 are located between opposed plates 8 and 8' of a suitable press, the die 6 being initially spaced from the press plate 8 by springs 9 as shown in Figure 1. The press plate 8 also carries a bushing 10 secured thereto in any suitable manner, as by welding, which said bushing extends into the lower end of the cavity 11 of the die which forms an extension of the larger cavity 5 before referred to.

The cavity 5 has slightly tapering walls 12 and the bottom of the cavity has a conical surface 13 adapted to cooperate with the conical end

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surface 3 of the mandrel to apply pressure to the shoulder of the tube. The upper part of the smaller cavity 11 is internally threaded at 14 for purposes hereinafter described.

A spindle 15 extends through the axial bore 16 of mandrel 1, said spindle having a portion 15a provided with rack teeth 17 adapted to cooperate with the teeth of pinion 18 mounted in the enlarged upper portion of the mandrel, the said pinion being secured to a shaft 19 adapted to be rotated in any suitable manner, as by a lever 20. The portion 15a of the spindle terminates in a shoulder 21 adapted to engage the shoulder 22 of the bore of the mandrel to limit the axial travel of the spindle.

Below the shoulder 21 the spindle has a portion 15b of reduced diameter which terminates in a shoulder 23 having smoothly rounded edges 24. Below the shoulder 23 the spindle has a portion 15c of additionally reduced diameter which projects into the center bore of the bushing 10.

In the operation of the apparatus, an embryo tube 25 of any suitable material, and roughly shaped in any suitable manner, as for example, by the method described in my copending application before referred to, to provide a shoulder 26 and an elongated tubular neck 27 integral with the tubular body, is placed on the mandrel 1 and the two pieces of the die 6 are closed around the mandrel and the tube with the elongated neck projecting into the cavity 11, as shown in Figures 1 and 4. The shoulder and neck of such an embryo tube will consist of overlapping plies of folded material which are subjected to pressure in the manner hereinafter described to form a finished tube.

For this purpose, pressure is first applied through the press plates 8 and 8' to cause the parts to assume the positions shown in Figures 2 and 5. Under these conditions, the shoulder 26 is subjected to pressure between the surfaces 3 and 13, which said pressure is cushioned, however, by the gasket 4 which accommodates itself to the irregularities of the folds and plies of the shoulder, thus tending to equalize the pressure and thereby minimizing any tendency to rupture the folded material of the shoulder. At the same time, the elongated neck 27 is subjected to longitudinal pressure by the bushing 10 to compress the neck material into the upper portion of the cavity 11, thus shortening and thickening the same. It is to be noted, however, that due to the springs 9, which should be relatively stiff, the shoulder 26 of the tube is gripped tightly between the opposed surfaces 3 and 13 of the man-

drel and die respectively, as soon as pressure is applied through the press plates 8, 8', thus confining the elongated tubular neck in the cavity 11 while longitudinal pressure is applied to the neck to shorten and thicken the same. The final forming pressure is applied to the shoulder after the springs 9 have been compressed and the press plate 8 is in contact with the die 6.

Then, while continuing to apply pressure through the press plates 8 and 8', the spindle 15 is moved to the position shown in Figures 3 and 6 by operation of the lever 20. This subjects the material of the neck to additional compression, but the compressive force is exerted radially through the internal wall of the neck, thus causing the neck material to expend radially into the threads 14 of the die cavity to increase the density of the tubular neck, and to increase the perfection of the thread formation of the neck by forcing the material laterally into the threads of the die.

After longitudinal and radial pressures have been thus applied, the plunger 15 is raised, the pressure applied through the press plates 8, 8' is relaxed, the die 6 is opened and the finished tube may be removed from the mandrel.

In many cases, the application of pressure alone is sufficient to compress the overlapping folds of the shoulder and neck so tightly as to resist subsequent separation of the folds, and to maintain the conformation of the shoulder and the threaded neck during ordinary usage of the tube. However, when using thermoplastic or heat sealing materials, the die 6 and/or the plunger 15 may, if desired, be heated in any suitable manner, as by electrical heating elements, with provision for temperature control at the required level for sealing the selected material, and with provision for cooling the die and/or plunger prior to removing the finished tube from the die.

It will be understood that the invention may be variously modified and embodied within the scope of the subjoined claims.

I claim as my invention:

1. Apparatus for making a finished collapsible tube from an embryo tube having a tubular body and a shoulder and elongated tubular neck integral with said tubular body, comprising a mandrel adapted to support said embryo tube internally, means for pressing the shoulder of the tube against said mandrel, means for applying longitudinal pressure to said neck to compress the neck material and shorten and thicken the neck while maintaining the pressure on the shoulder, and means for applying internal radial pressure to said neck to additionally compress the neck material.

2. Apparatus for making a finished collapsible tube from an embryo tube having a tubular body and a shoulder and elongated tubular neck integral with said tubular body, comprising means including opposed surfaces, at least one of which is lined with elastic, yielding material for applying pressure to said shoulder, means for applying longitudinal pressure to said neck to compress the neck material and shorten and thicken the neck, and means for applying internal radial pressure to said neck to additionally compress the neck material.

3. Apparatus for making a finished collapsible tube from an embryo tube having a tubular body and a shoulder and elongated tubular neck integral with said tubular body, comprising, a mandrel adapted to support said embryo tube internally, a die having a large cavity adapted to receive the end of said mandrel while supporting said tube and a smaller cavity adapted to receive the elongated tubular neck of the tube supported on said mandrel, said smaller cavity having a threaded portion adjacent said larger cavity, means for applying longitudinal pressure to said elongated neck to shorten and thicken the same and confine the same in the threaded portion of said cavity, and means for applying internal radial pressure to said neck to additionally compress the same and force the neck material laterally into the threads of the cavity.

4. Apparatus for making a finished collapsible tube from an embryo tube having a tubular body and a shoulder and elongated tubular neck integral with said tubular body, comprising, a mandrel adapted to support said embryo tube internally, a die having a large cavity adapted to receive the end of said mandrel while supporting said tube and a smaller cavity adapted to receive the elongated tubular neck of the tube supported on said mandrel, said mandrel and said die cavity having opposed surfaces lying on opposite sides of the shoulder of the embryo tube therebetween, a tubular bushing extending into the open end of said smaller cavity, a plunger extending axially through said mandrel and having a portion of reduced diameter extending through said smaller cavity and through said elongated tubular neck into said tubular bushing, means for applying pressure to said mandrel and die to grip the tube shoulder between said opposed surfaces and to cause said bushing to compress the elongated neck to shorten and thicken the same, and means for moving said plunger longitudinally to force the larger portion into said neck to apply internal radial pressure to additionally compress the same.

5. Apparatus for making a finished collapsible tube from an embryo tube having a tubular body and a shoulder and elongated tubular neck integral with said tubular body, comprising, a mandrel adapted to support said embryo tube internally, a die having a large cavity adapted to receive the end of said mandrel while supporting said tube and a smaller cavity adapted to receive the elongated tubular neck, means including a pair of press plates to apply pressure to said mandrel and die, one of said parts being spaced from one of said press plates by a spring which is compressed as pressure is applied.

6. Apparatus for making a finished collapsible tube from an embryo tube having a tubular body and a shoulder and tubular neck integral with said tubular body, comprising, a mandrel adapted to support said embryo tube internally, a die having a large cavity adapted to receive the end of said mandrel while supporting said tube and a smaller threaded cavity adapted to receive the tubular neck of the tube supported on said mandrel, and means for applying internal radial pressure to said neck to compress the neck material and force the same laterally into the threads of the cavity.

7. Apparatus for making a finished collapsible tube from an embryo tube having a tubular body and a shoulder and tubular neck integral with said tubular body, comprising, a mandrel adapted to support said embryo tube internally, a die having a large cavity adapted to receive the end of said mandrel while supporting said tube and a smaller threaded cavity adapted to receive the tubular neck of the tube supported on said mandrel, a plunger extending axially through said mandrel and having a portion of reduced diam-

eter extending through said smaller cavity and through said tubular neck, and means for moving said plunger longitudinally to force the larger portion into said neck to apply internal radial pressure to said neck to compress the neck material and force the same laterally into the threads of the cavity.

8. Apparatus for making a finished collapsible tube from an embryo tube having a tubular body and a shoulder and tubular neck integral with said tubular body, comprising, a mandrel adapted to support said embryo tube internally, a die

having a large cavity adapted to receive the end of said mandrel while supporting said tube and a smaller threaded cavity adapted to receive the tubular neck of the tube supported on said mandrel, means for applying longitudinal pressure to said elongated neck to shorten and thicken the same, and means for applying internal radial pressure to said neck to compress the neck material and force the same laterally into the threads of the cavity.

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