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2,431,537

METHOD AND APPARATUS FOR MAKING END CLOSURES FOR TUBULAR CONTAINERS

Filed Jan. 25, 1945

2 Sheets-Sheet 1

Fig. 1.

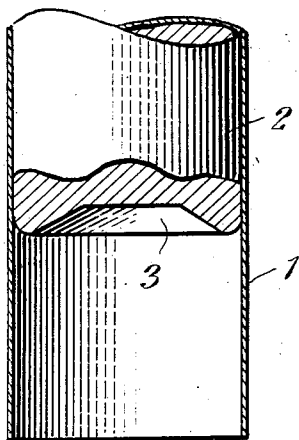


Fig. 2.

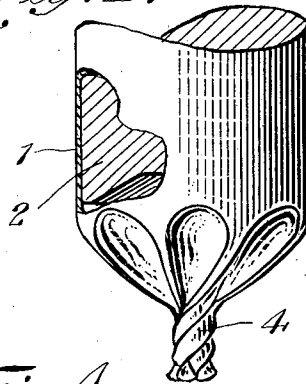


Fig. 4.

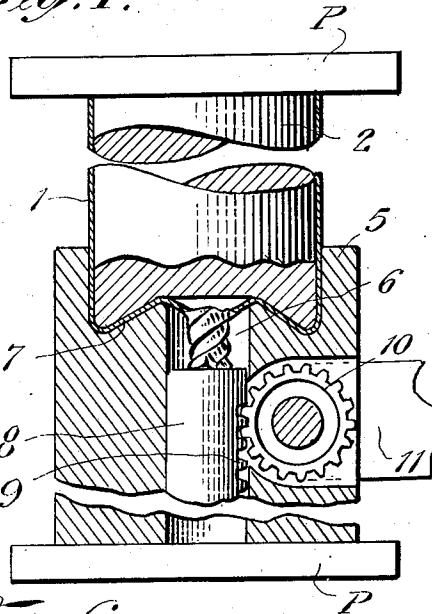


Fig. 3.

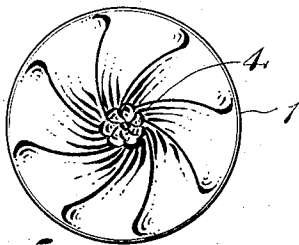


Fig. 5.

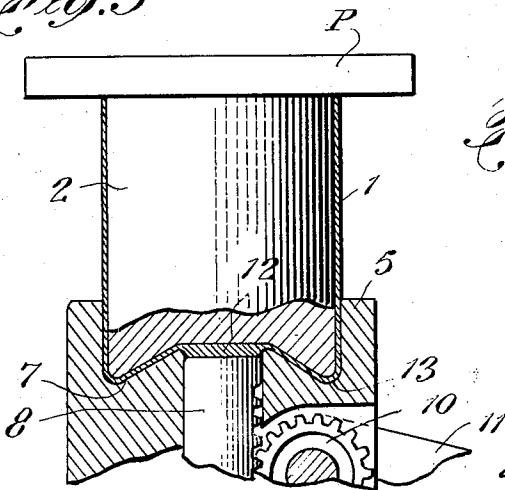
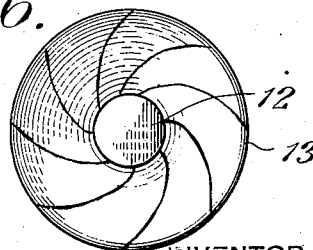


Fig. 6.



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2 Sheets-Sheet 2

Fig. 7.

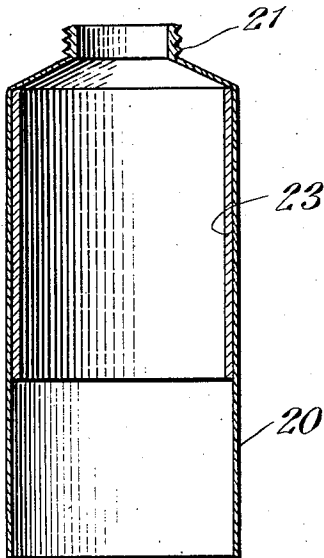


Fig. 8.

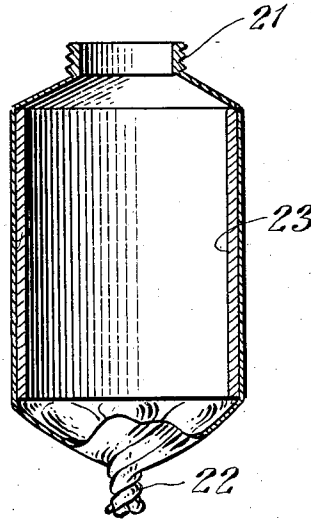


Fig. 9.

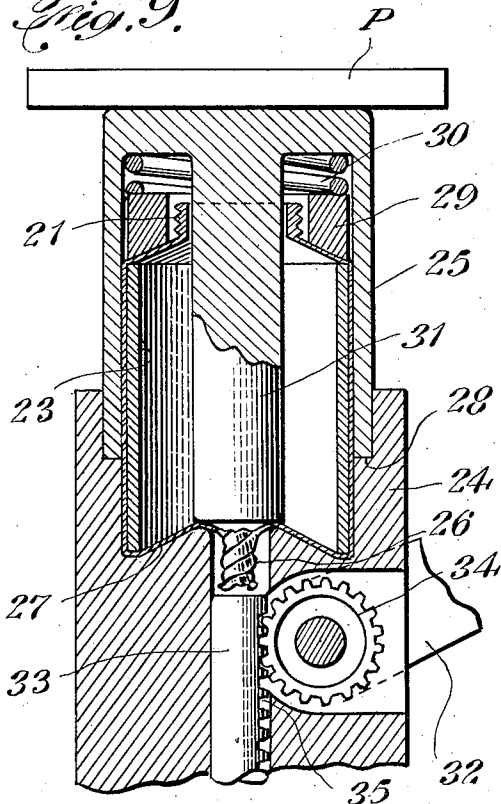
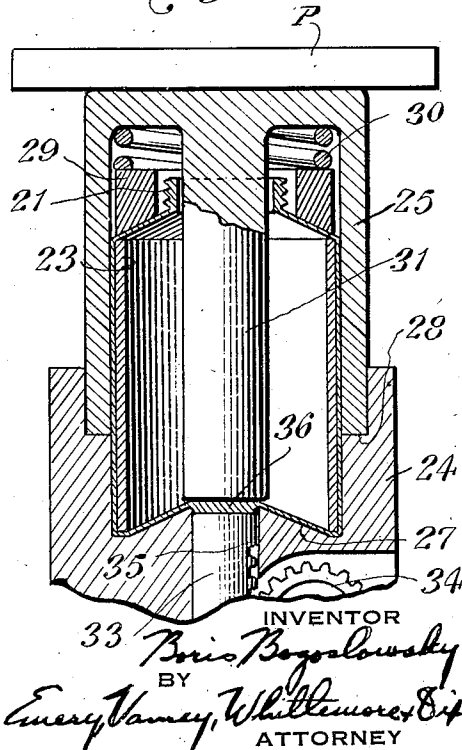


Fig. 10.



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METHOD AND APPARATUS FOR MAKING
END CLOSURES FOR TUBULAR CON-
TAINERS

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6 Claims. (Cl. 93-36.8)

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This invention relates to closures for tubular containers, and to methods and apparatus for making same.

It is an object of the present invention to provide a closure for a tubular container, which said closure is formed by proper manipulation of the tubular material, whereby the closure is integral with the tubular material. It is a further object of the invention to provide a closure which can be made quickly and cheaply, and which is strong and leak-proof.

It is a further object of the invention to provide methods and apparatus for making such closures.

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

Figure 1 is a front elevation partly in section showing the tubular blank on the mandrel.

Figure 2 is a similar view showing the preforming operation.

Figure 3 is a bottom plan view of Figure 2.

Figures 4 and 5 are front elevations, partly in section of the forming die, showing two stages of the forming operation.

Figure 6 is a bottom plan view of the finished closure.

Figure 7 is a longitudinal section of a modified form of tubular blank.

Figure 8 is a similar view showing the preforming operation.

Figures 9 and 10 are longitudinal sections showing the forming die, showing two stages of the forming operation.

Since the nature of the closure may be understood to best advantage by considering the methods of making the same, such methods will be first described, with such incidental reference to the nature of the closure as may be required.

In making such closures, I start with a tubular blank of any desired length and diameter, depending on the size of the container to be formed. Such tubular blanks may be formed from flat sheet material, either by convolute or spiral winding, or may be formed by extrusion of suitable plastic materials.

Many different types of materials are suitable for the purpose, including many of the plastic films or sheets now available in the commercial market, as for example cellulose base films such as the commercial products "Cellophane," or resin base films such as the commercial product "Vinylite." Other materials such as paper or

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metal foil may also be used successfully, and coated or laminated materials are especially useful for some purposes. For example, aluminum foil coated on both sides with Vinylite (vinyl ester resin) is an excellent material for use in containers for liquids, or in containers for dry materials which must be protected from moisture. The selection of a particular material or combination of materials will depend on the nature of the product to be contained, the important requirements, as far as the present invention is concerned, being that the material be reasonably strong and flexible and capable of being bent or folded without cracking.

A simple form of the invention is illustrated in Figures 1 to 6, in which the closure is formed in one end of the tubular blank, the other end being left open or closed subsequently in any desired manner. As shown in Figure 1, the tubular blank 1 is placed on a mandrel 2, preferably having a depression 3 formed in one end thereof. One end of the blank is allowed to protrude beyond the end of the mandrel, and as the first step of the method, the protruding end portions of the blank are folded inwardly and are then twisted together to form an elongated twisted neck 4 projecting outwardly from the end of the blank substantially coaxially therewith. This folding and twisting operation may be easily performed by hand or it may be performed mechanically, as for example, by means of the apparatus disclosed in my copending application Serial No. 567,267, filed December 8, 1944, with or without the use of the central spindle described therein.

It will be observed that the foregoing operation is in the nature of a preforming operation in that it roughly shapes the end of the tubular blank and prepares the material for subsequent operations which complete the closure. Accordingly, after the blank is so preformed, the end of the mandrel carrying the preformed blank is inserted in the cavity of a die 5 having a central passage 6 adapted to receive the elongated neck 4 and having a surface 7 conforming substantially to the shape of the depression 3 in the end of the mandrel. Longitudinal pressure is then applied to the mandrel and die, as by placing the same in a press, indicated diagrammatically by P, to cause the end surface of the mandrel to close the upper end of the passage 6, and to lock the tubular blank firmly in position for the next succeeding operation. Such pressure also presses the folds of the material which now constitutes the end wall, i. e. that lying between the tubular

wall and the neck, thus smoothing said folds and improving their appearance.

Mounted in the passage 6 of the die is a plunger 8 having rack teeth 9 adapted to engage the pinion 10 which may be rotated by lever 11 to move the plunger along the passage. Thus, while continuing to apply longitudinal pressure to the mandrel and die, the plunger is moved upwardly to apply heavy pressure to the material of the neck 4 which is confined in the closed end of the passage 6. Such pressure reforms and compresses the twisted material of the neck to form a relatively short "button" 12 of compressed material which is tightly sealed by the pressure applied. Said button has a thickness substantially in excess of the thickness of the tubular wall, and is compressed and compacted into a mass of substantial strength and rigidity. In the preferred embodiment illustrated said button protrudes outwardly somewhat, but the depression 3 in the end of the mandrel is preferably of a depth equal to or greater than the thickness of the button, so that in the finished closure the bottom of the button is flush with or recessed within the bottom rim 13 of the container, so that the container may stand upright on a flat surface. Alternatively, however, the mandrel may be recessed, in which case the compressed button protrudes inwardly somewhat.

I have found that the material of the neck may be sufficiently compressed by pressure alone to provide a button in which the folds of the material are so tightly compacted as to form a leak proof closure. In this connection, it will be noted that all of the end edges of the tubular blank are collected together during the preforming operation and are located within the twisted neck structure, so that when this structure is subjected to pressure, as described, all of the passages through which leakage might otherwise occur are effectively closed.

However, in cases where the tubular blank consists of or includes thermoplastic materials, the invention does not preclude the use of heat in addition to pressure to heat seal such thermoplastic material, if desired. For example, heat may be applied in the region of the button only, as by heating the plunger 8, or if it is desired to heat seal the folds which extend inwardly from the rim of the container to the button, the end of the mandrel or the surface 7 of the die, or both, may be heated.

In Figures 7 to 10, I have illustrated the invention as it may be applied to the provision of an end closure for a tubular blank 20 in which the opposite end has been previously provided with a shoulder and a somewhat constricted dispensing neck 21 adapted to receive a closure cap. Such shoulder and neck may be formed in any desired manner, as for example, by the methods and apparatus disclosed in my copending applications Serial No. 550,238, filed August 19, 1944, or Serial No. 548,895, filed August 10, 1944. In such cases, it is not possible to place the tubular blank on a mandrel, as previously described, and while the method employed in forming the closure is essentially the same as that previously described, the apparatus used in carrying out the method must be adapted to the absence of said mandrel.

Thus, as before, the first step of the method is to fold the end portions of the tubular blank 21 inwardly, and then to twist them together to form an elongated neck 22. Preferably, in order to be able to form a smooth rim, a tubular member 23 is inserted within the tubular blank prior to the

folding operation so that the end edges of the tubular member may define the fold line of the rim when the end portions of the tubular blank are folded inwardly.

Such tubular member may conveniently be allowed to remain in the finished container, in which case it provides increased strength and rigidity for the tubular wall, and in cases where such tubular member is to be allowed to remain in the finished container, the material of the tubular member may be selected with reference to the contents of the container. Thus, if the container is to be used to package dry material such as coffee, for example, the tubular member might be made of cardboard or paper. On the other hand, if the container is to be used to package a liquid, a material should be selected which is not affected by and which does not itself affect such liquid.

Alternatively, the tubular member may, if desired, be removed from the container after it is completed. In this case a tubular member of resilient material such as thin spring steel wound in convolute form may be employed. After the container is completed, such a tubular member may be collapsed and withdrawn through the dispensing neck previously referred to.

After the tubular blank has been preformed in the manner described, it is inserted in a die set comprising a lower block 24 and an upper block 25. The block 24 has a central passage 26 adapted to receive the elongated neck 22 and has a surface 27 shaped to give the desired depressed conformation to the bottom end wall of the container. The upper block 25 comprises a tubular portion which fits into an annular groove in the upper portion of the block 24, so that when the die parts 24, 25 are brought together, as shown in Figure 9, the end of the tubular portion rests against the shoulder 28.

The die block 25 also contains an annular ring 29 having a surface which conforms to the shape of the upper end of the tubular blank and is held in yielding engagement therewith by means of a spring 30 which is placed under compression when the die blocks 24, 25 are brought together, thus applying controlled pressure to the tubular wall, and causing the lower rim of the wall to seat against the bottom of the die cavity. The die block 25 is also provided with a centrally located longitudinal spindle 31 of a diameter small enough to enter the dispensing neck 21, but of a diameter and length sufficient to tightly close the end of the passage 26 when the die blocks are brought together.

After the die blocks are brought together as shown in Figure 9, longitudinal pressure is applied to the die set as by placing the same in a press, to lock the tubular blank firmly in position. Then heavy pressure is applied to the material of the neck, as previously described, using the lever 32 to operate the plunger 33 through pinion 34 and rack teeth 35 as before. As previously described, such pressure reforms and compresses the material to form a "button" 36 of compressed material of the nature previously described.

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. The method of making an end closure for a tubular container which comprises preforming the end portions of a tubular blank to form an end wall and a neck protruding outwardly therefrom with all of the end edges of said blank

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collected together in said neck, and applying pressure to said neck longitudinally thereof to compress and compact the same to form a button of substantial strength and rigidity.

2. The method of making an end closure for a tubular container which comprises preforming the end portions of a tubular blank to form an end wall and a neck protruding outwardly therefrom with all of the end edges of said blank collected together in said neck, confining said neck in a die passage, applying pressure to the portions of said end wall surrounding said die passage, and then applying pressure to said twisted neck to compress and compact the same to form a button of substantial strength and rigidity.

3. The method of making an end closure for a tubular container which comprises folding the end portions of a tubular blank inwardly, twisting said inwardly folded portions together to form an elongated twisted neck, and applying pressure to said twisted neck longitudinally thereof to compress and compact the same to form a button of substantial strength and rigidity.

4. The method of making an end closure for a tubular container which comprises folding the end portions of a tubular blank inwardly, twisting said inwardly folded portions together to form an elongated twisted neck, confining said neck in a die passage, applying pressure to the portions of said blank surrounding said die passage, and then applying pressure to said twisted neck to compress and compact the same to form a button of substantial strength and rigidity.

5. Apparatus for making an end closure for a tubular container from a tubular blank having a preformed end portion consisting of an end wall and a neck protruding axially therefrom,

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comprising, in combination a die block having a cavity adapted to receive said preformed end portion and a passage adapted to receive said neck, means to close one end of said passage to confine said neck therein, and means to apply pressure to the confined neck to reform and compress the same.

6. Apparatus for making an end closure for a tubular container from a tubular blank having a preformed end portion consisting of an end wall and a neck protruding axially therefrom, comprising, in combination, a die block having a cavity adapted to receive said preformed end portion and a passage adapted to receive said neck, a second die block adapted to receive the other end of said tubular blank, said second die block carrying a member extending through said tubular blank and closing one end of said passage to confine said neck therein, and means to apply pressure to the confined neck to reform and compress the same.

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