April 14, 1959 D. C. MADDUX 2,881,727

TUBE END CLOSING APPARATUS

Filed Sept. 2, 1954

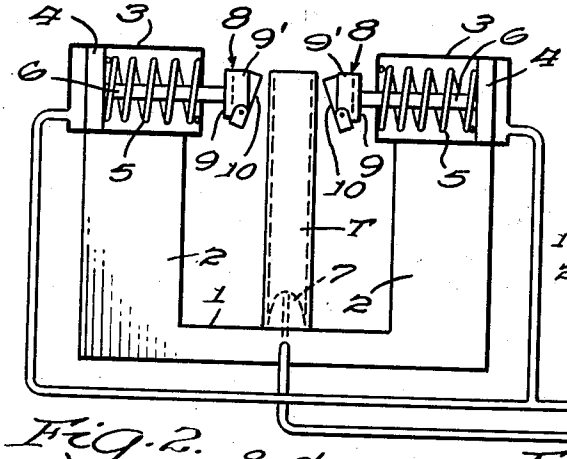
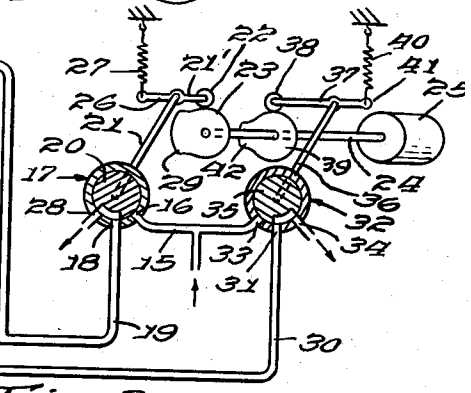


Fig. 1.



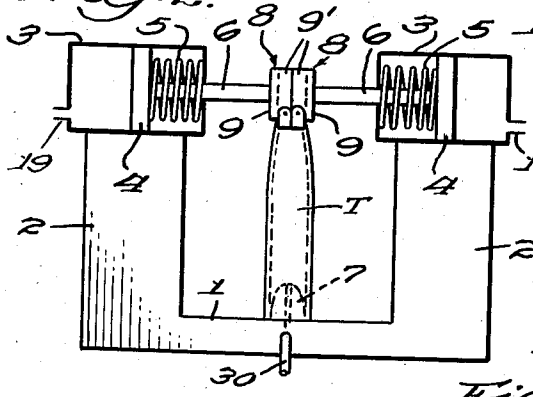


Fig. 2.

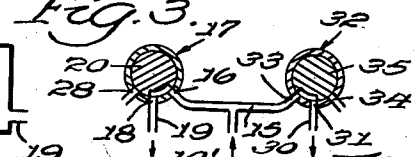


Fig. 3.

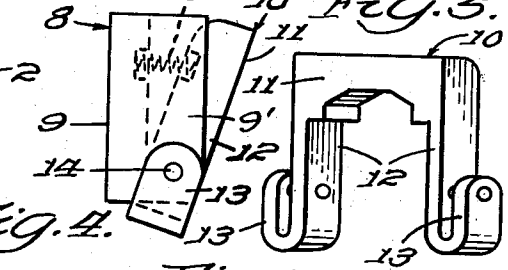


Fig. 5.

Fig. 4.

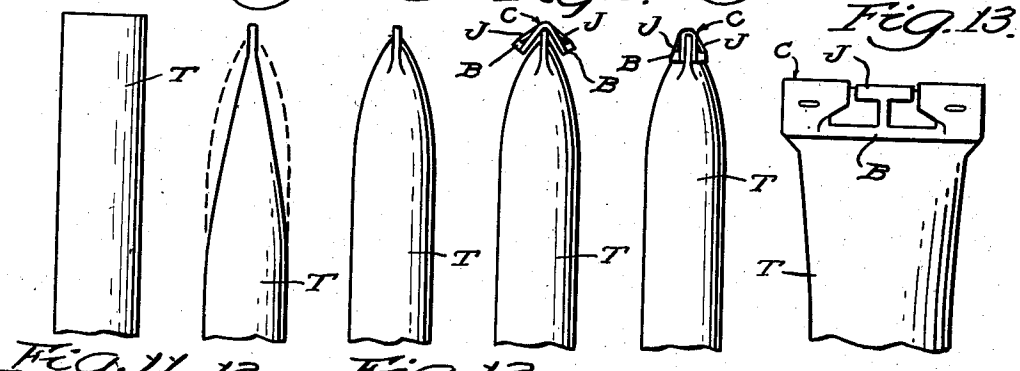


Fig. 6. Fig. 7. Fig. 8. Fig. 9. Fig. 10. Fig. 13.

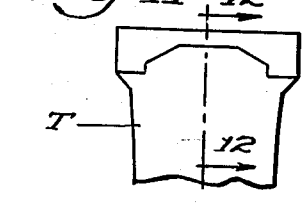


Fig. 11.

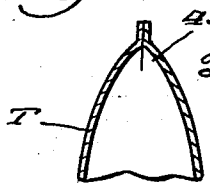


Fig. 12.

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TUBE END CLOSING APPARATUS

Duane C. Maddux, Burbank, Calif.

Application September 2, 1954, Serial No. 453,905

7 Claims. (Cl. 113—44)

This invention relates to closures of the self sealing type used on collapsible tubes and more particularly to a method and means for preparing such tubes for the application of such closure means.

In the pending application of Duane C. Maddux, Ser. No. 363,136, filed June 22, 1953, now abandoned, there is disclosed an improved form for a self sealing, clip-type closure means which, as shown in that application, is intended to be applied to the end of a tube after the tube has been filled. Subsequent experiments have demonstrated that this closure means may be more efficiently used if applied to the tube before filling, leaving the closing after filling to be performed on the existing equipment for that operation. This requires that the tube be open at both ends before starting the filling and closing operation. Under the method proposed by this invention, the tube is extruded from a slug of metal and the tube end which normally is formed to receive the screw cap closure is formed flat and is cut off leaving the tube open at both ends and the present invention is concerned with the closure of the first of these ends prior to the filling of the tube. Economies reside in the re-use of the cut off ends of the tubes and in the elimination of the drilling, threading and providing of the screw cap. The invention also contemplates the use of tubes produced by continuous extrusion.

Under the disclosure of the said prior application, the closing and filling equipment would require radical changes to accommodate the self-sealing closure, but as here proposed, the existing equipment can still be employed with only minor adaptation to accommodate the changed tube end form.

Under the present proposed method, when first tried out, it was found that applying the closure-forming clip of the said prior application to an empty tube resulted in the flattening of the walls of the tube to an extent that reduced the internal space as much as one third. The present invention is directed to a means and method for retaining the interior of the tube in such form that the fullest capacity thereof can be realized after applying the self-sealing closure means of the said prior application.

Accordingly, the principal object of the invention is to provide a method whereby self-sealing closure means of the clip type may be applied to empty collapsible tubes with retention of the maximum attainable internal capacity of the end of the tube so closed.

Another object of the invention is to provide means for preforming the end of an empty collapsible tube for subsequent application of a clip-type, self-sealing closure means whereby the preformed end of the tube is maintained in a shape assuring the maximum attainable internal capacity.

Still another object of the invention is to provide a tube end preforming means for accomplishing the said objective which is simple and reliable and which is capable of operating at high rates of production with resultant economy of operation essential to meet competitive costs.

With the foregoing objects in view, together with such additional objects and advantages as may subsequently appear, the invention resides in the hereinafter disclosed method and in the provision of means for the performance of the method described, by way of example, in the following specification, reference being had to the accompanying drawings which form a part of said specification and in which drawings:

Fig. 1 is a side elevation shown in semi-schematic form of an organized apparatus for performing the method of the invention; the parts thereof being shown in the position at the start of the operation,

Fig. 2 is a similar view of the tube engaging portion of the apparatus showing the tube engaged and expanded,

Fig. 3 is a view showing the position of the operating valves when the apparatus is in the position shown in Fig. 2,

Fig. 4 is an enlarged side elevation of one of the tube engaging head assemblies with the parts thereof in the position shown in Fig. 1,

Fig. 5 is a perspective view of one of the tube engaging jaws,

Figs. 6, 7 and 8 are fragmentary edge elevations of a tube showing the formation of the end thereof incident to the method of the application preparatory to affixing a self-sealing closure element thereto,

Fig. 9 is a view similar to Figs. 6, 7 and 8 showing the first step of applying the closure element to the tube after being preformed by the method and apparatus of the present invention,

Fig. 10 is a view similar to Fig. 9 but showing the closure clip element as finally applied to the tube,

Fig. 11 is a side elevation of the tube when formed as shown in Fig. 8,

Fig. 12 is a medial sectional view on the line 12—12 of Fig. 11, and

Fig. 13 is a side elevation of the finally closed end of the tube.

The method and apparatus relate to the preforming of the end of an empty collapsible tube formed of soft metal (such as is used for toothpaste, ointments, toilet creams and the like commodities) for the application of a self-sealing closure element of the type disclosed in the said application. Such closure elements comprise a piece of metal C bent into a wide V-shape as shown in Fig. 9 adapted to fit over the previously flattened end of a tube and to be then bent to become clamped thereto as shown in Figs. 10 and 13. The clip element includes spring jaw elements J which yieldingly press against the sides of the center portion of the edges of the tube and hold them in contact with each other to prevent the escape of the tube contents except in response to internal pressure derived from squeezing the tube sufficiently to force a portion of the contents past the tube edges contacted by the jaws J. This clip element forms no part of the present invention and is here described only sufficiently to facilitate an understanding of the invention.

The illustrated apparatus for performing the method is intended merely to show one way of achieving the desired result and comprises a base 1 having spaced upstanding members 2, 2, each of which supports one of a pair of opposed, axially aligned cylinders 3; each of said cylinders having a piston 4 normally moved to the closed end of the cylinder by a spring 5 and having a piston rod 6 projecting from the end thereof adjacent the opposite cylinder. Mounted on the base 1 midway between the cylinders is a tapered nozzle element 7 of a base size that closely engages the inner diameter of the tube T and the nozzle element is located a sufficient distance below the piston rods 6, 6 so that the clamping and forming jaw assemblies 8, 8 carried by the piston rods will properly engage the opposite end of the tube as will now be explained.

Each jaw assembly 8 includes a head element 9 of rectangular configuration fixed to the piston rod 6 and

at each side thereof is provided with a forwardly projecting flange 9'. Pivotally mounted on and fitting between flanges 9' of each head 9 is a jaw member 10 including a tube engaging face portion 11 having a lower outline corresponding to the configuration of the lower edge of the clip when applied to the tube and a pair of depending arms 12, 12 which extend along the adjacent inner faces of the flanges 9' of the head element and then turn up along the outer faces thereof as at 13, 13. Hinge pins 14 serve to mount the jaw element on the arms 9. The pivot pins are so located that the jaw element may rest flat against the outer face of the head element as shown in full lines in Figs. 2 and 4, and the clearance between the lower face of the arms 9 and the return bend forming the extensions 13, 13 serves to limit the extent to which the jaw element may pivot forward as shown in Fig. 1, and in broken lines in Fig. 4. A spring 10' interposed between the jaw element and the head 9 serves to cushion the initial contacts with the jaws with the tubes.

The actuating means for the pistons in the cylinders comprises a compressed air source (not shown) connected by a line 15 to a port 16 of a three-way valve 17 and another port 18 of said valve is connected to a line 19 which is manifolded to connect to each cylinder 3 so that the air will move the pistons in opposition to the springs 5, 5.

The valve 17 includes an oscillatable valve member 20 connected to one end of a rock shaft 21 and the opposite end of the rock shaft carries an arm 21' extending radially therefrom and carrying a roller 22 at the free end thereof which engages the periphery of a rotatable cam 23 carried by a shaft 24 which may be driven from any source of power by a pulley 25. The arm 21' includes an extension 26 connected with one end of a suitable spring 27 effective to maintain the roller in contact with the cam 23. The major portion of the surface of the cam 23 is coaxially disposed with respect to the axis of the shaft 24 and this allows the spring 27 to move the valve to the position shown in Fig. 1 with the port 18 connected to a port 28 which is open to atmosphere. The cam surface is interrupted by a lobe 29 of sufficient height to cause the rock shaft to move the valve to interconnect the ports 16 and 18 with resultant admission of pressure to the cylinders 3, 3 and movement of the jaw assemblies to each other. When the lobe passes beyond the roller, the spring 27 will return the valve to interconnect the ports 18 and 28 and the springs 5, 5 will retract the pistons and jaw assemblies.

The nozzle 7 is connected by a line 30 with a port 31 of a three-way valve 32 having another port 33 connected to the pressure source, a third port 34 open to atmosphere and an oscillatable valve member 35 movable between a position interconnecting the ports 31 and 34 and another position interconnecting the ports 31 and 33. The valve member 35 is connected to one end of a rock shaft 36 which at its other end carries a radially extending arm 37 terminating in a roller 38 maintained in engagement with the periphery of a cam 39 by a spring 40 connected to an extension 41 of the arm 37. The cam 39 is fixed to the rotatable shaft 24 and includes a major portion of its surface disposed in coaxial relation to the axis of the shaft 24 and a lobe 42 of sufficient height to cause the rock shaft 36 to move the valve to connect the ports 31 and 33 with resultant admission of pressure to the nozzle 7; the remainder of the cam surface being sufficiently low to allow the spring 40 to move the rock shaft and valve member to interconnect the ports 31 and 34.

The cams 23 and 39 are so proportioned and so arranged on the shaft 24 that upon rotation of the shaft, the valve 17 will first connect the cylinders 3 to pressure, then the valve 32 will admit pressure to the nozzle 7, then the valve 32 will connect the nozzle 7 to atmosphere and finally, the valve 17 will connect the cylinders 3, 3 to atmosphere allowing the springs to retract the jaw assemblies after which, the said cycle of operations will be repeated.

In practice and assuming that the pressure is being supplied and the shaft 24 is being rotated, the operator will place a tube such as shown in Fig. 6 on the nozzle 7 while the jaw assemblies are retracted with the opposite end of the tube disposed in the path of movement of the jaw assemblies. As pressure is applied to the cylinders by the movement of the valve 17 the jaw assemblies move toward each other and clamp the end of the tube therebetween and flatten it as shown in Fig. 7. As the tube is thus held, the admission of pressure through the nozzle 7 by the valve 32 expands the walls of the tube which on engagement by the jaw assemblies have been flattened, and this expansion causes the walls to assume the form shown in broken lines in Fig. 7 and in full lines in Fig. 8. As soon as this occurs, the nozzle 7 is disconnected from the pressure source and then the cylinders are disconnected from the pressure source allowing the formed tube to be removed and replaced by the next tube to be processed while the shaft 24 is moving the cams into position for the next cycle.

After completion of the above process the closure clip is applied and the tube inverted and filled and then permanently closed by flattening the end and folding it on itself and securing the folded end with a clip. The filling and closing can be performed on the automatic equipment presently employed for that purpose.

The above method and apparatus serves another important and useful function in addition to the expanding of the tube to obtain maximum internal capacity. As shown in the said application of Duane C. Maddux, the closure jaws J of the clip C are of T-shape with the stem portions thereof connected to bar portions B of the clip which are bowed outwardly from the planes of the end portions of the clips to provide a throat portion 43 in the tube leading to the portion of the tube end normally held closed by the clip jaws. The action of the air within the tube expands the tube walls so as to form this throat and thus allow the free and unobstructed flow of the tube contents toward the dispensing opening in the tube formed by the clip as best shown in Fig. 12.

Thus, the clip may be attached to the end of the tube before filling the tube, with the advantage that the tube may be provided with open ends instead of being formed with integral ends as has heretofore been necessary. Furthermore, the tube is shaped so as to have the greatest possible internal capacity at the time the closure means is applied to the end of the empty tube. It will be obvious that while the greatest utility of the invention will derive from applying self sealing closures to the ends of tubes as specifically described, the method is also useful in the conservation of tube material and in the production cost of tubes for those uses of tubes contemplating only a single use of the tube contents, in which case, the tube would be held clamped by jaws having a face configuration of the form of permanent closure clips heretofore in use and inflated to expand the interior thereof with the same advantage as above described. After filling, the tube would be closed by any of the means commonly in use for that purpose.

Accordingly, the invention is not to be deemed to be limited to the exact details of disclosure above set forth by way of example but it will be understood to include all such changes and modifications of such disclosure of method and apparatus as shall come within the purview of the appended claims.

I claim:

1. In an apparatus for preparing an end of an unfilled collapsible tube for application thereto of a clip-type, self-sealing, dispensing closure element with spaced

fastening panels located on opposite sides of the longitudinal axial line of the tube and forming in the tube a discharge passage therebetween and with clamping means extending between the panels along the end of the tube for engaging the discharge portion of the tube for closing the passage and opening the passage by separating said clamping means on pressure within the tube, a base, a nozzle mounted on said base and having a surface adapted to closely fit the inside of one end of the tube, a pair of jaw elements mounted for movement simultaneously toward and away from the longitudinal axial line of a tube mounted on said nozzle and disposed in the region of the end of the tube opposite the end mounted on said nozzle, said jaw elements each having a generally U-shaped configuration with side portions on opposite sides of said jaw element to press and seal the tube over the area engaged by the panels and providing a space to form the discharge passage in the tube between the panels, and a cross piece for pressing the end of the tube engaged by the clamping means, means for moving said jaw elements toward each other with the resultant clamping of the tube between said side portions on opposite sides of the axial line and between the cross pieces across the end of the tube, said means being thereafter effective to hold the tube end clamped for a predetermined time, means effective to disable said tube end flattening and clamping means at the expiration of said predetermined time and means for applying during a portion only of said predetermined time elastic fluid pressure through said nozzle to the interior of the tube to extend the tube between the side portions of the jaw elements to form the discharge passage.

2. In an apparatus for preparing an end of an unfilled, collapsible tube for application thereto of clip-type, self-sealing, dispensing closure element, a base, a nozzle mounted on said base and having a tapered external surface adapted to closely fit the inside of one end of the tube, a pair of jaw elements mounted for movement simultaneously toward and away from the longitudinal axial line of a tube mounted on said nozzle and disposed in the region of the end of the tube opposite the end mounted on said nozzle, a pair of axially opposed air cylinders each having a piston and a piston rod carrying one of said jaw elements, a three-way valve having a port connected to said cylinders, another port connected to a source of elastic fluid pressure, and a third port open to atmosphere, and means for moving said valve alternately between a position connecting said cylinders with the pressure source to a position connecting said cylinders with atmosphere to move said jaw elements in and out of engagement with the tube for clamping opposite ends of the tube therebetween, timing means coupled to said valve moving means to actuate said jaw elements to clamp the tube end for a predetermined time and release said tube end at the expiration of said predetermined time, means effective for applying elastic fluid pressure through said nozzle to the interior of the tube to expand the interior of the tube to its maximum internal capacity during a portion of said predetermined time.

3. An apparatus as claimed in claim 2 in which said means for moving said valve includes a rotatable cam having a lobe extending over a minor portion of its periphery, a cam follower yieldingly engaging said cam and operatively connected to said valve; said lobe upon engagement with said follower being effective to move said valve to connect said pressure source and said cylinders.

4. In an apparatus for preparing an end of an unfilled collapsible tube for application thereto of a clip-type, self-sealing, dispensing closure element, a base, a nozzle mounted on said base and having a surface adapted to closely fit inside one end of the tube, a pair of jaw elements mounted for movement simultaneously toward and away from the longitudinal axial line of a tube mounted on said nozzle and disposed in the region of the end of the tube opposite the end mounted on said nozzle, timing and actuating means coupled to said jaw elements to clamp said jaw elements against the tube end for a predetermined time and separating said jaw elements at the expiration of said predetermined time, a three-way valve having a port connected to said nozzle, another port connected to a source of elastic fluid pressure and a third port connected to atmosphere, means for moving said valve alternately between a position connecting said pressure source and said nozzle and another position connecting said nozzle with atmosphere for applying elastic fluid pressure through said nozzle to the interior of the tube to expand the interior of the tube to its maximum interior capacity only during a latter portion of said predetermined time.

5. An apparatus as claimed in claim 4 in which the means for moving said valve comprises a rotatable cam having a lobe extending over a minor portion of its periphery, a cam follower yieldingly engaging said cam and operatively connected to said valve; said lobe upon engagement with said follower being effective to move said valve to connect said nozzle with said pressure source.

6. In an apparatus for preparing an end of an unfilled collapsible tube for application thereto of a clip-type, self-sealing, dispensing closure element; a base, a nozzle mounted on said base and having a tapered external surface adapted to closely fit the inside of one end of the tube, a pair of jaw elements mounted for movement simultaneously toward and away from the longitudinal axial line of a tube mounted on said nozzle and disposed in the region of the end of the tube opposite the end mounted on said nozzle, a pair of axially opposed air cylinders each having a piston and a piston rod carrying one of said jaw elements, a three-way valve having a port connected to said cylinders, another port connected to the pressure source and a third port connected to the atmosphere, means for moving said valve alternately between a position connecting said cylinders with the pressure source and another position connecting said cylinders with atmosphere to move said jaw elements in and out of engagement with the tube for clamping opposite ends of the tube therebetween, timing means coupled to said valve moving means to clamp said jaw elements against the tube end for a predetermined time and separating said jaw elements at the expiration of said predetermined time, and means for applying elastic fluid pressure through said nozzle to the interior of the tube to expand the interior of the tube to its maximum interior capacity only during a latter portion of said predetermined time.

7. An apparatus as claimed in claim 6 in which the means for actuating said cylinder operating valve includes a cam rotatable with said cam for operating said nozzle connected valve and effective to maintain connection between the pressure source and said cylinders during a period before and after said pressure source is connected to said nozzle.

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