

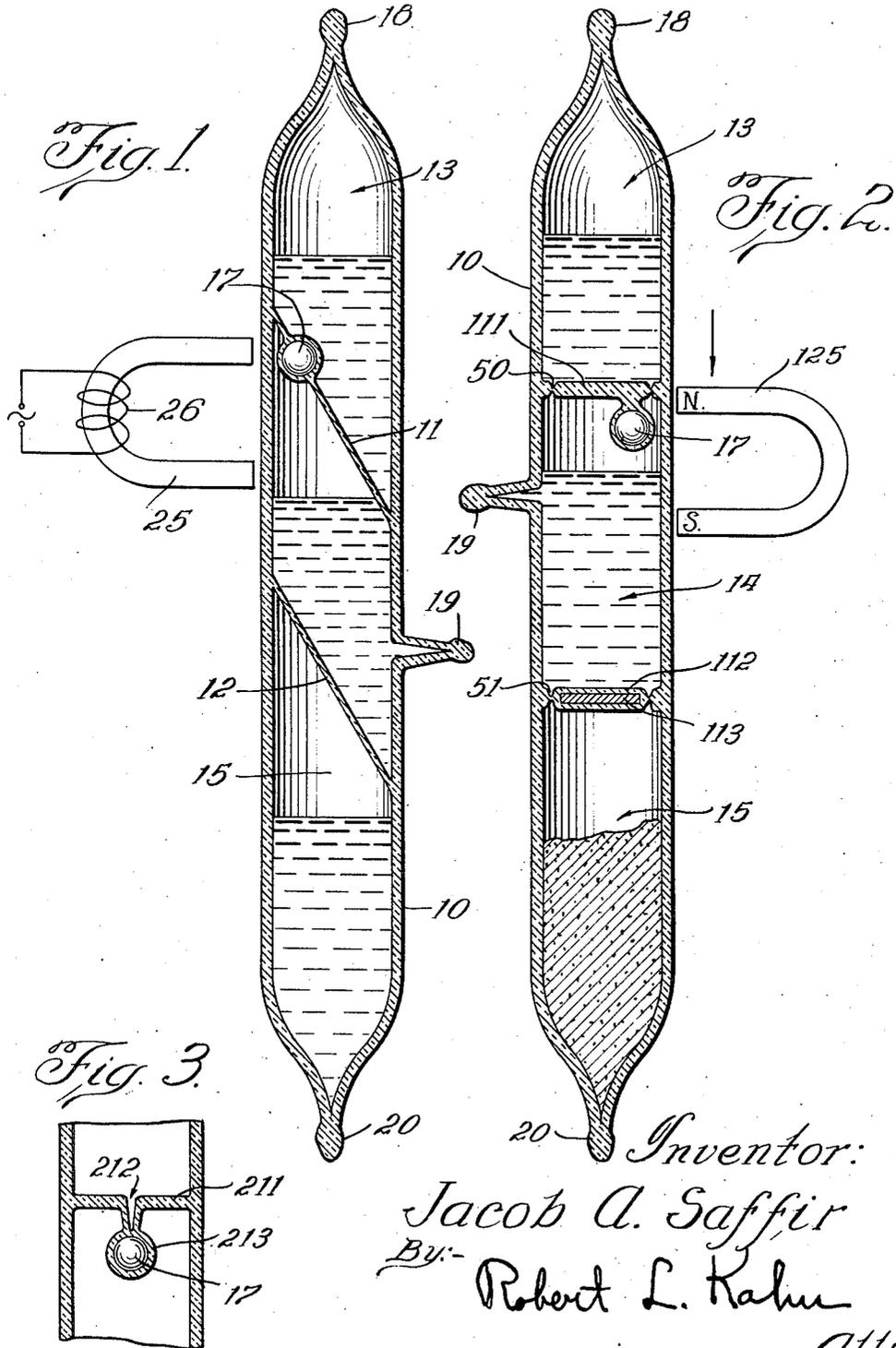
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AMPOULE

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AMPOULE

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15 Claims. (Cl. 128—272)

This invention relates to a multi-cellular or multiple-chambered ampoule wherein each cell or chamber may be hermetically sealed from each other as well as from the atmosphere and where-
5 in means are provided for destroying the seal between adjacent cells while maintaining intact the hermetic seal to atmosphere.

Frequently it is desirable to store a plurality of chemicals, separate from each other, each
10 under controlled conditions of vacuum or desirable ambient medium prior to ultimate intermixture also under controlled conditions. Thus in the field of medicine it is frequently necessary and very often desirable to mix two or more
15 chemically pure substances under controlled conditions in order to obtain the desired product. Such substances may require storage in a vacuum or inert gas to prevent deterioration and the admixture and resulting interaction of these sub-
20 stances might preferably be carried out under such special conditions, as vacuum or inert gas in order that no undesired reactions occur.

As an example, in the handling of arsenic compounds for injection, great care must be ex-
25 ercised. Thus considerable difficulty has been experienced in the handling of arsphenamine and neararsphenamine compounds. Stable storage conditions require that these compounds be main-
30 tained in a concentrated form in a vacuum. On the other hand, these arsenic compounds cannot be used in their stored form but must be dis-
solved in predetermined quantities of sterile water or alkaline solution or other solvent just
35 prior to actual injection. These compounds both before and after solution are highly unstable in air and tend to react with air to form poisonous substances. The solution of these compounds is unstable even in a vacuum.

Inasmuch as time is required for the thorough intermixture and complete interaction of the
40 compound and the solvent, it is clear that for best results this mixing and interaction should be carried out in a vacuum or under the same conditions as exist in the storage container.
45 Thereafter the syringe may be filled with the prepared material and used with a minimum exposure to the air.

Various expedients have been relied upon in an attempt to devise an ampoule to meet the above
50 requirements. In some instances the act of intermixing the separately sealed materials involves the destruction of the hermetic seal to atmosphere with an imperfect seal substituted to reduce the access of the atmosphere to the in-
55 terior of the ampoule to a minimum. In other

instances the ampoule is so constructed as to provide a liquid seal at the region of interaction between the water or other liquid solvent and the solute. Still other expedients have been
5 relied upon, such as wax partitions, in an effort to permit interaction between the normally isolated contents of a multiple chamber ampoule and permit said reaction to take place under controlled conditions.

These various expedients, however, have proven
10 to be impractical for various reasons. Thus, within certain limits, increased expense is a factor. The destruction of the hermetic seal to atmosphere prior to actual use of the final chem-
15 icals always involves a departure from desired ideal conditions and represents a compromise which frequently is reflected in the form of dangerous physiological complications. The use of non-vitreous materials such as wax and rubber is highly objectionable because of difficulty in
20 removing occluded air therefrom and in avoiding secondary undesired reactions.

By the invention herein described I have solved this problem in a simple effective manner. An
25 ampoule having a plurality of cells or chambers may be constructed out of any suitable material, such as glass, which is not ferro-magnetic. Adjacent cells or chambers of the am-
30 poule are separated by a frangible wall or partition which may be of the same material as the ampoule, such as glass. Within each inter-cellular partition, the removal of which is desired
35 for mixing of chemical contents, there is disposed a ferro-magnetic member of any suitable shape. This may preferably take the form of a steel ball sealed in the glass partition. The application
40 of a magnet, on the outside of the ampoule, results in an attractive force upon the ferro-magnetic member to pull the same toward the poles of the magnet. This attractive force on the
45 sealed member may be utilized to break down the intercellular partition, it being understood that the ferro-magnetic member has sufficient mass to permit this operation. Too heavy a member may be objectionable because of possible break-
age due to jars.

In order to promote this breakage of the par-
50 tition, reliance may be had upon scoring or thinness of the wall. It is understood, of course, that the outer wall of the ampoule may be made strong enough so that the destruction of the par-
55 tion need not involve the breaking of the outer wall of the ampoule. In fact, by making the breaking effort of the intercellular partition substantially weaker than that of the ampoule outer

wall, two substantially different attractive forces on the ferro-magnetic member may be utilized for selective destruction of both walls.

5 It is also possible to provide a frangible partition free of any ferro-magnetic member and seal said member to any interior part of the ampoule. The member may be broken away from its fastening and permitted to act on the frangible partition either by operation with a magnet or sudden impact.

10 Instead of a steady magnetic pull on the ferro-magnetic member, a pulsating cyclically varying pull may be utilized for vibrating the partition. When made of glass or non-elastic material, the partition may be shattered by a comparatively small force used to vibrate the partition. This variation of magnetic pull may be obtained either by changing the position of the magnet or its polarity.

20 Referring to the drawing:

Fig. 1 is a sectional elevation of one form of ampoule together with an actuating electro-magnet. Fig. 2 is a sectional elevation of a modified form of ampoule and an actuating permanent magnet. Fig. 3 is a modified form of partition.

25 Referring to Fig. 1, the ampoule comprises an outer wall or shell 10 of glass or other suitable non-magnetic material. Partitions 11 and 12 are formed within shell 10 and serve to define three cells or chambers 13, 14 and 15, respectively. It is understood, of course, that as many or as few cells may be provided as desired. It is also understood that partitions 11 and 12 are frangible and would ordinarily be made of the same material as the outer shell 10. Sealed within partition 11 is a ferro-magnetic member here shown as a steel ball 17. This ball is preferably covered over with glass and forms a portion of partition 11.

40 Access to each of chambers 13 to 15 inclusive is obtained at sealing tips 18, 19 and 20. It is understood, of course, that each chamber or cell may be evacuated and filled with a desired substance and the glass melted as shown in the drawing to seal the cell.

45 In order to break down partition 11 an electro-magnet 25 having an actuating coil 26 is provided. Either a steady magnetic field may be created as shown, for example, by the permanent magnet in Fig. 2 or a fluctuating field may be created by reversing the polarity of the magnet. This may be done either by supplying an alternating current or by manually reversing a direct or alternating current. By a proper design of the partition thickness and mass of ferro-magnetic member 17, as well as by the intensity of the magnetic field, it is possible to pull ferro-magnetic member 17 away from its normal position and break the partition. In case the partition is made of glass, the changes in intensity of the attractive force on the ferro-magnetic member 17 may be used to shatter the partition.

50 Partition 12 may thereupon be broken by permitting the ferro-magnetic member, in this case the steel ball 17, to be used as a hammer. The ball 17 may be raised up by the magnet and then be permitted to quickly drop or, if desired, the ball may be pushed through partition 12 by the magnet. In either case, partition 12 may be broken even though it does not have any ferro-magnetic member therein.

75 It is understood, of course, that when the contents of the entire ampoule are to be used the ampoule itself must be broken. This may be

done either by breaking off any one of the sealing tips or, if a sufficiently powerful attractive force is used on ball 17, to actually break the outer wall in a manner similar to that used with the partitions.

5 Preferably, partitions 11 and 12 are substantially weaker as regards breaking than outer wall 10 so that the initial destruction of one or more of the partitions will leave the outer wall 10 of the ampoule intact. It is understood, of course, that by suitable manipulation and care, this selective destruction of the partition and outer wall may be accomplished without necessarily having the partitions weaker than the ampoule wall.

15 Referring to Fig. 2, partition 111 carries a steel ball 17 attached thereto, the steel ball being preferably covered over with the partition material such as glass. It will be noted that the partition wall 111 is rather thick and in order to promote the removal of the partition, scoring 50 of the glass is relied upon. This scoring may be at any portion of the partition and, as shown here, is around the edge thereof near wall 10.

25 Lower partition 112 has sealed therein a ferro-magnetic member 113 in the form of a flat disk. This partition 112 is also scored at 51 for weakening. A permanent magnet 125 may be used instead of the electro-magnet for effecting breakage.

30 It is understood that the cross-section of the ampoule, while generally circular, may be of any desired shape and that the shape and disposition of the ferro-magnetic member may vary within wide limits. In general, the ferro-magnetic member should have sufficient mass so that ready breakage of the partition can be effected. The mass of the ferro-magnetic member will depend in some measure upon the thickness of the partition and the intensity of the attractive force created by the magnet. It is also understood that the ferro-magnetic member may be permanently magnetized so that either attraction or repulsion will be utilized.

45 In practice, the ferro-magnetic member, usually of steel, retains its glass coating intact under ordinary conditions of use. Thus, the separate, hermetically sealed chambers may have their intercellular partitions broken down without in any way damaging the seal to the atmosphere. It is understood, of course, that this ampoule may be used in other fields than medicine and the storage conditions within each cell may be as desired.

55 In Figure 3, a modified form of partition is shown wherein the outer wall 10 has a partition 211 provided with a channel 212. This channel 212 has a dead end formed of the spherical part 213 enclosing steel ball 17. A side pull on steel ball 17 will break part 213 away and open up channel 212.

What is claimed, is:

1. A multi-cellular ampoule comprising an ampoule of non-magnetic material having a plurality of sealed cells therein with a frangible dividing partition between adjacent cells, each cell being adapted to contain a substance, and a ferro-magnetic member forming at least part of at least one of said intercellular partitions, said member having sufficient mass whereby a magnetic pull thereon may be utilized for destroying at least part of the partition.

2. A multi-cellular ampoule comprising an ampoule of non-magnetic material formed into a plurality of separate chambers having frangible

dividing partitions therebetween to form sealed chambers adapted to contain a material therein, said partitions being of non-magnetic material, and a ferro-magnetic member sealed in at least one of said intercellular partitions, said member having sufficient mass whereby magnetic attraction thereon may be utilized for destruction of at least part of said partition.

3. A multi-cellular ampoule comprising an ampoule of non-magnetic material formed with a plurality of frangible partitions to form a plurality of separate cells into each of which a substance may be stored, each partition being of the same material as the ampoule, and a ferro-magnetic member sealed in at least one of said intercellular partitions, said member having sufficient mass whereby a magnetic attraction on the outside of said ampoule may be relied upon for destruction of at least part of said partition.

4. A multi-cellular ampoule comprising an ampoule of non-magnetic material, said ampoule having plurality of cells separated by frangible partitions, said intercellular partitions being of non-magnetic material and a ferro-magnetic ball sealed in at least one intercellular partition, said ball being sufficiently large so that magnetic force extending through the walls of said ampoule to said ball may be utilized for breaking down at least part of said partition.

5. A multi-cellular ampoule consisting of a shell of non-magnetic material, said shell having a plurality of cells separated by at least one frangible intervening intercellular partition, said intercellular partition being of non-magnetic material and having a ferro-magnetic member sealed therein, said one partition being substantially weaker than the shell wall of said ampoule whereby a magnetic force from the outside of said ampoule may be utilized for attracting said ferro-magnetic member and breaking said partition.

6. A multi-cellular ampoule comprising an outer shell of glass having a plurality of cells divided by at least one glass partition, and a ferro-magnetic ball sealed in said one partition and being sufficiently massive so that a magnetic pull from the outside of said ampoule may be utilized for attracting said ball and break said partition.

7. A multi-cellular glass ampoule consisting of an outer shell having a plurality of cells separated by intervening intercellular partitions, at least one of said intercellular partitions having a ferro-magnetic member sealed therein, said one partition being substantially weaker than the shell wall of said ampoule and said member having sufficient mass whereby a magnetic force from the outside of said ampoule may be utilized

for attracting said ferro-magnetic member and breaking said partition.

8. A multi-cellular ampoule comprising an outer shell of glass having a plurality of cells divided by at least one glass partition, and a steel ball sealed in said one partition and being sufficiently massive and the partition being substantially weaker than the shell wall so that a magnetic pull from the outside of said ampoule may be utilized for attracting said ball and break said partition.

9. In combination, the ampoule of claim 1 and a magnet having a pair of poles, said magnet being sufficiently strong to pull said member toward at least one of said poles and break the member bearing partition.

10. In combination, the ampoule of claim 7, a magnet having a pair of poles, said magnet exerting a substantial attractive force on said member and means for cyclically varying said attractive force to induce a shattering of said partition.

11. The method of breaking a partition in the ampoule of claim 1 which consists in applying a magnet having a pair of poles to said ampoule and exerting sufficient attractive force on said member to break said partition.

12. The method of breaking a partition in the ampoule of claim 7 which consists in applying a magnet having a pair of poles to said ampoule and exerting a rapidly cyclically varying attractive force on said member to shatter said partition.

13. A multi-cellular ampoule comprising an outer shell of glass having at least two cells therein with a glass dividing wall therebetween and a ferro-magnetic member sealed to said glass on the inside of the outer wall, said member having sufficient mass whereby a magnetic pull thereon may be utilized for breaking said member away from its fastening and utilizing said member for destroying at least part of said partition.

14. The method of breaking down the partition in the ampoule of claim 13 which consists in applying a magnetic attractive force on said member sufficiently strong to break said member away from its fastening and thereafter breaking said partition with said member.

15. An ampoule comprising an ampoule of non-magnetic material having a plurality of cells separated by at least one partition, said partition being frangible and non-magnetic and having a channel normally establishing communication between said cells and a ferro-magnetic member sealed to said partition and closing said channel, said member having sufficient mass whereby a magnetic pull on said member will break it away from said partition and open said channel.

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