

Oct. 3, 1967

S. A. BLOOM ETAL

3,344,914

MIXING CAPSULE

Filed Oct. 19, 1965

3 Sheets-Sheet 1

FIG. 1

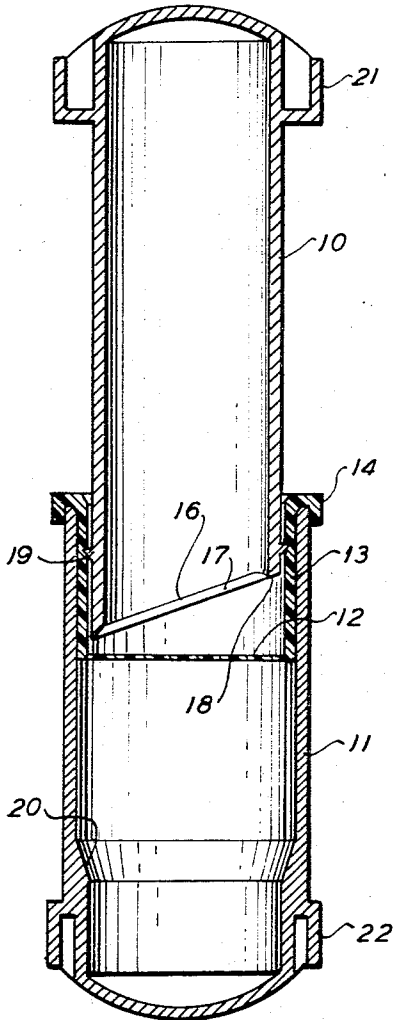


FIG. 2

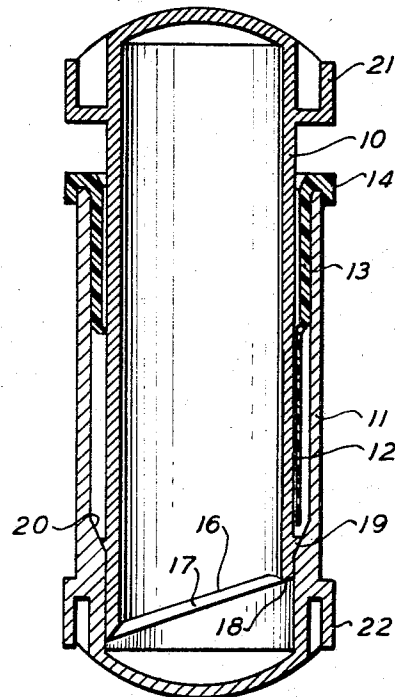
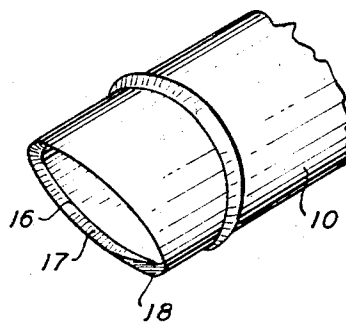


FIG. 3



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FIG. 4D

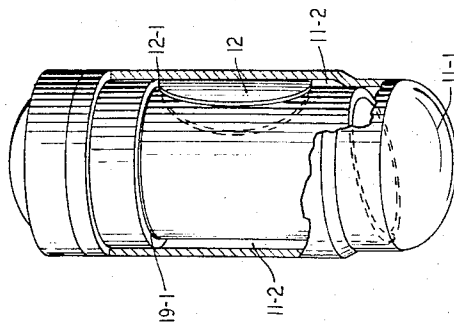


FIG. 4C

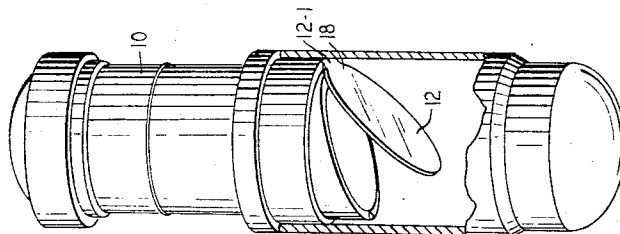


FIG. 4B

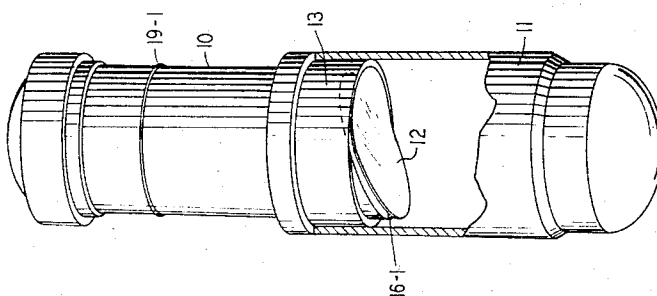
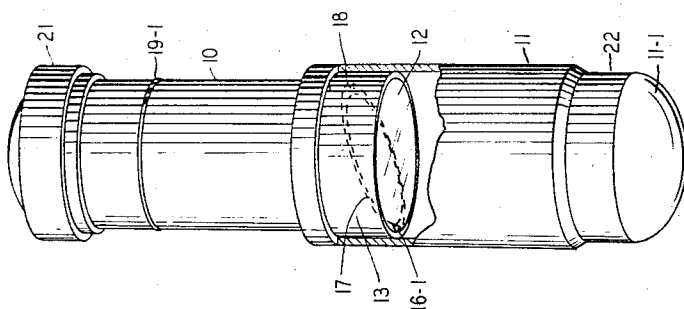


FIG. 4A



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FIG. 5

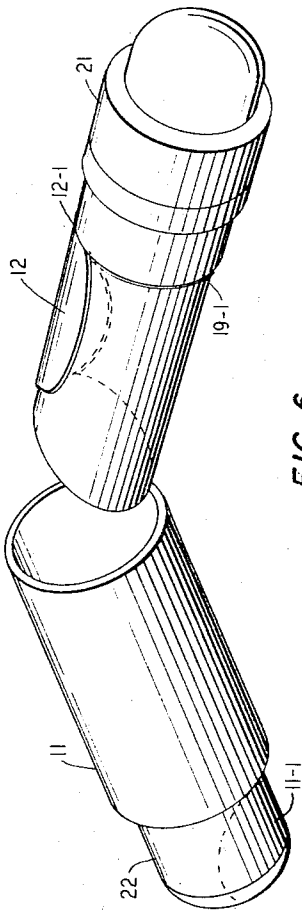
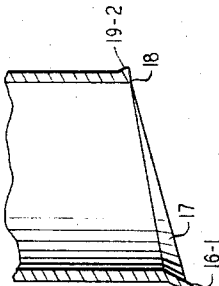


FIG. 6



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MIXING CAPSULE

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Filed Oct. 19, 1965, Ser. No. 497,891
21 Claims. (Cl. 206—47)

This invention relates to a capsule for mixing quantities of complementary materials, for example (and without limitation thereto) such as an amalgam of silver powder and mercury for use by dentists, and other liquids, powders, and mixtures which must remain separate until shortly before use.

The invention provides a mixing capsule having first and second body members which may be prefilled, in initial manufacture by the manufacturer, with precisely the small quantities of the materials to be mixed, and then the parts assembled to maintain said materials separate and in sealed relation until the time of use, when the capsule is activated, mixing said materials.

The invention provides a novel, simple and effective means for preparing and mixing materials, eliminating the need for measuring separate quantities and for clean containers, and avoiding waste such as inherent heretofore in preparation of materials of small quantities, due to the difficulties in measurement and resultant inaccuracy and inefficiency.

The invention accomplishes the foregoing and other objectives by the use of two capsule halves or body members which may be provided with premeasured quantities of the materials to be mixed, separated by a thin diaphragm, preventing reaction therebetween until the capsule is activated.

The invention further contemplates novel means for maintaining a sealing diaphragm in the capsule until it is desired to activate the capsule, and novel means for facilitating rupturing and separation of the diaphragm to open the interiors of the body members for mixture of the contents.

The capsule of this invention is designed to enable activation to be achieved in a positive and effective fashion, eliminating risk of error in use.

The invention further provides novel means for maintaining capsule half parts sealed so as to isolate the respective materials contained therein until the time of use, and thereupon isolating the mixed materials until it is desired to open the capsule for use thereof.

The drawings, illustrating procedures and devices useful in carrying out the invention, and the description below, are exemplary only of the invention, which shall be deemed to cover all other devices and procedures coming within the scope and purview of the appended claims.

In the drawings, wherein similar reference characters indicate like parts:

FIG. 1 is the longitudinal sectional view of a mixing capsule embodying our invention, shown prior to compression,

FIG. 2 is a similar view thereof on compression,

FIG. 3 is a fragmentary, perspective view of the lower portion of the first body member of the invention,

FIGS. 4A through 4D are perspective views of a mixing capsule according to the invention in various stages of compression, FIG. 5 is a perspective view of the mixing capsule of FIG. 4D after separation, and FIG. 6 is a fragmentary, perspective view of the lower portion of the first body member in FIG. 5.

In the drawings (FIG. 1) a mixing capsule embodying the invention is shown to comprise a first body member 10 and a second body member 11, proportioned to slidably receive the first body member therein. In use, said

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body members may be formed as elongated members open at one end, and closed at the other end, assembled by the insertion of the open end of one member (10, FIG. 1) into the other. The capsule may be made of any materials desired, such as plastic or other materials and of tubular or other form. Each of the members 10, 11 is adapted to be filled by the manufacturer with the predetermined, precise quantity of materials to be mixed. Novel means are provided for separation of said materials, while, at the same time, sealing the capsule. A diaphragm 12 is formed unitary with, or secured to, a cup-shaped member 13, which, in turn, is secured to the free end of the second body member by a marginal retention flange or the like, 14. Thus the contents of the first body member or of the cup are isolated from the contents of the second body member on initial manufacture and up to the time of actual use of the capsule, at which time, on movement of body member 10 into second body member 11, the diaphragm 12 will be punctured. The parts are so proportioned that, on occurrence of the puncturing operation, the diaphragm 12 will be moved to a position intermediate the walls of the first and second body members 10, 11 (FIG. 2). To that end as shown more clearly in FIG. 3, the free end 16 of the first body member may be formed at an angle to the longitudinal axis thereof and chamfered as noted at 17 except for a dull edged portion 18. When the first body member is moved into the second body member, the cutting edge 16 will puncture the diaphragm 12 and the latter will (as above noted) be moved to a position adjacent the interior of the second body member and intermediate the walls of the first and second body member (FIG. 2). A circumferential flange 19 on first body member 10 initially engages the inner walls of the cup member 13, and, upon activating the capsule (FIG. 2) engages a complementary stop portion such as chamfered edge 20 formed interiorly of the second body member 11. Thus, in the non-activated as well as activated position of the parts, the circumferential edge 19 serves as a sealing means. Each of the body members may be formed with spherical closed ends, and with knurled diameters, as noted at 21, 22 for facility of handling of the parts.

The mode of operation of the mixing capsule, and its various features, are clarified with preference to the perspective views of FIGS. 4A through 4D, which show a mixing capsule according to the invention in various stages of compression.

Initially, as indicated by FIG. 4A, a toe portion at the free end of the first body member 10 is in the vicinity of the diaphragm 12 of the cup member 13. To facilitate the ensuing piercing of the diaphragm 12, the toe portion includes a piercing point 16-1. A bowl portion 11-1 of the second body member 11 contains one of the materials to be mixed, e.g., silver powder (not shown). During assembly the first body member 10 is filled with the other material to be mixed, e.g., mercury (not shown) which, after assembly of the mixing capsule, is disposed in the cap 13.

It is to be noted that for the mixing capsule of FIG. 4A the sealing flange 19 of the mixing capsule in FIG. 1 has been moved upward along the shank of the first body member 10 forming a sealing flange 19-1. The sealing flange 19-1 is positioned to assist separation of the capsule components in the manner described subsequently once mixing is completed. In addition, as shown in FIG. 6, the free end of the first body member 10 desirably includes a second sealing flange 19-2 which passes in the vicinity of the piercing point 16-1 and encircles the free end. The first body member 10 is advantageously constructed with a dulled portion 18 near its heel, but with a relatively sharp cutting edge in the vicinity of its piercing point 16-1.

As shown in FIG. 4A, the first and second body members 10 and 11 are cylindrical with the cup member 13

being snugly inserted into the second body member 11 and the first body member being snugly inserted into the cup member 13.

When compressional force is applied along the longitudinal axis of the mixing capsule, the first body member 10 moves slideably with respect to the second body member 11 within the cup 13. The piercing point 16-1 at the toe of the first body member 10 engages the diaphragm 12, and begins to shear the diaphragm 12 as shown in FIG. 4B. The shearing effect takes place even if the piercing point 16-1 is omitted, but it is initiated with less compressional force by having the piercing point present.

As the first body member 10 continues its longitudinal travel due to the compressional force, the capsule adopts the configuration of FIG. 4C with the diaphragm 12 circumferentially sheared from the cup 13 except for a hinge region 12-1. The presence of the hinge 12-1 is promoted by the dulled region 18 at the heel of the first body member 10. However, in a test model of the invention, using a sufficiently resilient plastic for the diaphragm 12, the hinge 12-1 was present with the dulled portion 18 omitted from the first body member 10.

When the diaphragm 12 has been sheared sufficiently, e.g., as in FIG. 4C, the complementary material such as mercury originally placed in the first body member 10 falls into the bowl portion 11-1 of the second body member 11. Upon further movement of the first body member 10 with respect to the second body member 11 the hingeably sheared diaphragm 12 is forced against the inner wall of the second body member, becomes trapped and adopts the contour of a gap or recess 11-2 between the inner and outer walls of the two body members, as shown in FIG. 4D. For the embodiment of FIG. 4D the recess extends from the open end of the second body member 11 to the vicinity of its closed end, where the inside diameter of the second body member is substantially the same as that of the first body member 10.

When the first body member has run the full course of its travel, due to the applied compressional force, the outer wall of its free end mates with the inner wall of the second body member so that a resultant unitary chamber is formed which extends upward from the bowl portion 11-1 of the compressed mixing capsule. A sealing flange minimizes access to the recess 11-2.

Once the capsule has been fully compressed, the ingredients to be mixed occupy the bowl portion 11-1. Thereafter the mixing can take place by shaking either manually or by machine. Because of the way in which the diaphragm 12 is trapped in the recess 11-2, it is unable to interfere with any subsequent shaking operation. In addition the engagement of the lower portion of the first body member 10 with the bowl portion 11-1 of the second body member 11 produces a unitary mixing chamber which forestalls the loss, in the recess 11-2, of any of the materials being mixed. It is to be noted that even where the capsule is only partially compressed, the membrane or diaphragm 12 becomes trapped and unable to interfere with any subsequent shaking operation.

In addition to producing a unitary chamber, full compression of the mixing capsule causes the upper flange 19-1 to engage the base of the cup member 13 from which the membrane or diaphragm has been sheared. This facilitates the separation of the components of capsule in the fashion of FIG. 5 once the shaking operation is completed and the constituent materials have been thoroughly mixed. In the case of a capsule designed for partial compression, the flange 19-1 is disposed accordingly. To obtain access to the resulting mixture in the unitary chamber of FIG. 4D, the principal components of the mixing capsule can be separated by grasping the knurled portions 21 and 22 and withdrawing the first body member from the second. As shown in FIG. 5, the cup and diaphragm can be withdrawn from the second body member 11 as a unit.

While the foregoing disclosure of exemplary embodi-

ments is made in accordance with the patent statutes, it is to be understood that the invention is not limited thereto or thereby, the inventive scope being defined in the appended claims.

We claim:

1. A mixing capsule comprising:

a first elongated body member open at one end and closed at the other end;

a second elongated body member open at one end, closed at the other end and proportioned to receive the first body member with a gap between respective inner and outer walls of the two body members;

each of said body members being adapted to receive a quantity of material for mixing;

a cup member open at one end and closed at the other end by a frangible, transversely extending diaphragm;

said cup member receiving, at its open end, the open end of said first body member and being secured to said second body member, filling said gap, at the open end of said second body member with said diaphragm transversely disposed therein;

the open end of said first body member being proportioned to break said diaphragm and trap the diaphragm thus broken in the gap below said cup member when said open end is moved from said cup member into said second body member thereby interiorly connecting said body members for the mixing of materials therein.

2. A mixing capsule as defined in claim 1 wherein said diaphragm is of resilient plastic and the open end of said first body member is proportioned to hingedly shear said diaphragm and trap the diaphragm thus sheared in said gap below said cup member when said open end is moved from said cup member into said second body member.

3. A mixing capsule as defined in claim 1 further including a circumferential flange upon said first body member.

4. A mixing capsule as defined in claim 1 further including a sealing flange on said first body member for facilitating the withdrawal from said second body member of said first body member intact with said cup member.

5. A mixing capsule as defined in claim 1 wherein said second body member includes, at the closed end thereof, a bowl portion which, upon full compression of said mixing capsule, engages the open end of said first body member and forms a unitary chamber therewith.

6. A mixing capsule as defined in claim 1 wherein the open end of said first body member includes a chamfered, interrupted cutting edge.

7. A mixing capsule as defined in claim 6 wherein said cutting edge is interrupted by a dulled portion.

8. Apparatus as defined in claim 1 wherein the open end of said first body member is formed at an angle with respect to the longitudinal axis thereof and is proportioned to shear said diaphragm to form a unitary hinge member and trap entirety of said hinged member in said recess when said capsule is longitudinally compressed.

9. Apparatus as defined in claim 8 wherein the thickness of said diaphragm is less than the wall thickness of said cup member and the open end of said first body member is proportioned so that said unitary hinge member sheared from said diaphragm adopts the contour of said recess.

10. A mixing capsule comprising:

an elongated body member for containing a first substance and having an interior recess extending from a closed end to an open end;

a flexible membrane sealing said body member below the open end thereof;

another elongated body member, closed at one end, for containing a second substance and having an open end inserted into the first mentioned body member above said membrane;

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the open end of the second mentioned body member being proportioned to shear said membrane and trap the membrane thus sheared in said recess when said capsule is compressed, thereby to prevent the sheared membrane from interfering with the intermixing of the first and second substances.

11. A mixing capsule as defined in claim 10 wherein said flexible membrane is of plastic and the open end of said second mentioned body member is proportioned to hingeably shear said membrane.

12. Apparatus as defined in claim 11 wherein said body members are tubular and the open end of said second body comprises means for shearing said membrane over a major portion of the circumference thereof and trapping the membrane thus sheared in arcuate contour in said recess in response to the compression of said first body member with respect to said second body member.

13. Apparatus as defined in claim 11 wherein the open end of said second body member has a toe portion and a cutting edge extending peripherally away therefrom.

14. Apparatus as defined in claim 13 wherein the open end of said first body member is formed at an angle with respect to the longitudinal axis thereof and said cutting edge extends from said toe portion to the vicinity of a heel portion, opposite from said toe portion, said cutting edge being of greater longitudinal extent in the vicinity of said toe portion than in the vicinity of said heel portion.

15. A mixing capsule as defined in claim 10 wherein said second mentioned body member includes circumferential sealing means on the shank portion thereof.

16. A mixing capsule as defined in claim 10 further including means on said second mentioned body member for facilitating the withdrawal, from said first mentioned body member, of said second mentioned body member, said cup member and said sheared membrane as a complete unit.

17. A mixing capsule as defined in claim 10 wherein said first mentioned body member includes, at the closed end thereof, a bowl portion which, upon full compression of said mixing capsule, engages the open end of said second mentioned body member and forms a unitary chamber therewith.

18. A mixing capsule as defined in claim 10 wherein

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the open end of said second mentioned body member includes a chamfered, interrupted cutting edge.

19. A mixing capsule as defined in claim 17 wherein the open end of said second mentioned body member has a heel region with a dulled portion.

20. A mixing capsule comprising:

a first cylindrical body member closed at one end and open at the other end;

a second cylindrical body member closed at one end and open at the other end, the inside diameter of said second body member being (1) smaller in the vicinity of its closed end than in the vicinity of its open end and being (2) substantially equal, near said closed end, to the outside diameter of said first body member in the vicinity of the open end thereof;

a cup member open at one end and closed at the other end by a flexible and frangible plastic diaphragm, the closed end of said cup member being snugly inserted into the open end of said second body member; and the open end of said first body member being snugly inserted into the open end of said cup member and including means for (1) shearing the diaphragm of said cup member and (2) trapping the diaphragm thus sheared in the region between the inside diameter of said first body member and the outside diameter of said second body member.

21. Apparatus as defined in claim 20 wherein:

the wall thickness of said cup member is greater than the thickness of said diaphragm;

the open end of said first body member is formed at an angle with respect to the longitudinal axis thereof and chamfered to form a cutting edge for shearing said diaphragm;

the chamfer of said cutting edge extending over at least the major portion of the periphery of said open end.

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