July 8, 1969 S. A. BLOOM 3,454,177

PLURAL COMPARTMENT CAPSULE

Filed Nov. 17, 1967

FIG. 1

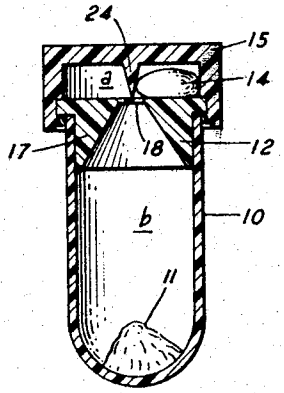


FIG. 2

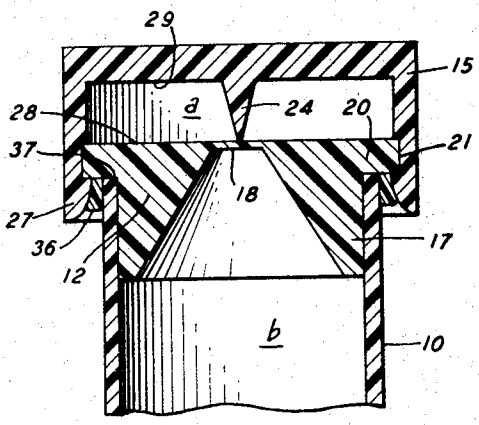


FIG. 3A

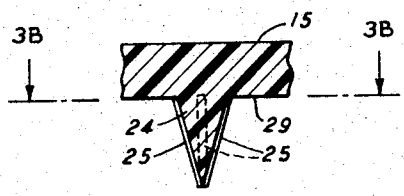


FIG. 3B



FIG. 4

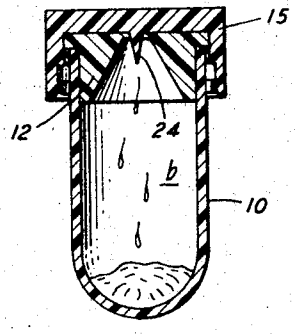
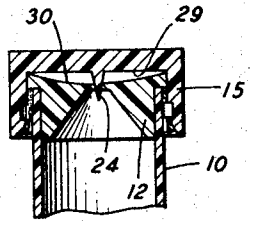


FIG. 5



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PLURAL COMPARTMENT CAPSULE

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ABSTRACT OF THE DISCLOSURE

A two chamber capsule is disclosed in which a sealing member fits into the lower vial-like member and has a thin central membrane portion. An end cap, defining with the sealing member the upper chamber, has a piercing pin positioned directly adjacent the thin membrane so as to pierce a hole in the membrane immediately upon motion of the cap onto the sealing member and the vial. The piercing pin has flutes or grooves in its surface so that the liquid contained in the upper chamber is ejected into the lower vial without removing the pin from the hole in the membrane.

BACKGROUND OF THE INVENTION

This invention relates to a plural compartment capsule particularly adapted to the packaging or premeasured quantities of material to be mixed together before use.

There are a number of instances in the medical and dental fields, among others, when a doctor or a dentist has to mix together two ingredients before using them. These ingredients may be two liquids, which must be mixed together before being used for an injection; a liquid and a powder, as to form an amalgam for a dental filling; or any complementary materials. The amounts of these ingredients must be carefully measured, but it is not possible to mix them together until just before they are to be used.

To relieve the user of the tedious and unnecessary bother of actually measuring out these ingredients and then mixing them together, there have been proposed and are available a number of disposable capsules to fill this need. Disposable capsules have a number of other advantages including avoiding any contamination from poorly cleaned utensils used in the mixing process or from poor cleaning of reusable capsules, if such are employed. Disposable capsules obviously eliminate the need to clean any utensils in preparation for the mixing of the ingredients. These capsules may be of several different types but basically all involve a plurality of compartments with one ingredient placed in one compartment and another ingredient priorly placed in another.

In one type an upper and a lower chamber are defined with one of the mixture ingredients in each. The two chambers are then brought together, as by telescopically sliding them together, and a membrane between the two chambers is ruptured. The two ingredients are then mixed together in either the lower of the chambers or in the chamber defined now by both together. In some capsules of this type the ruptured membrane falls into the lower chamber and is in the way of the mixture. In other capsules of this type the membrane is a flap, pushed to one side. In either case, however, the contents of the upper chamber are allowed to fall through this hole into the lower chamber.

In another type the bringing together of the upper and lower chamber merely forces a hole to be made in the membrane that separates the two chambers. The upper chamber is then withdrawn to allow the contents of the upper chamber to drop through this hole into the lower chamber for mixing. This has both the defect that it requires more than a single action on the part of the user and also the defect that not all of the contents of the upper chamber may fall through this hole.

In another type of known capsule when the amount of liquid to be mixed with the powder is small, the liquid is not placed in a chamber but is instead sealed into a sack. The movement of the capsule parts is then utilized to rupture the sack causing the release of the liquid. The major defect of these capsules is that only a very limited amount of liquid can be accommodated in a sack. Further the fabrication of these sacks is more expensive than just the placing of the same liquid into a cap or other chamber of a multi-compartment capsule.

It is therefore an object of my invention to allow a single squeezing together of the different portions of a multi-compartment capsule to assure, by a positive action, the ejection of all of the contents of the one compartment into the other for mixing.

It is a further object of my invention to reduce the cost of fabrication of such capsules.

It is a further object of my invention to simplify the usage of such capsules by the user, whereby a single action only is required to mix the ingredients and only a single action is required to remove all the parts from the mixing chamber.

It is a still further object of my invention to allow fabrication of such a capsule without critical tolerances on the various parts.

It is another object of my invention to prevent contamination of the ingredients within the compartments either from the outside atmosphere or from each other. Further it is an object of my invention that this double function be accomplished by a simple and single structure that serves both to seal the compartments from the outer atmosphere and from each other.

SUMMARY OF THE INVENTION

These and other objects of my invention are attained in one illustrative embodiment wherein the multi-compartment capsule contains three elements: a lower vial defining a mixing chamber in which one of the premeasured ingredients of the mixture is retained; an upper cap which partially defines an upper chamber in which the other premeasured ingredient is stored; and a sealing member or separator between these two elements and cooperating with each.

The sealing member is quite thin adjacent the center of the open mouth of the lower vial and the upper cap has centrally located on its inner surface directly opposite this thin membrane portion a piercing pin. Unlike prior arrangements, however, this piercing pin does not cause the membrane to be cutaway and fall into the lower vial, neither does the piercing pin itself fall into the lower vial. At the same time because of my unique arrangement the pin does not block the hole it creates upon piercing the sealing membrane. This is because, in accordance with an aspect of my invention, the piercing pin is fluted, having one or more channels along its surface thereby providing paths for the liquid stored in the upper cup to go into the lower or mixing chamber without withdrawing the pin from the hole it creates.

Further, because of the arrangement and cooperation of the three parts of my capsule, a positive piston-like action occurs when the upper cup is pushed towards the lower vial and, by its piercing pin, creates the path for the liquid to be ejected into the lower mixing chamber. Specifically, in accordance with another aspect of my invention, the sealing member has a flange extending beyond the wall of the lower vial and providing a sealing edge against which the inner surface of the upper cup abuts and moves. This causes a piston action to occur

forcing the fluid in the upper cup to be ejected into the mixing chamber through the fluted piercing pin.

Advantageously the upper surface of the sealing member and the complementary inner surface of the end cap define mating surfaces which, upon completion of the motion of the cap over the sealing member, abut each other. In this way substantially all of the liquid in the upper chamber is forced into the lower chamber without relying on gravity or the back and forth motion of the capsule during the mixing operation.

In one specific embodiment these two surfaces are normally flat and parallel each other. In another embodiment the upper surface of the sealing member is slightly concave so that contact with the inner surface of the cap is first made at the periphery and the area of contact then grows radially inward from this periphery.

It is a feature of my invention that a plural compartment capsule have a sealing member between two chambers and adapted to be pierced by a fluted piercing point, whereby the liquid in the one chamber can be forced through the grooves or channels in the surface of the piercing point in bypass thereof without the necessity for withdrawing the piercing point from the hole it has made.

It is another feature of my invention that the sealing member is adapted to be transferred during the operation of the capsule from the lower vial member to the upper cap member. Specifically, in accordance with this feature of my invention, the sealing member acts as a plug or stopper in the open mouth of the lower vial initially but is subsequently forced into the upper cap member so as to be removed together with it from the vial after the mixing of the ingredients. Thus the sealing member forms a first smooth seal with the mouth of the vial and then a tighter seal with the end cap.

It is another feature of my invention that the sealing member have a flange portion extending beyond the mouth of the vial and fitting into a groove on the inner surface of the end cap. Further in accordance with this feature, the flange portion extends into the end cap groove in such a way that the under surface of the flange defines a space between the end cap side wall and the outer wall of the lower vial. I provide that this surface and the volume defined by it, the end cap, and the vial walls be filled with a sealing material which prevents leakage of any contaminants along the surfaces of the various parts and into the compartments, whether from the outer atmosphere or between the compartments themselves.

It is another feature of my invention that the sealing member be of a softer or more compliant material than either the vial or the end cap. More specifically, it is a feature of this invention that the three parts thereof may readily be molded of plastic, with the middle sealing member of a softer plastic. It is further a feature of my invention that the dimensions are not critical.

It is still another feature of my invention that the sealing member have a thin membrane portion centrally thereof and the piercing point be positioned adjacent or directly on this membrane so that immediately upon motion of the cap the membrane is pierced. In accordance with this feature, pressure does not build up in the smaller upper chamber before it can be utilized in forcing the liquid into the lower chamber, where the pressure is effectively released because of the larger volume of the lower chamber.

It is still a further feature of my invention that the liquid in the upper chamber is forced into the lower chamber through the fluted piercing point by the piston-like action of the end cap as it moves over the outer flange portion of the sealing member.

It is still a further feature of my invention that the upper surface of the sealing member and the inner surface of the end cap be mating surfaces so as to be directly abutting each other after completion of the motion of the end cap. In one specific embodiment the two surfaces are flat and parallel while in another specific embodiment the one surface is flat while the other surface is concave, but becomes flat after completion of the motion of the end cap.

DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional view of one specific illustrative embodiment of my invention, the plural compartment capsule being depicted with the two compartments each containing their separate ingredients prior to use;

FIG. 2 is an enlarged view of the upper cap, the sealing member, and the upper mouth of the lower vial, depicting particularly the interlocking of these components;

FIGS. 3A and 3B depict the piercing pin of the embodiment of FIG. 1, FIG. 3B being a sectional view taken along the line 3B—3B of FIG. 3A;

FIG. 4 is a view similar to FIG. 1 but depicting the two compartment capsule after operation to mix the two ingredients in the lower vial; and

FIG. 5 is a sectional view of another specific illustrative embodiment of my invention, the view being taken during the operation of forcing the fluid from the upper compartment into the lower compartment.

DETAILED DESCRIPTION

General description

Turning now to the drawing, there is depicted in FIG. 1 one illustrative embodiment of my invention. As there seen I employ a vial **10** defining lower or main chamber *b* in which is located an accurately premeasured amount of powder or fluid **11** which comprises one constituent of the final mixture. Cooperating with the main mixing vial **10** are a sealing member **12** and an end cap **15** which defines an upper chamber *a* in which is contained the other constituent, which may be a fluid or other liquid element **14**. In one specific utilization of my invention in the preparation of dental amalgams, the constituent **11** in the lower chamber *b* may be a silver alloy powder, known as dental alloy, and the constituent **14** in the upper chamber *a* may be mercury.

The sealing member or separator **12** has an inner support portion **17** which fits snugly into the upper open mouth of the lower vial **10**. This support has its own inner surface shaped in the form of a truncated cone, thereby defining a very thin central membrane portion **18** which may be only 7 to 10 mils in thickness. This central portion provides for the transfer of the fluid **14** to the lower vial **10**, after rupture, as described below. This construction of the sealing separator **12** so as to define only a very small area thin membrane **18** may have another important advantage. Frequently it is desired to fabricate multi-compartment capsules of a material which may allow an osmotic or vapor transfer through the material, which transfer is, of course, increased when the material is very thin. However, by providing that the thin central membrane is of a very small area I inhibit or strongly limit such transfer, even were such materials to be used.

The sealing member **12** has an outer flange **20** which extends beyond the outer surface of the lower vial **10**. The end cap **15** has an inner peripheral groove **21** into which this flange **20** fits during the initial filling of the two compartment capsule; this arrangement is best seen in FIG. 2. Because of the mating of these surfaces there is a transfer of the sealing member from the lower vial **10**, where it is initially placed, to the upper cap **15** with which it is removed after mixture of the ingredients. Between this initial manufacturing step and the final removal of the end cap preparatory to use of the mixed ingredients, the sealing member is locked into position so as effectively to separate the two chambers.

As can be best seen in FIG. 2, the lower end of the side wall of the cap **15** is chamfered or beveled, as at **27**; however, this beveled portion **27** is not contiguous to the wall of the lower vial **17**. Instead there is a portion of the lower surface **37** of the flange **20** between them. In accordance with an aspect of my invention a sealant

36, which may be of wax, plastic, rubber, or other material which will seal to the material of the other parts of the capsule, fills this space between the beveled portion 27, the surface 37, and the vial 10. This single sealant element 36 serves to prevent any leakage along the surfaces of the separator 12 between the compartments *a* and *b* and also to prevent any leakage into either chamber from the outside atmosphere. This sealing is of particular importance if either ingredient is water sensitive, being likely to absorb water vapor from the atmosphere; volatile and likely to evaporate; or likely to oxidize if in contact with air.

The aspect of my invention referred to above and involving the different functions of the sealing member 12 at different times during the assembly and use of my invention will be further discussed below with reference to the manufacture, filling, and operation of my invention.

In accordance with another aspect of my invention the end cap 15 has centrally formed therewith a piercing point 24. The point 24 is positioned directly above the thin central portion 18 of the sealing member 12. Further, and in accordance with an important aspect of my invention, the point 24 is formed with flutes or channeled grooves 25 on its surface. As best seen in FIGS. 3A and 3B in this specific illustrative embodiment, four flutes 25 are provided.

The piercing pin 24 may be quite short, and as ⅛ of an inch. The dimensions of the pin 24 are not critical, which is of considerable importance to the ease of manufacture of the two chamber capsule. Similarly neither the number of flutes 25 nor their dimensions are critical; however, the number and their size obviously affect the rapidity with which the liquid in the upper chamber *a* can be forced into the lower chamber *b*.

Manufacture and assembly of the capsule

Each of the three parts of a capsule in accordance with my invention may advantageously be readily molded of known plastic materials, though other materials may be employed as will be apparent. However, in accordance with an aspect of my invention and to allow for the transfer of the sealing member 12 from the lower vial 12 to the end cap 15 it is advantageously of a softer or more compliant material than either the vial 10 or the end cap 15.

Specifically in one exemplary embodiment the lower vial 10 may be of polypropylene, molded to form a vial about one inch long and about one-half inch in diameter across the open mouth. Similarly, the end cap 15 may be molded of polypropylene, may be about 9/16 of an inch across and about ¼ of an inch in height. The groove 21 is located on the inner surface so as to define an upper chamber *a* about ⅛ of an inch deep. The piercing pin 24 is thus about ⅛ of an inch long so that it just abuts the upper surface of the thin central portion 18 of the sealing membrane 12 when the capsule is assembled. It is, however, of course understood that the capsule could be of any reasonable size and is not to be considered limited to the exemplary dimensions mentioned herein.

Other relatively hard materials may be used for the vial 10 and end cap 15, the only requirements being ease of manufacture and that a sharp, rigid piercing point 24 can be located in the end cap 15.

The sealing member 12 may also advantageously be of a molded plastic, but of a softer plastic such as, in this exemplary embodiment, ethylene vinyl acetate, though other plastics such as polyvinyl chloride or a soft polyethylene may be employed. Similarly the sealing member 12 may be of a rubber, the rubber being also molded and being relatively hard, but softer or more complaint than the material of the vial 10 and end cap 15.

After the individual parts are manufactured, they may readily be assembled by suitable machinery. First the premeasured amount of powder 11 is placed into the vial 10. The sealing member 12 is then forced into the open mouth of the vial 10. The outer surface of the inner support portion 17 of the sealing member 12 is smooth and fits snugly against the smooth inner surface of the open mouth of the vial. The lower vial 10 is now effectively sealed or plugged and the powder held in place.

Next the end cap 15 is positioned on a surface so that the piercing point 24 is pointing up and the accurately premeasured drop of liquid 14 is placed in it. The vial with the diaphragm or member 12 plugging its open mouth is then forced into the cap 15, the vial 10 being of course upside down from what is depicted in FIG. 1.

As seen in FIG. 2 and mentioned above, the lower end of the side wall of the cap 15 is chamfered or beveled, as at 27, so that the outer flange 20 can readily be forced into the cap 15 until it snaps into position in the groove 21. It is to be remembered that the middle or diaphragm member 12 is of a softer material than either the vial 10 or cap 15. The sealant 36 may then be applied between the beveled portion 27 and the vial 10 so as to seal to them and to the surface 37.

At this time the powder 11 is sealed into the lower vial 10 by the plug effect of the diaphragm member 12 and the liquid 14 is sealed into the cap 15 by the flange portion 20 locked into the groove 21. The two ingredients are thus protected and prevented from spilling or loss, and they are further prevented from evaporation or contamination by the sealing material 36.

In this condition, which is as shown in FIGS. 1 and 2, the capsule may be shipped to its ultimate user and stored by him until use.

Mixing of the ingredients

When it is desired to perform the mixing operation preparatory to using the mixed material, the user need only squeeze the assemblage together, breaking the seals formed by sealant 36. When this is done the piercing point 24 immediately pierces the thin sealing membrane 18. Advantageously in accordance with my invention the piercing point is directly adjacent or abutting the membrane 18 prior to this telescoping of the parts so that there is no unwanted build up of air pressure in the upper chamber *a;* instead this pressure is immediately released and forced into the larger lower chamber *b*.

The pin 24 thus immediately pierces the membrane 18. Unlike prior devices of this general type, however, the pin 24 does not itself seal the hole it has thus made. Instead, because of its unique structure the flutes 25 in its surface allow the liquid 14 trapped in the upper chamber *a* to bypass the point 24 and fall into the lower chamber *b* for mixing.

However, in accordance with another aspect of my invention the liquid 14 does not merely fall into the lower chamber *b* but instead is positively forced into the lower chamber. The squeezing action causes a positive forcing of the liquid from the upper chamber *a* into the mixing chamber *b*, thus assuring that all the accurately premeasured liquid is available in the lower chamber *b*. Specifically, the telescoping of the parts together forces the flange 20 out of the groove 21. The material of the sealing member 12 being somewhat softer or more compliant than that of the end cap 15, the flange 20 is compressed as the inner wall of the cap 15 is forced over it. This causes a piston-like action to occur, positively driving or forcing the fluid 14 through the grooves 25 in the pin point 24 and thus into the mixing chamber *b*.

At this point another important advantage of my construction may be pointed out. Plastic materials are known to set with time. If the end cap 15 did not have the groove 21 therein so that the separator 12 was merely forced into the smooth inner wall of the cap 15, upon the plastic of the separator 12 setting the interference fit between it and the wall of the cap 15 would diminish. The

result would be that when the cap was pressed down over the separator, as described above, the piston action would not occur. Instead a portion of the pressure build up in the upper chamber *a* would be released between the wall of the cap **15** and the separator **12** and would not be effective in forcing the liquid through the flutes **25** of the point **24** into the lower chamber *b*. Accordingly, my construction, including the groove **21** into which the flange portion **20** fits and the relative softness of the plastic of the separator **12** with respect to the end cap **15**, serves to solve the shelf life problem inherently encountered in plastics due to their tendency to set.

In accordance with another aspect of my invention the upper surface **28** of the sealing diaphragm **12** and the lower surface **29** of the end cap **15** are mating surfaces. In this specific illustrative embodiment these two surfaces are both flat and parallel each other, thus assuring that the liquid is all ejected through the fluted piercing point **24**.

It should be pointed out that the size of the hole itself made by the piercing point **24** in the thin membrane **18** is not critical. It is only necessary that the flutes **25** allow the liquid to bypass the point and drop, under the ejection pressure created in the upper chamber *a* into the lower chamber *b*.

After the end cap **15** is pressed down upon the sealing membrane **12**, the resultant structure is as shown in FIG. 4. At this time the resultant assemblage can be thoroughly shaken to mix the two ingredients together, both being now in the mixing chamber *b*, as by an amalgamator, vibrator, or, if desired, by hand.

Removal of the cap and diaphragm from the lower vial

After the ingredients have been thoroughly mixed, the user can hold the lower vial **10** in one hand and pull the end cap **15** with two fingers away from it. Because of the organization of the sealing diaphragm **12** with the vial **10** and the end cap **15**, in accordance with my invention, the diaphragm **12** has been effectively transferred from the vial **10**, to which it was first assembled, to the end cap **15**, with which it is now removed.

It will be recalled that the flange **20** when forced out of the groove **21** fits very tightly against the inner wall of cap **15**, thereby creating the piston pressure to eject the liquid through the flutes or grooves **25**. At the same time the outer surface of the support **17** and the wall of the mouth of the vial **10** formed a snug but smooth fit. Accordingly, diaphragm **12** is more tightly held by the end cap **15** and is removed with it in a single motion.

This is an important aspect of my invention as it is readily understandable that opening of the capsule must be both easy and simple. With my invention the outer surface of the end cap **15** provides a sufficient area for the user to grasp the cap, and only a single operation, namely removal apparently of the cap alone, is required to remove both the cap and the diaphragm, leaving only the open vial **10** in which is contained the mixed ingredients ready for use.

Embodiment of FIG. 5

In FIG. 5 there is depicted a slightly different embodiment of my invention. As there seen, the sealing diaphragm **12** has an upper surface **30** which is very slightly concave. FIG. 5 depicts the capsule during the operation of ejecting the fluid from the upper chamber into the lower chamber. Accordingly, the flange of the diaphragm has been removed from the inner groove but the two surfaces **29** and **30** have not yet mated flat.

As can be seen with this embodiment and with the slightly concave surface **30** the outer end of the surface **30** touches the surface **29** first and the area of mating contact then increases inwardly. This further serves to force the liquid trapped in the upper chamber *a* from the outer periphery of the chamber inwardly towards the center of the chamber and specifically towards the piercing point **24** which extends through the thin membrane **18** into the lower chamber. In this way the forced ejection of all the liquid into the mixing chamber *b* is further enhanced.

Conclusion

While specific illustrative embodiments of my invention have been described herein, it is to be understood that these are merely illustrative of the principles of my invention and that various modifications may be made by those skilled in the art without departing from the scope and spirit of my invention.

I claim:

1. A plural compartment capsule for containing materials to be mixed together comprising

a lower vial-like vessel defining a mixing chamber,

a separator member across the open end of said vessel, and

an upper cap member positioned on said separator member and having a pin adapted to pierce said separator member upon motion of said lower vessel and cap member towards each other, said piercing pin having a piercing point and a plurality of shallow flutes in its surface not directly involved in the piercing of said separator member whereby the contents of said upper cap member are forced through said shallow flutes in the surface of said piercing pin directly into said mixing chamber after said separator member is pierced by said pin without removing said piercing pin from said separator member.

2. A plural compartment capsule for containing materials to be mixed together comprising

a lower vial-like vessel defining a mixing chamber,

a separator member across the open end of said vessel, and

an upper cap member positioned on said separator member and having a pin adapted to pierce said separator member upon motion of said lower vessel and cap member towards each other, said piercing pin having at least one flute in its surface whereby the contents of said upper cap member are forced directly into said mixing chamber without removing said piercing pin from said separator member, and

wherein said separator member fits into the open mouth of said lower vessel and has a flange portion extending beyond the side wall of said vessel, said flange portion providing a sealing edge for said upper cap member.

3. A capsule in accordance with claim **2** wherein the inner wall of said cap member has a groove therein, said flange portion fitting into said groove when said separator member is between said mixing chamber and an upper chamber defined by said cap member.

4. A capsule in accordance with claim **3** wherein the lower surface of said cap member is beveled to facilitate positioning of said flange portion in said groove.

5. A capsule in accordance with claim **4** wherein a sealant element is located between and sealed to the beveled lower portion of said cap member, the outer wall of said lower vessel, and the lower surface of said flange portion.

6. A capsule in accordance with claim **3** wherein said separator member is of a more compliant material than said vessel and said cap member.

7. A plural compartment capsule for containing materials to be mixed together comprising

a lower vial-like vessel defining a mixing chamber,

a separator member across the open end of said vessel, and

an upper cap member positioned on said separator member and having a pin adapted to pierce said separator member upon motion of said lower vessel and cap member towards each other, said piercing pin having at least one flute in its surface whereby the contents of said upper cap member are forced directly into said mixing chamber without removing

said piercing pin from said separator member, and wheren the upper surface of said separator member and the inner surface of said cap member define mating surfaces whereby the contents of the chamber defined by said cap member are forced through said fluted piercing pin when the motion of said cap member and vessel towards each other is complete and whereby said mating surfaces abut when said motion is complete.

8. A capsule in accordance with claim **7** wherein said upper surface of said separator member is flat and parallel to the inner surface of said cap member.

9. A capsule in accordance with claim **7** wherein said inner surface of said cap member is flat and the upper surface of said separator member is concave, whereby mating of said surfaces occurs from the outer periphery inward as said cap member and said vessel move towards each other.

10. A plural compartment capsule for containing materials to be mixed together comprising

a lower vial-like vessel defining a mixing chamber,

a separator member across the open end of said vessel, and

an upper cap member positioned on said separator member and having a pin centrally positioned by said end cap member and adapted to pierce said separator member upon motion of said lower vessel and cap member towards each other, said separator member defining a thin membrane opposite said pin,

said piercing pin having at least one flute in its surface whereby the contents of said upper cap member are forced directly into said mixing chamber without removing said piercing pin from said separator member, and

wherein said piercing pin is directly adjacent said membrane prior to motion of said cap and vessel towards each other, whereby the pressure built up in the upper chamber defined by said cap by said motion is immediately effective to eject the contents of said upper chamber into said mixing chamber.

11. A two compartment capsule comprising

first means defining an upper chamber,

second means defining a lower chamber,

separator means between said chambers, and

means for forcibly ejecting the contents of said upper chamber into said lower chamber through said separator means, said last mentioned means including a piercing pin carried by said first means and having a piercing point at its end for cutting through said separator means and further having at least one shallow groove in its surface through which said ingredients are ejected, said pin extending through said separator means after it is cut by said point and said groove not being required for cutting through said separator means.

12. A two compartment capsule in accordance with claim **11** wherein said separator means is adapted to be transferred from said second means to said first means on motion of said first and second means towards each other, said separator means being of a softer matreial than said first and second means.

13. A two compartment capsule comprising

a lower vial-like vessel defining a mixing chamber,

a separator member across the open mouth of said vessel,

an upper cap member extending over said separator member and defining therewith an upper chamber, said cap member having an inner groove therein and said separator member having a flange portion extending into said groove,

said upper cap member defining below said separator member a space between said cap member, the lower surface of said separator member, and said vessel, and

a sealing element positioned in said space and sealed to said cap member, said lower surface of said separator member, and said vessel.

14. A capsule in accordance with claim **13** wherein said separator member is of a more compliant material than said cap member and further comprising means carried by said cap member for piercing said separator member.

15. A two compartment capsule comprising a plastic vial defining a first chamber and having an open mouth,

a sealing member having a smooth outer surface fitting into said open mouth, said sealing member defining a thin membrane portion centrally thereof and having a flange portion extending beyond the outer edge of said open mouth,

a plastic cap member defining a second chamber fitting over said sealing member, said cap member having a groove in its inner surface into which said flange portion fits and having a piercing pin centrally located directly adjacent said membrane portion, said piercing pin having at least one groove on its surface through which the ingredients in said chamber are forcibly ejected into said first chamber on motion of said cap member and said vial towards each other,

said sealing member being of a softer plastic than said cap member whereby said sealing member is held by said cap member after said cap member has been forced down over said sealing member so that said cap and sealing members are removed together from the mouth of said vial in one operation.

References Cited

UNITED STATES PATENTS

2,527,992	10/1950	Greenberg.	
2,642,870	6/1953	Smith	215—6 X

DONALD F. NORTON, *Primary Examiner.*

U.S. Cl. X.R.

206—47; 215—40