

May 17, 1938.

W. T. DAVIS

2,117,407

TUBE AND CAP ASSEMBLY

Filed Jan. 9, 1937

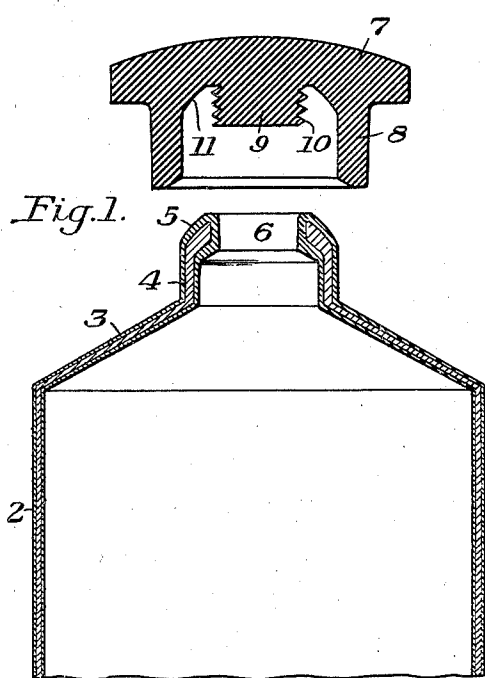


Fig. 1.

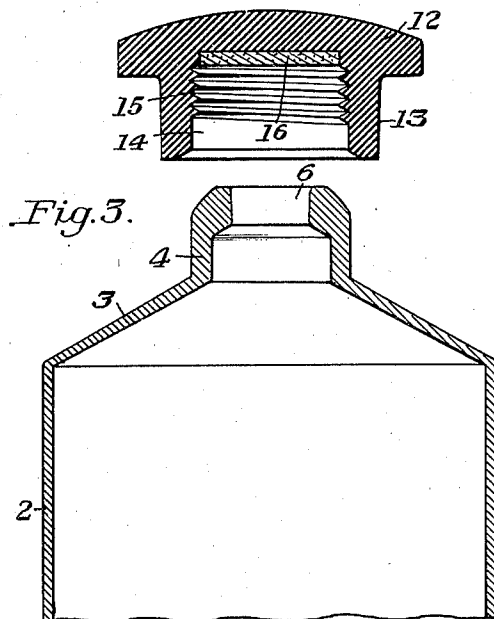


Fig. 3.

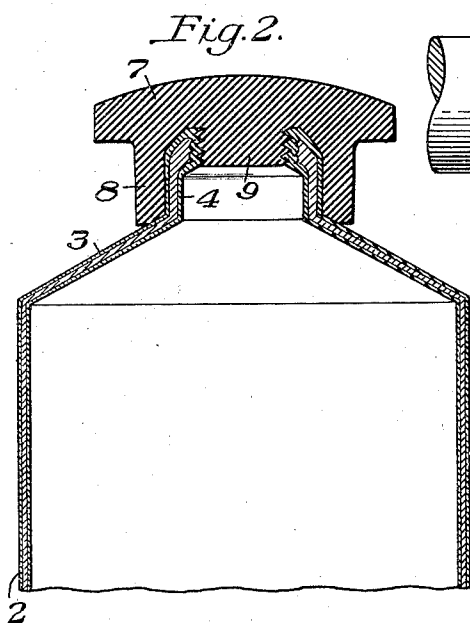


Fig. 2.

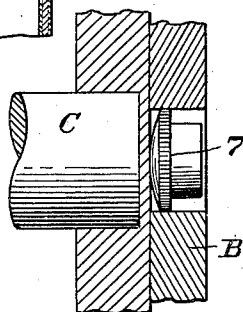


Fig. 4.

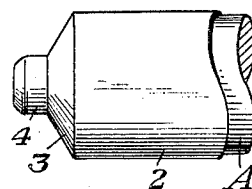
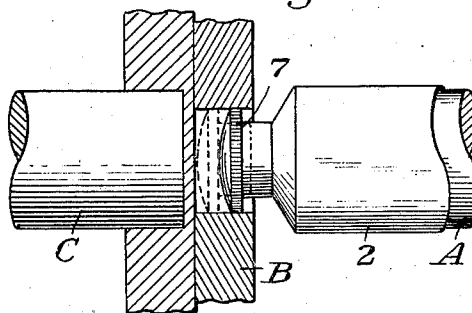


Fig. 5.



INVENTOR

Walter T. Davis

by his attorney

Stephen, Blank, Partridge

UNITED STATES PATENT OFFICE

2,117,407

TUBE AND CAP ASSEMBLY

Walter T. Davis, Wheeling, W. Va., assignor to
Wheeling Stamping Company, Wheeling,
W. Va., a corporation of West Virginia

Application January 9, 1937, Serial No. 119,800

8 Claims. (Cl. 221—60)

This invention relates to collapsible tubes of the type commonly employed for dental paste and toilet creams of various kinds, and more particularly to the assembly of the tube and cap for closing the outlet of the tube and to the manner of effecting the tube and cap assembly.

Tubes which are used for dental paste and toilet compounds of various kinds require a cap for closing the discharge end of the tube and which tightly seals the discharge end of the tube and prevents the escape either of essential oils or oily constituents and avoids seepage of the contents of the tube past the cap into the package in which the tube is placed. The most common expedient is the provision of a flanged cap which is internally threaded that screws onto threads formed on the outside of the neck of the tube, this cap being provided with a liner of cork or other sealing material. Another closure assembly which is used to a considerable extent is that shown in Paull and McGinnis Patent No. 1,935,100, under date of November 14, 1933, wherein the threads are formed on the outside of the neck of the tube in the usual manner and the cap is provided with an interiorly threaded apron or flange to engage over the neck of the tube. Inside the cap there is a plug or valve element having threads formed on its exterior, the arrangement being such that when the cap is screwed onto the outside of the tube the plug will enter the orifice in the neck of the tube, cutting a thread on the inside of the neck. With this type of assembly no packing or lining inside the cap is required as the plug fitting into the orifice in the neck of the tube and being threaded therein forms an effective seal in conjunction with the rest of the cap.

It has also been common practice in the case of lead tubes used for the packaging of adhesives, such as mucilage, paste and cements of various kinds, to provide a closure which enters the opening in the neck of the tube and which has a plug that is sometimes threaded in such manner as to cut a thread on the inside of the neck of the tube when it is applied to the tube. Tubes of this character, however, do not require as tight a seal as those used for various toilet preparations, first, because the cementitious material in the tube itself tends to close off any leakage between the tube and the closure; and, secondly, because the constituents are not as volatile or as unguent and, therefore, do not seek minute passages of escape.

In the usual practice in assembling tubes and caps for toilet preparations, the tube, after it is

formed, has the neck properly trimmed and threads are cut into the neck. The same machine which cuts the threads in the neck of the tubes is frequently but not always provided with a cap applying attachment. After the threads are formed on the neck of the tube the caps which have interiorly threaded flanges or aprons are applied to the threaded necks of the tubes. In order to cut a thread satisfactorily, the thread must be cut fairly deep, which requires that there be an appreciable wall thickness in the neck of the tube. Where these tubes are of solid tin, and tin must be used where the tube is used for dental creams and toilet preparations, this requires that considerable tin be used in the neck of the tube. Tin-coated lead tubes are also widely used. The coating of tin on the neck of a tin-coated lead tube is very thin, and the tool which cuts the thread cuts through this surface film of tin, exposing the underlying lead. This is very undesirable for the reason that accumulations of tooth paste or other preparations may gather on these threads and subsequently be removed and taken into the mouth or applied to the skin. Moreover, the presence of deeply cut threads on the exterior of any tube serves to accumulate some of the contents of the tube after the tube has been used, becoming both unsightly and unsanitary.

The present invention provides a cap and tube assembly which will result in a saving of metal in the neck of any tube and which has particular importance in connection with tin-coated lead tubes, although being applicable to all tubes. Furthermore, in the preferred embodiment of the invention, the presence of any external threads on the tube is entirely avoided. My invention further presents a tube and cap assembly in which the step of cutting the threads on the neck of the tube is rendered unnecessary. However, the invention enables caps to be applied to the tubes by capping machines of the type now commonly used.

In accordance with the present invention a flanged cap of the type necessary for giving a tight seal to the end of the tube is employed. The flange of the cap is provided with a smooth interior portion which engages the exterior of the neck of the tube and which serves to properly center the cap and the tube. Spaced inwardly in the cap from this guide portion is a threaded portion which subsequently comes into contact with the neck of the tube after the cap has been centered. This threaded portion of the cap will upon relative rotation between the cap and tube

form a thread in the portion of the neck of the tube which it engages without actually cutting deeply into the metal. Thus the cap serves to form its own thread, eliminating the thread-cutting operation, but the thread so formed is not of sufficient depth to cut through the neck of a tin-coated lead tube or to require any substantial thickness of metal in the neck of the tube if the tube is a solid tin tube. In the preferred embodiment of the invention, the apron of the cap has the interior surface thereof completely smooth, forming one continuous guiding surface while the center of the interior of the cap is provided with a plug which is externally threaded, this plug serving to form the thread on the inside of the neck of the tube when the tube and cap are brought together with one of them rotating relatively to the other.

The invention may be readily understood by reference to the accompanying drawing, in which—

Figure 1 shows on a greatly enlarged scale the end of a collapsible tube formed in accordance with the present invention, the view representing a longitudinal section through the tube, the view also showing a transverse section through a cap embodying the preferred form of my invention, the cap being in position to be placed on the neck of the tube;

Figure 2 is a view similar to Figure 1, showing the cap in position on the end of the tube;

Figure 3 is a view similar to Figure 1 of a modified arrangement wherein the central plug is omitted and there is a guide surface followed by a threaded surface on the interior of the apron of the cap;

Figure 4 illustrates the first step in the method of completing the assembly, showing the cap positioned in a chuck and the tube on a rotating mandrel, the tube and the cap being in alignment; and

Figure 5 is a view similar to Figure 4, showing the chuck moved over to a point where the cap is brought into engagement with the end of the tube.

Referring to the drawing, 2 designates a conventional tube having an end wall 3 terminating in a neck 4. The neck 4 has an inwardly turned terminal portion 5 through which is a central opening 6 for the discharge of the contents of the tube. In the drawing, the tube is illustrated as being a tin-coated lead tube, wherein the layer of lead forming the principal part of the body of the tube is completely coated by a surrounding thin film or jacket of tin so as to keep the contents of the tube from coming into contact with the lead. It is not necessary, however that the tube be a composite tube, as the invention is equally applicable to a tube formed entirely of one metal as, for instance, the tube shown in Figure 3.

The cap is preferably a molded plastic cap. It is designated generally as 7 and it is provided with a flange or apron 8. The inner surface of this apron 8 is smooth and free of threads and the inside diameter of the cap conforms to the outside diameter of the neck of the tube, so that the flange will fit snugly over the neck of the tube. At the center of the cap there is an integral plug 9 having exterior threads 10 thereon, the plug 9 being considerably shorter than the flange or apron 8 so that when the cap is applied to the tube the flange 8 will fit over and center the cap on the tube before the central plug 9 engages the tube. The central plug 9 is of such diameter

that when the cap is applied to the tube as shown in Figure 2, the threads 10 on the plug will distort the tin on the inside of the opening 6 in such a manner as to form a thread without, however, actually cutting through the surface of the tin into the body of the lead. The plug 9 with its thread 10 completely fills the passage 6 in the neck of the tube and since the threads are formed in situ on the inside of the neck of the tube, a very tight seal initially exists between the cap and the tube. Since the cap is put on the tube at the time the tube is being made and the tube is filled from the opposite end, this seal does not have to be broken until the cap is removed by the customer. Even then, the threads on the plug and on the inside of the neck of the tube are close-fitting. To further increase the sealing effect between the cap and the tube, the interior of the cap is sloped inwardly as indicated at 11 to conform accurately to the shape of the end of the tube. When the cap is screwed down against the end of the tube the surface 11 will press down against the exterior of the portion 5 of the tube to form a very tight and close seal. This is clearly shown in Figure 2.

The only portion of the neck of the tube which is engaged by a threaded part of the cap in the arrangement shown in Figures 1 and 2 is the interior wall of the opening 6. By reason of this fact, the metal in that portion of the neck of the tube between the end wall 3 and the inwardly turned terminal portion 5 is relatively thin, whereas in tube assemblies as heretofore commonly provided this same portion of the neck of the tube has a thread cut therein and, therefore, has a considerably greater wall thickness. By reducing the thickness of the metal in this portion of the neck of the tube a very appreciable saving in the weight of metal used for making the tubes is effected, and where the tube is made entirely of tin this saving of metal because of the high cost of tin, is of considerable importance.

For applying the caps to the tubes, machines heretofore provided for the purpose can be used. For applying caps to tubes, the tubes are frequently mounted on a mandrel. This is illustrated in Figure 4 where the mandrel is designated A. The mandrel is provided with means for rotating it. This mandrel may be, for example, a mandrel similar to that shown in my prior Patent No. 1,678,463, dated July 24, 1928. The mandrel is moved into a position opposite a cap-holding chuck B, which chuck is moved toward and away from the mandrel, being carried on a slide bar C by means of which it is reciprocated. When a cap is in the chuck B and a tube is on the mandrel A and the two are in alignment, the mandrel A is turned while the chuck B moves over to bring the cap into engagement with the neck of the tube. The flanged apron of the cap first engages the smooth exterior of the neck of the tube properly centering the cap on the tube. Upon continued movement of the chuck B against the end of the tube, the plug 9 engages in the orifice 6, causing the cap to forcibly form a thread in the neck of the tube and to thereby be screwed onto the neck of the tube in the manner hereinbefore described. When the cap has been screwed home the jaws of the chuck will no longer prevent the cap from turning with the tube and the chuck will then be operated to release the cap and return to the position shown in Figure 4. The chuck may correspond to the chuck shown in my patent above referred to, the particular mech-

anism forming no part of the present invention and being only diagrammatically illustrated insofar as the same is necessary for indicating the method of applying the cap to the tube.

In the modification shown in Figure 3, the tube is similar to that shown in Figure 1 and corresponding reference numerals have been used, the tube being designated generally as 2, having an end wall 3 with a neck 4 and an inwardly turned terminal portion 5 through which is a discharge orifice 6. The tube in this instance is illustrated as being formed entirely of one kind of metal instead of being a composite tube. The cap designated generally as 12 is provided with a flange or apron 13. It is provided with a smooth interior surface 14 forming a guide surface, and back of this is an interiorly threaded portion 15. The arrangement is such that the smooth surface 14 first engages the neck of the tube and centers the cap on the neck of the tube after which the threaded portion of the cap engages the neck of the tube for forming a thread thereon. The thread which is formed by this method is shallower than a thread which is actually cut by a die, so that the advantage of a thin wall in the neck portion pointed out in connection with the structure shown in Figures 1 and 2 applies also in connection with this modification. In the modification shown in Figure 3, the cap is shown as having a compressible liner 16.

With either form of cap the shape of the tube is the same and it will be understood that the tube formed entirely of one metal or a composite tube may be used with either form of cap. In both forms of the invention, the neck of the tube is left unthreaded and no thread-forming operation is performed until the time when the cap is applied to the tube. Even then the thread-forming does not begin until the cap has been centered on the neck of the tube by reason of a smooth surface of the skirt of the cap first engaging a smooth surface of the neck of the tube. The steps of applying the cap and forming the thread are performed simultaneously. The thread is formed more by deforming the metal than by any cutting operation and, therefore, in the case of a composite tube, particularly, there is no rupturing of the surface coating of tin to expose the underlying lead. The assembly and method shown in Figures 1 and 2 are preferable to that shown in Figure 3 for the reason that with the former the exterior of the tube remains at all times smooth and free of any irregularity which will in the use of the tube collect any foreign matter or collect any of the contents of the tube. The invention presents a definite advantage over that shown in Patent No. 1,935,100, to Paul and McGinnis above referred to, in that in said patent it was required that the exterior of the tube be threaded and that the skirt of the cap be threaded. The invention is an improvement over the cement and paste tubes in that the skirt or apron of the cap provides the user with an easy way of centering the cap on the tube and, moreover, the assembly is one which is adapted to use in the present types of capping machines, whereas the threaded plugs heretofore employed in cement tubes could not be applied with the present types of capping machines.

I claim:

1. The method of constructing a tube and cap assembly comprising forming a tube with a smooth neck portion, both the interior and exterior being devoid of threads forming a cap with a smooth guide portion and a threaded portion, the guide

portion being adapted to embrace and surround the smooth neck of the tube before the threaded portion engages the neck of the tube to thereby center the cap on the neck of the tube, bringing the cap and the tube into engagement with the cap centered on the unthreaded neck of the tube, then effecting relative rotation of the tube and the cap while pressing the cap against the tube to cause the threaded portion of the cap to engage a smooth portion of the neck of the tube and thereby form the only threads on the neck of the tube required to retain the cap.

2. The method of constructing a tube and cap assembly comprising forming a tube with a smooth outer neck portion and with a discharge opening in the end thereof, forming a cap having a flange with a smooth interior adapted to fit over and slidably engage the outside of the neck of the tube and to center the cap on the neck of the tube and also forming the cap with an internal central plug of less length than the flange, the plug being of a diameter such that it will enter the discharge opening in the tube and form threads in a wall thereof, applying the cap to the tube to first center the cap thereon and thereafter effecting relative rotation between the cap and the tube while pressing the cap against the tube to cause the plug portion of the cap to enter the opening in the tube and form the only screw thread therein required to retain the cap on the tube.

3. The method of forming a tube and cap assembly which comprises centering a flanged cap over the smooth unthreaded end of the neck of a tube and thereafter effecting relative rotation between the cap and tube to cause a threaded surface on the cap to engage a portion of the neck of the tube and completely form all threads on the neck of the tube required to retain the cap on the tube.

4. The method of forming a tube and cap assembly comprising forming a tube with a smooth unthreaded neck portion, forming a flanged cap adapted to fit over and engage the neck portion of the tube, the interior of the flange of the cap having a smooth portion to first engage the neck of the tube and having a threaded portion to thereafter engage the neck of the tube, applying the cap to the neck of the tube with the smooth portion of the cap engaging the smooth portion of the neck of the tube to first center the cap on the tube, and thereafter effecting relative rotation between the tube and the cap while holding the cap and tube in engagement to cause the threads on the cap to form threads on the neck of the tube for retaining the cap on the tube.

5. A tube and cap assembly comprising a tube member having a smooth exterior neck, the neck having a central opening in the end thereof, a cap member having an apron with a smooth interior adapted to slidably engage the neck of the tube and which serves to center the cap on the tube, the interior of the cap having an exteriorly threaded plug therein adapted to enter the opening in the end of the neck of the tube and to form threads on the wall of the opening, said plug being of a length less than the length of the apron whereby the plug does not engage in the opening in the neck until after the neck of the tube and the apron of the cap have been engaged in telescoping relation.

6. A tube and cap assembly comprising a tube having a smooth unthreaded neck with a central opening in the end wall thereof, and with a beveled terminal surface, and a cap on the tube

having an apron that fits closely over the smooth neck, the cap having an internal central plug considerably shorter than the apron which enters the central opening and the threads of which are 5 screwed into the wall of the central opening, the interior of the cap between the base of the plug and the apron being beveled to conform to and press against the surface of the neck of the tube.

7. A tube and cap assembly comprising a tin- 10 coated lead tube with a neck portion having a central opening, the tin coating being inside and outside the tube and lining the walls of the opening, and a cap having a threaded portion force-threaded onto the neck of the tube in such man- 15 ner that the threads of the cap form threads in the tin coating while leaving the coating continu-

ous and unbroken, the force-threaded engagement constituting the sole means for holding the cap on the tube, the cap having an apron which encloses the neck of the tube and serves to guide the cap onto the neck of the tube.

8. The method of effecting a tube and cap as- 5 sembly which comprises initially bringing cooperating smooth surfaces of the cap and tube into telescoping sliding engagement to center the cap on the tube and then manipulating the tube and 10 cap to cause a threaded surface on the cap to come into force-threaded engagement with a previously unthreaded portion of the tube and thereby produce the only threaded engagement 15 that exists between the cap and the tube.

WALTER T. DAVIS.