

[54] **MULTIPLEX CAPSULE FOR DENTAL  
FILLING MATERIALS**

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128/272

[56]

**References Cited**

**UNITED STATES PATENTS**

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[57]

**ABSTRACT**

A capsular container for storing separate components which are mixed together prior to use in the field of dentistry having a container body closed by a threaded cap-like telescoped capsule closure member which forms a separate chamber with a perforated wall of the container body for receiving a frangible foil bag having a second liquid component adapted to be broken by pressing the closure member against the container body so as to cause the liquid component to flow through the perforated wall and mix with the first component in the container body.

**1 Claim, 4 Drawing Figures**

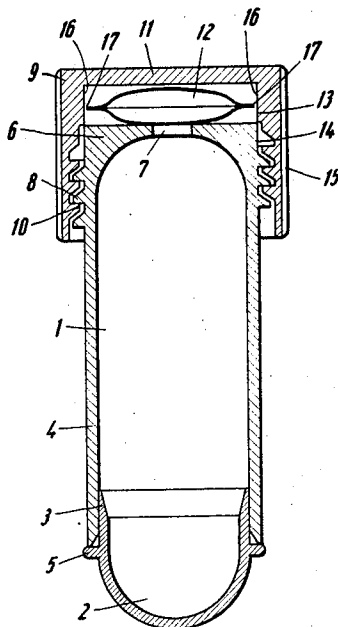
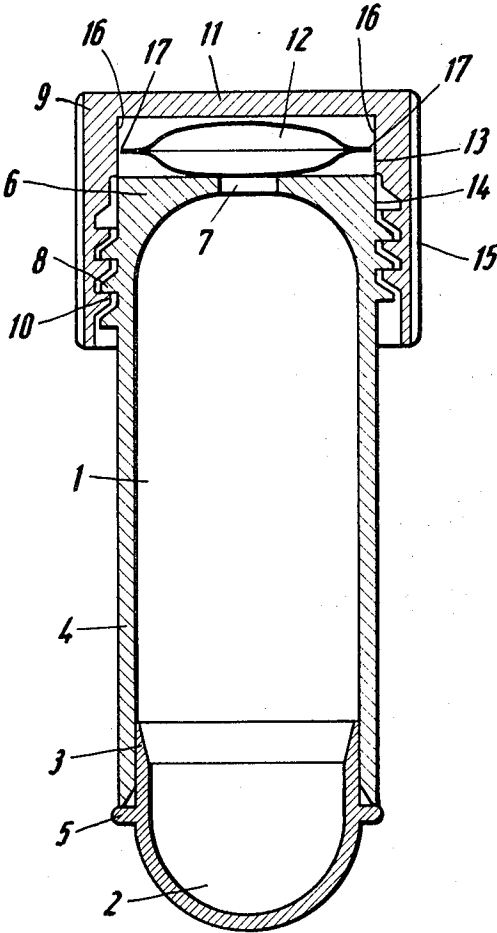


Fig. 1



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*Fig. 2*

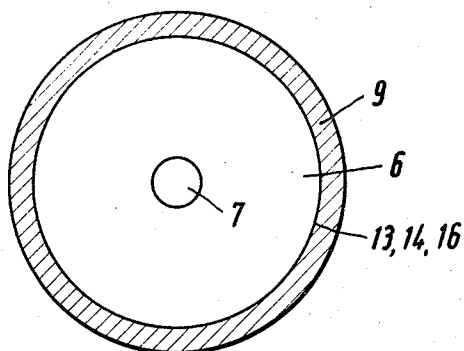


*Fig. 3*

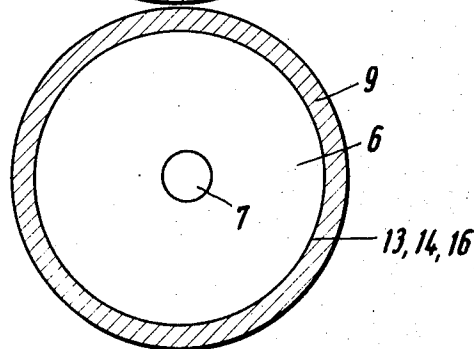
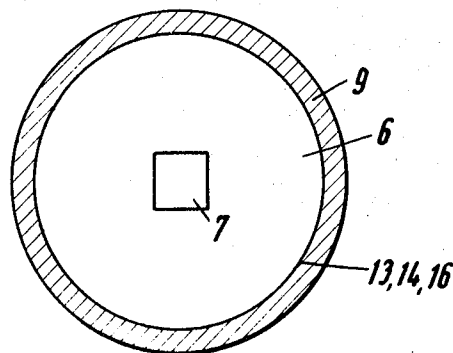


*Fig. 4*



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## MULTIPLEX CAPSULE FOR DENTAL FILLING MATERIALS

The invention relates to capsular containers for storing separately components or ingredients which are to be later mixed together to produce a dental filling material, such as an amalgam, alloy or cement.

It has been known to provide a capsular container for dental purposes of this type with a container body closed by a cap-like telescoped capsule closure member for receiving a first component of a dental filling material the container body comprising a locally perforated wall on the end facing the closure member and a frangible bag of foil material interposed between this wall and the closure member, containing a liquid second component and adapted to be destroyed by pressing the closure member against the container body (refer to French Patent 1 445 946).

When so packaged in a multiplex capsule of this known general type, the two components are safely separated from one another during storage, i. e. as long as the bag of foil material is intact. By pressing the closure member against the container body, a violent pressure is applied to the bag, causing it to burst at the insufficiently supported locations, i. e. at the at least one opening of the perforated wall of the container body, whereby the liquid component contained therein is discharged through the openings into the container body. By use of suitable mixing apparatus, the two components can be intimately mixed while contained in the container body. The container body is subsequently opened to permit the mixture to be withdrawn for use.

U.S. Pat. No. 1,207,703 of Basehore et al. dated Dec. 12, 1916 discloses a cylindrical capsular device for mixing components used in the dental field having removal end portions.

U.S. Pat. No. 1,384,035 of H.L. Alexander issued July 12, 1921 discloses a receptacle having a cover which is adapted for use as an auxiliary container for mixing.

The multiplex capsules of this known general class, however, have the disadvantage that a considerable effort is required for pressing the capsule closure member against the container body in order to cause the bag of foil material to burst. It has further been known in conjunction with similar duplex capsules for dental purposes (such as disclosed in U.S. Pat. Nos. 2,527,992 and 2,487,236) to provide pointed or spherical members within the closure member in order to facilitate the destruction of the foil material of the bag by pressing the two container sections together. The use of such supplementary members in conjunction with the capsules of this general class, however, is not always practical because they impede the complete discharge of the liquid component from the bag. The complete discharge of the liquid contents of the bag, however, is necessary when a highly accurate ratio of mixture between the liquid component and the other component is required.

It is therefore an object of the invention to facilitate the purposeful destruction of the bag of foil material without the use of such supplementary members. This object is solved by connecting the closure member to the container body by means of interengaged threads respectively provided on the closure member and container body or on parts respectively connected thereto, whereby the closure member can be screwed to the container body.

The threaded portion of the container body is preferably disposed near its end facing the closure member, where it is radially supported by the perforated end wall of the container body. It has been known to provide this perforated wall as a separate insert member. In conjunction with the present invention, however, it is particularly advantageous to have the wall of the container body which faces the closure member formed integrally with the container body. The bottom of the container body is then formed as a separate member and detachably affixed to the container body.

It is another object of the invention to further facilitate the destruction of the bag of foil material and to ensure that the bag of foil material will open only at the perforated location or locations of the perforated wall, as may be the case, while

preventing it from bursting at other locations from which the flow of the liquid into the mixing chamber might be impeded or prevented.

Pursuant to this object, the invention provides means causing the bag of foil material to more firmly adhere to the closure member than to the perforated wall and means in the form of sharp edges, burrs, ridges or points at the periphery of the at least one opening in the perforated wall capable of scoring the foil.

It has been known from the publication referred to in the beginning to provide a conical or prismatic spike for puncturing or tearing the bag of foil material and drilled passage at the base of the spike which permit the liquid component to flow into the mixing chamber. However, as a result of the plastic deformation of the foil material, the latter will become punctured at the point of the spike only, while portions thereof are pressed against the base of the spike with increased firmness as a result of the stress due to deformation and will consequently sealingly rest against the base of the spike. Thus, the necessary quantities of the liquid component cannot enter the mixing chamber until the foil material of the bag has also been caused to burst in the area at the openings, which action, however, is practically not facilitated by the presence of the spike. The operation is fundamentally different with the construction in accordance with the invention because, owing to the unique friction conditions and to the rotation of the closure member, a relative movement is brought about between the bag of foil material and the perforated wall. It has been found that, in this case, the tearing of the foil material can very well be enhanced by supplementary mechanical means, maximum efficiency being obtained when such mechanical means are provided in the form of sharp edges, ridges or points at the periphery of the opening or openings rather than at a certain distance therefrom as in the known construction.

Particular advantage can be obtained by providing mechanical means of the kind specified above which are low as compared to the thickness of the foil material, such as sharp edges at the openings having no dimension in height at all or ridges or burrs of very low height, whereby the foil material is merely scored and then caused to burst at the location injured by the scoring action in the very instant when this location is disposed above an opening, thereby ensuring that punctures in the foil material will always occur at those locations where an opening is available so that all of the liquid is transferred into the mixing chamber, which would not be possible if the foil material were punctured at other locations.

In one embodiment which is particularly simple and consequently practical, the perforated wall is provided with a single opening only, which is concentric to the axis of rotation of the closure member, the opening having a sharp edge or a slight burr formed in the production process. When the closure member is rotated, the bag of foil material is caused to participate in this rotation and the sharp edge of the burr acts on a circular line, which does not change its relative position during rotation, and produces a cut along this line thus permitting the area of the foil material defined by such circular line to be easily separated under the action of the increased internal pressure.

In some instances it may be preferable to provide the bore at a somewhat eccentric position whereby the movement of the foil relative to the edge of the bore is not limited to the direction of these edges but has an additional slight component transversely thereof whereby the foil material is subjected to a dragging or rubbing action which likewise enhances the bursting of the foil material. The same result is obtained when the edge of a centrally disposed opening is other than circular, e.g. polygonal.

It has further been found to be advantageous to provide the closure member and container body with cooperating means for creating a threshold value of resistance opposed to the torque applied to the closure member which becomes effective before the closure member is screwed onto the container body to the extent that a pressure is applied to the bag of foil

material. This feature prevents the bag of foil material from being untimely destroyed by screwing the closure member too tightly against the container body by inadvertence. The means providing this threshold value of resistance to torque, may, for example, comprise cooperating stop means on the container body and closure member which may be rendered inactive by plastic or elastic deformation. Thus, the inner surface of the closure member may be provided with an inwardly projecting annular collar having an inner diameter somewhat less than the outer diameter of the upper outer edge of the container body. When the perforated wall of the container body which faces the closure member is in the form of an inserted member, the latter may be provided with prominences which project radially out through appropriate apertures in the wall of the container body and which are provided with thread-like formations for cooperation with the closure member. This arrangement permits the force resulting from the screwing action to become active directly between the closure member and the perforated wall, ensuring at the same time that the insert member is prevented from any rotation relative to the container body, which might hamper the cooperation between the radial projections and the associated apertures in the container wall.

A few advantageous embodiments of the invention will now be described by way of example and explained in more detail with reference to the drawings wherein:

FIG. 1 is a longitudinal section through a multiplex capsule for dental purposes in accordance with the present invention and

FIGS. 2 to 4 are cross sections through the closure member as viewed in the direction toward the perforated wall of the container body.

The container body 1 which contains the first component of the mixture is closed at its lower end by an insert member 2 having an axial flange section 3 which is a sealing and relatively firm press fit in the wall 4 of the container body 1. The insert member may have a radial flange 5 which permits it to be pulled out from the container body for removal of the mixed preparation.

The container body is closed at its upper end by an integral wall 6 which is perforated at its center at 7. The container body is provided with a male threaded section at 8.

A capsule closure member 9 having matched internal threads 10 is screwed onto this threaded section 8. The inner configuration of the upper wall 11 is matched to the cooperating face of the wall 6. A bag 12 of foil material is interposed between the container body 8 and the capsule closure member 9 and contains the liquid second component of the mixture. The closure member 9 is adapted to be screwed onto the container body to an extent such that the spacing that remains between the inner face of wall 11 and the outer face of wall 6 is just sufficient to accommodate the bag 12 of foil material when emptied.

As an illustrative example only of a simple means for providing the threshold value of resistance to torque as defined above, the upper section of the closure member has an inner diameter 13 which does not exceed the outer diameter of the upper cylindrical portion 14 of the container body and may even be less so that the closure member cannot be screwed down completely onto the container body except when subjected to a certain plastic deformation. This threshold of resistance, however, must not be as high as to substantially impede manipulation of the capsule. Cooperating radial projections on the container body and on the closure member, respectively, are believed to be still more suitable than the embodiment shown by way of example because it requires the threshold of resistance to be overcome but once without the further screwing operation being subsequently further impeded. Like results are obtained by providing irregularities in the threads which will oppose a slightly increased resistance to the threading movement of the closure member with respect to the container body at a predetermined stage of such relative movement, which resistance, however, is easily overcome.

FIG. 1 shows the particular embodiment at the stage at which this threshold value of resistance to torque has just been reached as the section 13 having the smaller diameter has reached a position of engagement with the edge of section 14 which has the larger diameter.

The provision of a threshold value of resistance to torque in accordance with the invention permits the parts of the capsule to be screwed together to the extent permitted by such threshold value whereby they become joined sufficiently firmly in order to prevent accidental separation of the screw connection. Regardless of this threshold value of resistance, however, cooperating elements provided on the closure member and the container body, such as the cooperating threads, may be made to so closely interfit that a certain slight resistance is opposed to relative rotation at any stage whereby accidental separation, such as by vibration, is precluded.

In order to facilitate relative rotation of the two parts by hand, the closure member is shown as provided with a knurl 15. A similar knurl may be provided on the lower section of the container. FIGS. 2 to 4, wherein like reference numerals are used to designate like parts as in FIG. 1, show three different arrangements of a single opening 7 in wall 6. In the embodiment of FIG. 2, the opening is circular and concentric; FIG. 3 shows the opening as circular, but eccentric with respect to the center of rotation; and FIG. 4 illustrates a square concentric opening. In all the instances, the edge of the opening which faces the bag of foil material is sharp, ridged or even saw-toothed. The term "sharp" is meant to include configurations of the edge wherein the cross section of the edge is defined by substantially a right angle, although possibly rounded to an extent occasioned by the production process employed, such as by injection moulding or the like. The appropriate degree of sharpness of the edge can be easily determined for any particular case by way of experiment. Irregularities of the edge are advantageous in the sense of the invention because they result in increased and varying stress being applied to the foil material thereby facilitating its destruction.

The bag of foil material may be caused to more firmly adhere to the closure member, e. g. by interposing a disc of material having a high coefficient of friction, such as rubber, between the closure member and the bag of foil material or by bonding these two parts to each other or by merely providing reduced friction on the side of the perforated wall 6, such as by applying to the bag and/or to the wall a substance which acts as a lubricant, such as a fat or oil, or by producing the bag of two different foil materials of which that facing the closure member has a higher coefficient of friction as compared to the low coefficient of friction of the foil material facing the wall 6. It may be sufficient in some instances to cause the lateral edge portions 17 of the bag 12 to rest against the wall 16 of the closure member, with high friction, such as by producing the bag with an initial diameter larger than that of the internal space of the closure member and by subsequently inserting it into the closure member with a press fit.

It will be understood that variations and modifications may be effected without departing from the spirit and the scope of the novel concepts of this invention.

What is claimed is:

1. A capsular container for storing separate components or ingredients which are to be mixed upon demand to produce a dental material comprising in combination, a cylindrical container body having a mixing chamber therein containing a first material component and having a wall integral with and extending transversely across one end of said body, said wall having at least one perforation therethrough communicating with one end of said chamber and the other end of said chamber being open, a cup-shaped member having a closed end, the interior surface of said closed end being substantially complementary to the outer surface of said wall on said container body to provide cooperating pressure surfaces when said cup-shaped member is mounted over the end of said body having said wall thereon, complementary coengaging threaded means on the inner wall of said cup-shaped member

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and the exterior wall of said container body adjacent the end having said wall thereon, a bag of frangible material positioned between said cooperating pressure surface and containing a liquid second component adapted to be discharged into said mixing chamber when said cup-shaped member is tightly 5 screwed onto said body in a direction to move said pressure surfaces toward each other to effect rupturing said bag and force the contents thereof through said perforation in said wall across said container body, and a removable closure for said open end of said chamber operable to close said chamber to 10 retain said first material component therein until mixing

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thereof with said liquid second component is to occur and also maintain said chamber closed during mixing of said components, said closure having a telescopic engagement with said open end of said chamber an annular axial flange slidable engaging the inner surface of said open end of said chamber and being readily removable to permit discharge of the mixed dental material through said open end of said chamber without disturbing the opposite end of said body and cup-shaped member in tightly threaded attachment thereto.

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