United States Patent [19]

Purrmann et al.

[11] **3,907,106**

[45] **Sept. 23, 1975**

[54] **COMPOUNDING VESSEL**

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[73] Assignee: **E S P E GmbH,** Seefeld, Germany

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[21] Appl. No.: **360,532**

[30] **Foreign Application Priority Data**

May 31, 1972 Switzerland 008066/72

[52] **U.S. Cl.** **206/219;** 259/18; 222/80

[51] **Int. Cl.²** **B65D 81/32**

[58] **Field of Search** ..... 259/72, 27, 47, 48, 49, 259/54, 57, 60, 70, 71; 206/47 A, 219, 222; 222/80

[56] **References Cited**

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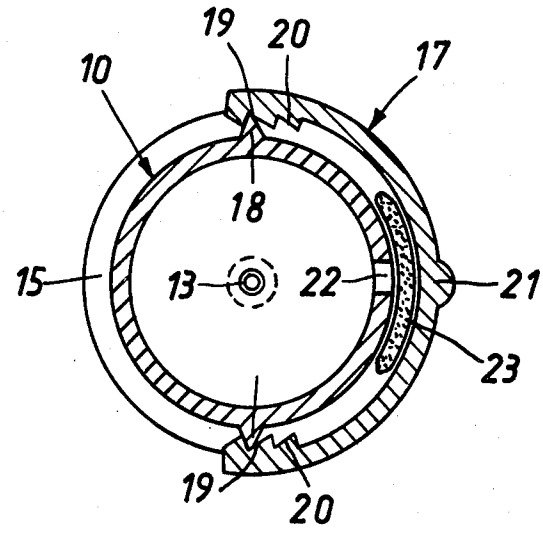
Primary Examiner—Robert W. Jenkins

Attorney, Agent, or Firm—Bierman & Bierman

[57] **ABSTRACT**

A compounding vessel for component substances which interact and form ready-for-use dental preparations. The vessel has a main chamber forming a mixing compartment (and adapted to contain a first component), and a supplementary chamber (adapted to contain a second component) separated by a membrane-closed opening from the mixing compartment. Mixing is effected by rupturing the membrane by pressure applied in a direction towards a wall of the main chamber.

10 Claims, 5 Drawing Figures



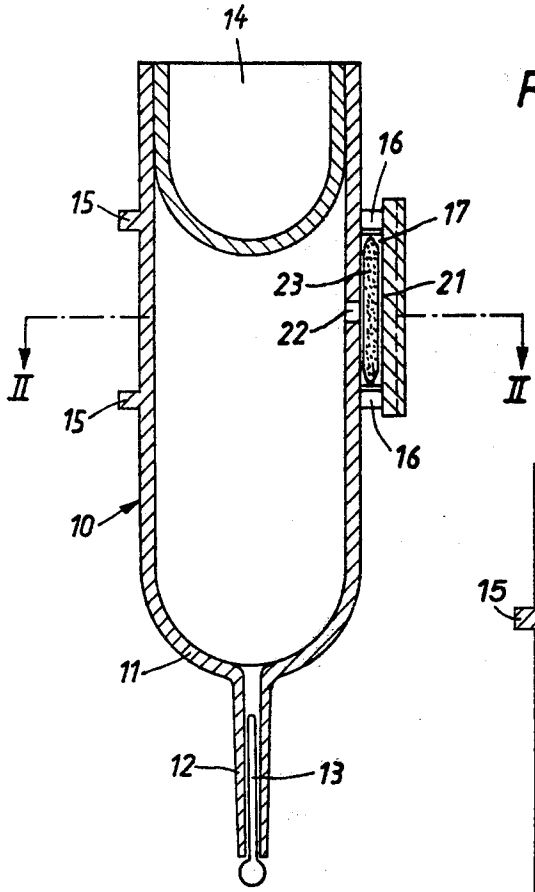


Fig. 1

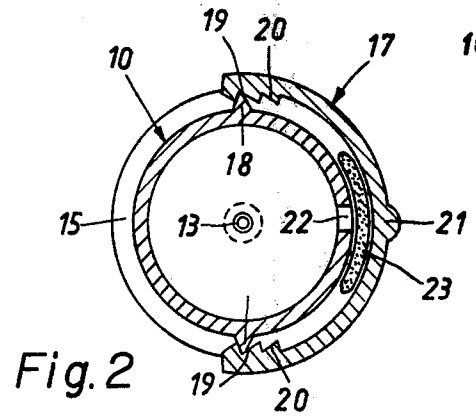


Fig. 2

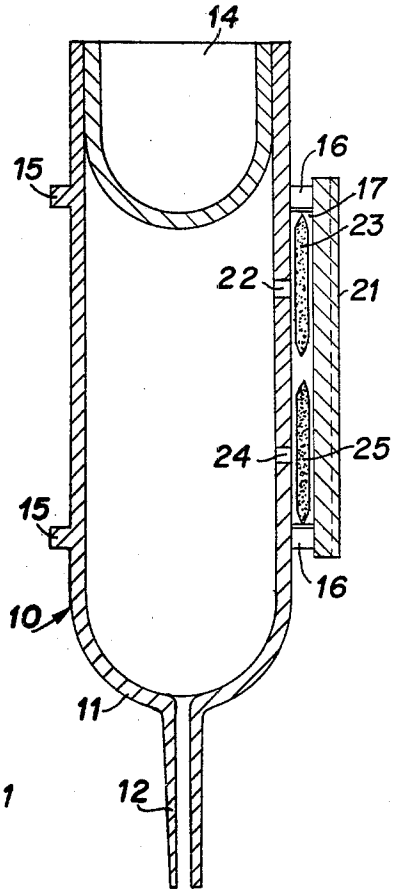
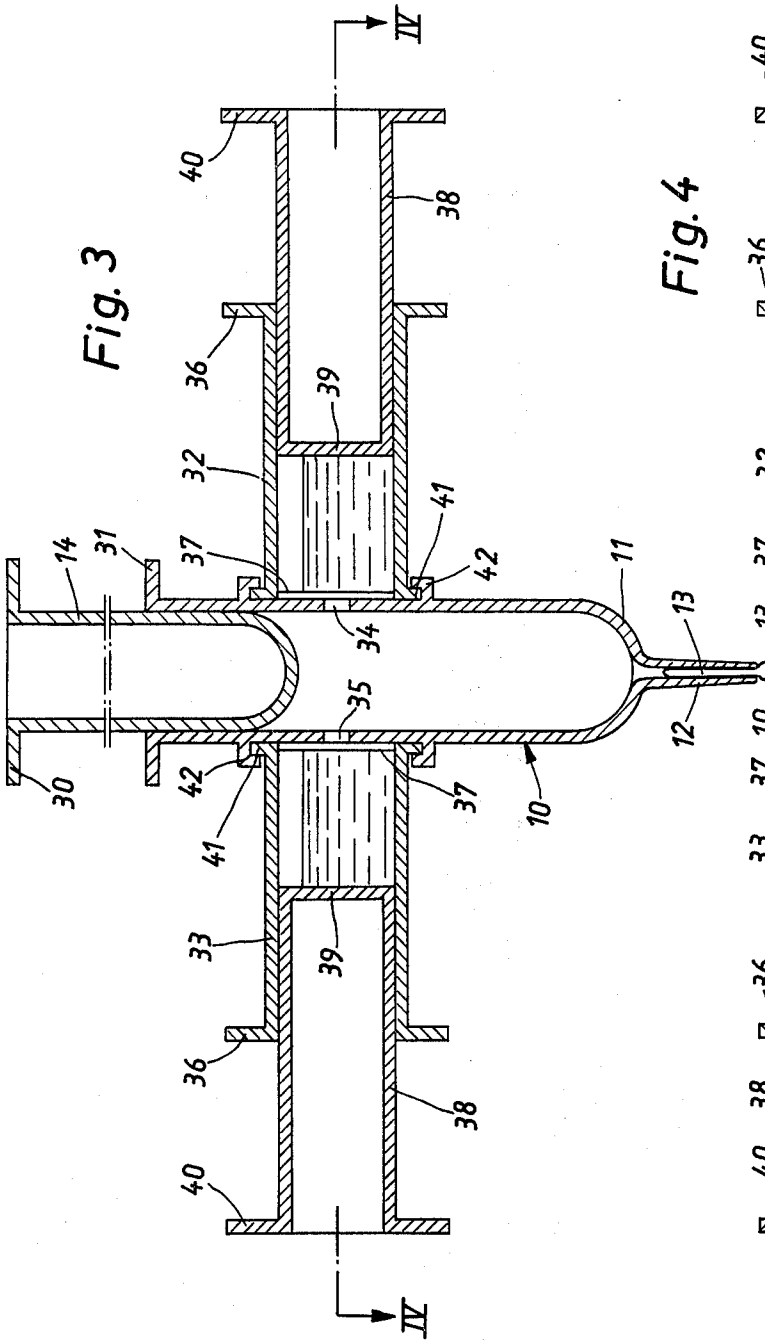


Fig. 5

Fig. 3


IV
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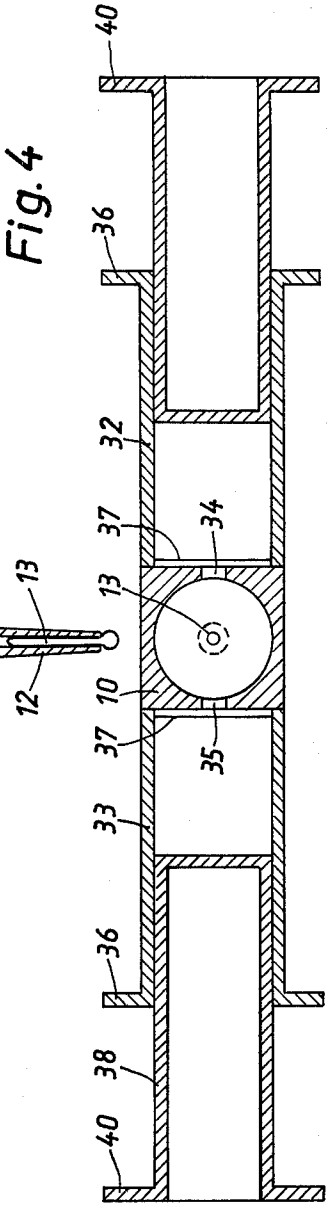
IV

Fig. 4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COMPOUNDING VESSEL

The invention relates to a compounding vessel for component substances which interact and form ready-for-use dental preparation, comprising a main chamber forming a mixing compartment and adapted to contain a first component, and at least one supplementary chamber adapted to contain respectively, one or more additional components and which adjoins a portion of the outside wall containing an opening which communicates with the mixing compartment, and which is closed by a membrane or bag which is ruptured when for the purpose of combining the components the capacity of the supplementary chamber is reduced.

Such a vessel has already been described in the published specification of German application No. 1,910,885. In this vessel the supplementary chamber which contains a foil bag is formed by the external surface of the cylinder wall of the main chamber wall and-/or the inside surface of the cover deviate from a pure concentric, axially symmetrical shape. By turning the cover in relation to the main chamber the capacity of the supplementary chamber can be reduced to the destruction of the foil bag which discharges its contents through the opening into the mixing chamber. In this vessel there is a risk of the rotary movement not being continued far enough for the foil bag to be completely discharged. When this happens the proportions of the components of the mixture will vary and the finished dental preparation will fail to have the expected optimum properties. Moreover, in the case of this vessel, special steps must be taken to ensure that during the twisting of the cover the foil bag will not be displaced from the opening in the wall of the main chamber. This requirement creates difficulties in the design or assembly of the several parts of the vessel.

Furthermore, the published specification of German patent application No. 1,939,316 describes a mixer vessel in which the supplementary chamber, which again contains a foil bag, is disposed between a piston that can be moved inside the main chamber and a plunger which is movable in relation to the piston. The reduction in capacity of the supplementary chamber for the destruction of the foil bag and the discharge of its contents into the mixing compartment of the main chamber is effected by displacing the plunger in relation to the piston. When the components that have thus been combined have been mixed the piston is displaced in the cylindrical main chamber and expels the mixture through a delivery nozzle in the other end wall of the main chamber. In other words, in this vessel the movements for bringing the two components together and for expelling the finished mixture proceed in the same direction axially in the cylindrical main chamber. However, since first only the plunger is moved in relation to the piston whilst the latter remains stationary inside the main chamber, appropriate arresting means or frictional resistances must be provided. These call for an extremely precise manufacture of the several parts of the vessel. The tolerances which must be observed are extremely critical because the piston which is first kept stationary in the main chamber must be capable of withstanding considerable pressure by the plunger to ensure that the foil bag will be completely discharged. Another difficulty inherent in this type of vessel is that portions of the ruptured bag can enter the mixture during the following violent shaking which is needed for

satisfactory commixture of the two components, and that the properties of the preparation may thus be impaired.

The present invention seeks to provide a compounding vessel for the production of dental preparation, which on the one hand enables the desired preparation to be produced in precisely the required mixture proportions without any risk of the inclusion of foreign matter and, on the other hand, comprises simple, easily produced elements that can be assembled without much trouble.

According to the invention, in a compounding vessel of the first hereinabove specified kind the capacity of the supplementary chamber is reduced by pressure applied in a radially inwards direction towards the wall of the main chamber. Such a pressure can be generated by a thrust-induced movement, which can be abruptly produced, causing the capacity of the supplementary chamber to be reduced essentially to zero and thus completely discharging the component of the mixture in the bag. Moreover, the opening in the cylindrical wall of the main chamber may be so disposed that a plunger, which may be provided in the main chamber, can be displaced to cover said opening after the supplementary chamber has been emptied and before the mixture is shaken, so that on the one hand portions of the ruptured bag cannot enter the mixing compartment and, on the other hand, the mixture cannot leak back into the possibly re-expanded supplementary chamber. For ejecting the finished mixture, such a plunger can be designed to move easily since it does not require the cooperation of arresting means and need not overcome special frictional resistance. Another advantage of the invention is that a compounding vessel based on the proposed principle of construction can be readily designed to mix three or more components by the provision of additional supplementary chambers.

In a convenient embodiment of the invention the supplementary chamber is constituted by a movable wall such as a partially cylindrical clip containing the second component in a foil bag, the internal diameter of said clip being substantially equal to the external diameter of a cylindrical wall of the main chamber and being held by engageable retaining elements in a position in which the inner surface of the clip is spaced away from the external surface of the cylindrical wall by a distance equal to the thickness of the filled foil bag. The compounding vessel in this arrangement is easy and cheap to produce and no strict tolerances need be observed.

To prevent the supplementary chamber from resiliently re-expanding after an abrupt capacity reduction and from thus drawing portions of the mixture back again by suction effects, it is preferred to provide further engageable elements for retaining the clip in a position in which its inside surface presses the empty foil bag tightly against the outside surface of the cylindrical wall.

If the compounding of the desired dental preparation requires the combination of three components, then two foil bags may be located either under a common, axially wider, clip, or one under each of two different separate clips.

In another convenient embodiment of the invention the supplement chamber is constituted by a cylindrical attachment disposed with its axis normal to the axis of a cylindrical main chamber and containing an axially slidably movable plunger which closes its free open

end. This embodiment is of particular utility when a relatively large quantity of the second component is needed, more than could be conveniently accommodated in a foil bag adapted to be destroyed by shock thrust.

For mixing three components this latter embodiment can be provided with an additional supplementary chamber which may resemble or be identical with the first supplementary chamber, and which is likewise attached to the main chamber, both supplementary chambers being preferably coaxially disposed.

In an advantageous further development of the invention, one end of the main chamber is closed by an axially tapering end wall from the centre of which an ejector nozzle projects, whereas the other end is closed by an axially slidably movable plunger. A mixer vessel which is thus constructed permits a ready-mixed dental preparation to be directly injected into the dental cavity that is to be filled.

The invention will now be more particularly described by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a first embodiment of a compounding vessel according to the invention, in longitudinal section,

FIG. 2 is a cross section taken on the line II — II in FIG. 1,

FIG. 3 is a second embodiment of a compounding vessel according to the invention, likewise in longitudinal section, and,

FIG. 4 is a cross section taken on the line IV — IV in FIG. 3,

FIG. 5 is an additional embodiment of the present invention in longitudinal section.

Referring to the compounding vessel shown in FIGS. 1 and 2, this comprises a generally cylindrical main chamber 10 of a circular cross-section, containing a first substance (not shown) which may be in the form of a powder. The lower end of the cylindrical main chamber 10 is terminated by a hemispherically dome-shaped portion 11 which is formed with a delivery nozzle 12 projecting therefrom coaxially with the longitudinal axis of the main chamber 10. The mouth of the nozzle 12 is closed by a removable pin 13. The upper end of the main chamber 10 is closed by a hollow plunger 14 which has a hemispherically dome head facing the interior of the main chamber, the radius of this dome head being equal to the radius of the interior of the dome-shaped portion 11.

At axially spaced levels, the cylinder wall of the main chamber 10 is formed externally with two annular flanges 15 provided with axially aligned gaps 16. These two annular flanges 15 serve for axially locating a roughly semicylindrical clip 17 which embraces the outside of the cylindrical wall of the main chamber 10. On diametrically opposite sides of the external surface of the cylindrical wall of the main chamber 10, ribs 18 are formed between the two annular flanges 15. These ribs 18 are adapted to engage notches 19 or 20 formed on the inwardly facing surfaces of the ends of the clips 17. Moreover, in the middle, the clip 17 is provided with a bulbous enlargement 21 which extends in the axial direction, the length of this enlargement exceeding the distance between the two annular flanges 15, its ends aligning with the gaps 16 in the annular flanges.

Midway between the annular flanges 15 the cylindrical wall of the main chamber 10 contains an opening 22 facing the clip 17. A bag 23 of rupturable material (e.g., metal foil), contains for instance a liquid, is interposed between the clip 17 and that part of the cylindrical wall of the main chamber 10 containing the opening 22. The bag walls are of material of two different strengths, that facing the opening 22 being weaker than the other.

When the compounding vessel illustrated in FIGS. 1 and 2 is to be used, one component of the substance to be mixed is placed in the chamber 10 and the other component is in the bag 23. When pressure is applied to the clip 17, more particularly to the enlargement 21 thereof, the clip 17 is forced from the position shown in FIGS. 1 and 2 (in which the ribs 18 engage in outer notches 19) inwards towards the wall of the main chamber 10 until the ribs 18 snap into engagement with the inner notches 20. During this inward displacement, the wall of the bag 23 facing the opening 22 will burst and the substance contained in the bag will spill through the opening 22 into the mixing compartment of the main chamber 10. The ribs 18 which engage the notches 20 prevent the clip 17 after pressure on the clip is released from being forced back by the resiliency of the clip and possibly drawing some of the mixture, by suction outwardly through the opening 22. Since the radius of the inner wall of the clip 17 in the region holding the bag 23 is equal to the radius of the external surface of the cylindrical wall of the main chamber 10, the bag 23 is pressed completely flat and is substantially completely empty when the ribs 18 snap into engagement with the inner notches 20.

The vessel can then be shaken (e.g., in a mechanical shaker) for thoroughly mixing the two combined substances. The pin 13 can be pulled out of the nozzle 12 and the ready-mixed dental preparation introduced directly into a cavity of a tooth by expelling the compound through the nozzle 12 by means of the plunger 14. The displacement of the plunger 14 inside the cylindrical main chamber 10 may possibly be effected by auxiliary means. The fact that the internal wall of the portion 11 of the vessel and the facing surface of the head of the plunger 14 are parts of spheres having identical radii, substantially all the compounded preparation in the chamber 10 can in practice be ejected.

In the compounding vessel illustrated in FIGS. 3 and 4 the main vessel 10 is formed in the same way as in the previously described embodiment with a part spherically domed portion 11 which is centrally elongated into a delivery nozzle 12 which is closed by a removable pin 13. The hollow plunger 14' in this embodiment is extended rearwards beyond the end of the main chamber 10 and its rear end is formed with a flange 30. The rear end of the main chamber 10 is likewise formed with a flange 31. The internal wall of the main chamber 10 is again of circular cylindrical shape, whereas its external wall has a central portion which is square in cross section, as can be seen in FIG. 4. In this region two circularly cylindrical chambers 32 and 33 are attached to opposite sides, their common axis extending centrally through holes 34 and 35 in each of the two corresponding side faces of the main chamber wall. The two cylindrical accessory chambers are also formed with flanges 36 at their free ends. The inner end of each accessory chamber 32, 33 is closed by a destructible membrane 37 (e.g., of foil) which also seals the corresponding holes 34 and 35 into the main chamber 10. The other end of each accessory chamber is closed by a slidably movable hollow plunger 38 which

differs from plunger 14' in not having a hemispherical, but a flat inner face 39. The accessory chamber 32, 33 may be affixed to the square side faces of the main chamber 10 either with an adhesive, or they may be fused or secured in some other convenient way. Flanges 41 provided on the accessory chambers may be arranged to engage rails 42 formed on the outside square faces of the main chamber 10.

The compounding vessel illustrated in FIGS. 3 and 4 is used by first emptying the two accessory chambers 32 and 33 by pushing their plungers 38 inwards, (possibly in a prescribed order consecutively). If both chambers are emptied simultaneously pressure can be applied to the terminal flanges 40 from both sides; if each chamber is to be emptied separately, this can be done manually by applying the thumb to one of the flanges, say 40, and the index and second fingers to the other flange 36. Inward displacement of the plunger 38 causes the membrane 37 to be destroyed and the substance in the chamber, say a liquid, to be forced through the appropriate hole 34 or 35 into the mixing compartment of the main chamber 10. When all the substances have been thoroughly mixed, possibly with the aid of a mechanical shaker, the pin 13 is removed from the nozzle 12 and the finished dental preparation can be ejected possibly directly into a dental cavity by pressing the plunger 14' inwards.

Many of the features that have been described in connection with each of the two above embodiments are interchangeable or applicable in combination. For instance, the plunger 14 in the embodiment according to FIGS. 1 and 2 may be rearwardly extended like the plunger 14' and both plunger and main chamber may be provided with terminal flanges. The compounding vessel according to FIGS. 3 and 4 may be fitted with only one accessory chamber. Conversely, the vessel according to FIGS. 1 and 2 may be provided with two openings 22 and two bags 23 may be located either under a wider clip or under two separate clips. When two separate clips are provided the two bags can be emptied in succession. Instead of a single membrane 37 one or both the accessory chambers 32, 33 in the embodiment according to FIGS. 3 and 4 may contain a destructible bag for the reception of the substance in question FIG. 5 illustrates the embodiment of the present invention in which more than one opening is provided under a single clip. Hence, openings 22 and 24 correspond respectively to bags 23 and 25. The bags are positioned over their respective openings, thereby permitting separate components to be added to main chamber 10 without premixing. The membranes or bags of the present invention can be of any suitable material which has the characteristics of being compatable with the components to be mixed, and which is easily rupturable upon application of external pressure. For example, the material could be metal foil, treated paper, cellophane and other materials within the pen of a skilled artisan.

We claim:

1. An apparatus for mixing at least two components in precise proportions comprising a main mixing chamber containing one component of the mixture, at least one supplementary chamber containing an additional component of the mixture, said chamber being defined by a radially inwardly movable wall embracing in movable relationship thereto, the outer wall of the main chamber, said outer wall being cylindrical, the movable wall conforming to the outer wall of the main chamber, the supplementary chamber communicating with the main chamber through an opening in the wall of the main chamber, the component in the supplementary chamber being sealed from the main chamber by a rupturable bag containing the additional component, said bag being placed over said hole, whereupon said bag, upon substantially reducing the volume of the supplementary chamber, abruptly ruptures to allow the additional component to enter the main chamber, means for rupturing the bag comprising external pressure applied in the direction of the wall of the main chamber, whereby the bag is ruptured and the volume of the supplementary chamber is reduced substantially to zero, and a means for retaining the movable wall in a terminal position against the main chamber, comprising axially disposed ribs which engage corresponding notches provided in the movable wall.

2. The apparatus of claim 1 in which one end of the main chamber is closed by an axially sliding plunger and the other end is provided with an axially tapering end wall, said wall having an axially outwardly projecting ejector nozzle.

3. An apparatus for mixing at least two components in precise proportions comprising a main mixing chamber containing one component of the mixture, at least one supplementary chamber containing an additional component of the mixture, said chamber being defined by a radially inwardly movable wall embracing in movable relationship thereto, the outer wall of the main chamber, said outer wall being cylindrical, the movable wall conforming to the outer wall of the main chamber, the supplementary chamber communicating with the main chamber through an opening in the wall of the main chamber, the component in the supplementary chamber being sealed from the main chamber by a rupturable bag containing the additional component, said bag being placed over said hole, whereupon said bag, upon substantially reducing the volume of the supplementary chamber, abruptly ruptures to allow the additional component to enter the main chamber, means for rupturing the membrane comprising external pressure applied in the direction of the wall of the main chamber, whereby the volume of the supplementary chamber is reduced substantially to zero and the membrane is ruptured, and a means for retaining the movable wall in a terminal position against the main chamber outside wall, the axial position of the movable wall being fixed by two flanges projecting radially from the outside wall of the main chamber.

4. The apparatus of claim 3 in which each flange is provided with a notch, the notches being axially aligned; and the movable wall is provided with projections which align with the notches and which engage therein.

5. An apparatus for mixing at least two components in precise proportions comprising a main mixing chamber containing one component of the mixture, at least one supplementary chamber containing an additional component of the mixture, the supplementary chamber communicating with the main chamber through an opening in the wall of the main chamber, the component in the supplementary chamber being sealed from the main chamber by a rupturable membrane which, upon substantially reducing the volume of the supplementary chamber, abruptly ruptures to allow the additional component to enter the main chamber, means

for rupturing the membrane comprising external pressure applied in the direction of the wall of the main chamber, whereby the membrane is ruptured and the volume of the supplementary chamber is reduced substantially to zero, said supplementary chamber being cylindrical, its axis being substantially normal to the axis of the main chamber, the supplementary chamber being provided with a slideable plunger which seals the end of its supplementary chamber remote from the main chamber.

6. The apparatus of claim **5** in which there are two supplementary chambers disposed coaxially opposite each other about the main chamber.

7. The apparatus of claim **5** in which one end of the main chamber is closed by an axially sliding plunger and the other end is provided with an axially tapering end wall, said wall having an axially outwardly projecting ejector nozzle.

8. An apparatus for mixing at least two components in precise proportions comprising a main mixing chamber containing one component of the mixture, at least one supplementary chamber containing an additional component of the mixture, said chamber being defined by a radially inwardly movable wall embracing in movable relationship thereto, the outer wall of the main chamber, said outer wall being cylindrical, the movable wall conforming to the outer wall of the main chamber, the supplementary chamber communicating with the main chamber through an opening in the wall of the main chamber, the component in the supplementary chamber being sealed from the main chamber by a rupturable membrane which, upon substantially reducing the volume of the supplementary chamber, abruptly ruptures to allow the additional component to enter the main chamber, means for rupturing the membrane comprising external pressure applied in the direction of the wall of the main chamber, whereby the membrane is ruptured and the volume of the supplementary chamber is reduced substantially to zero, said main chamber being cylindrical, one end of which is closed by an axially sliding plunger, and the other end of which is provided with an axially tapering end wall, the end wall having an axially projecting ejector nozzle.

9. An apparatus for mixing components in precise proportions comprising a main mixing chamber containing one component of the mixture, two supplementary chambers containing additional components of the mixture, said supplementary chambers being defined by a common radially inwardly movable wall embracing in movable relationship thereto, the outer wall of the main chamber, said outer wall being cylindrical, the movable wall conforming to the outer wall of the main chamber, each of the supplementary chambers communicating with the main chamber through an opening in the wall of the main chamber, each of the components in the supplementary chamber being sealed from the main chamber by a rupturable bag containing an additional component, said bags being placed over said holes, wherein said bags, upon substantially reducing the volume of the supplementary chamber, abruptly rupture to allow the additional components to enter the main chamber, means for rupturing the bags comprising external pressure applied in the direction of the wall of the main chamber, whereby the bags are ruptured and the volume of the supplementary chambers is reduced substantially to zero.

10. The apparatus of claim **9** in which one end of the main chamber is closed by an axially sliding plunger and the other end is provided with an axially tapering end wall, said wall having an axially outwardly projecting ejector nozzle.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,907,106
DATED : September 23, 1975
INVENTOR(S) : Purrmann, Schmitt, Jochum, and Grimm-Lenz

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 42, cancel "membrane", insert -- bag --.

Column 6, line 44, after "whereby the" insert -- bag is ruptured and the --.

Column 6, lines 45 - 46, cancel "and the membrane is ruptured"

Signed and Sealed this

seventeenth Day of *February 1976*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks