

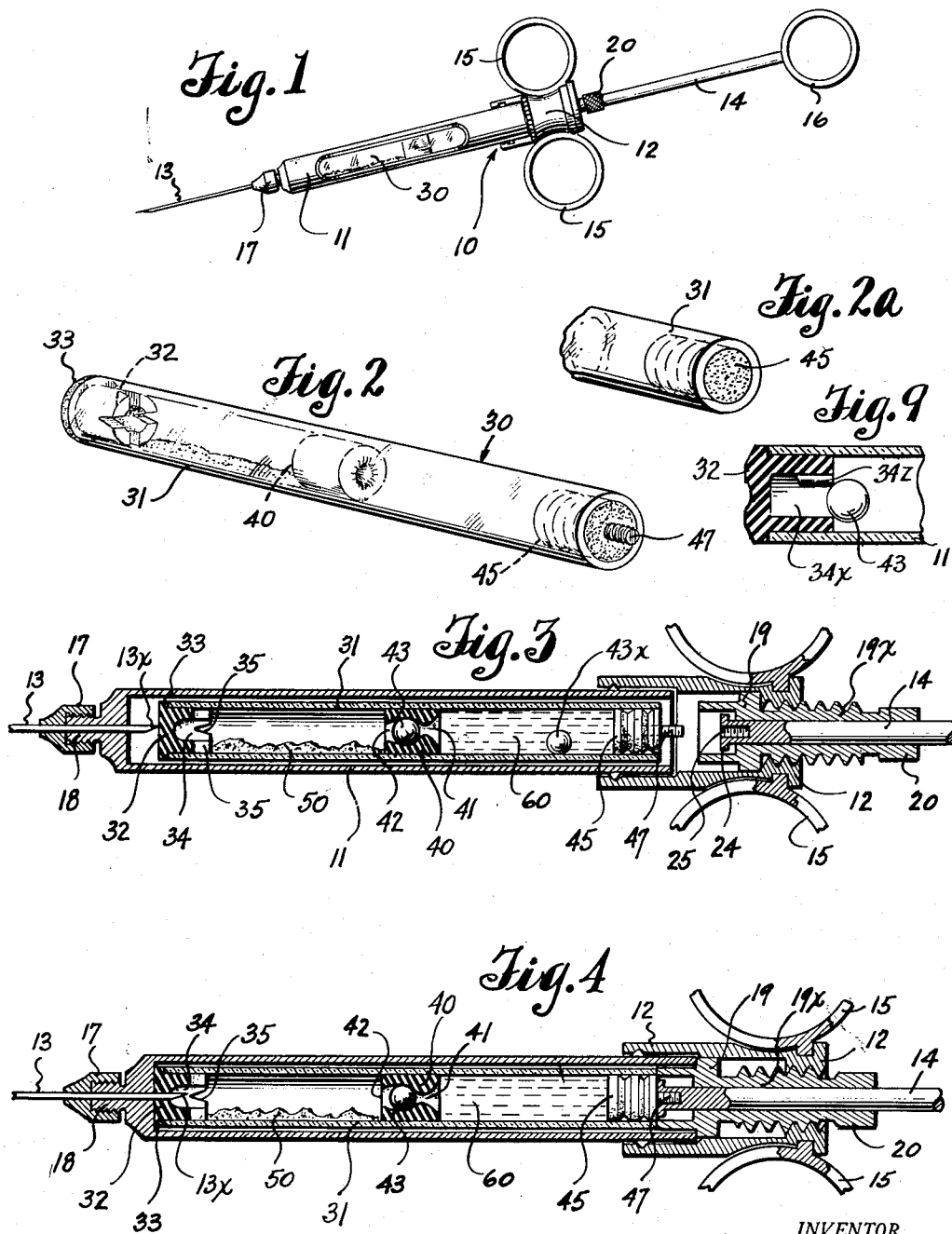
Sept. 14, 1954

R. L. HUBER
COMPARTMENTED AMPOULE

2,688,966

Filed Oct. 6, 1951

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

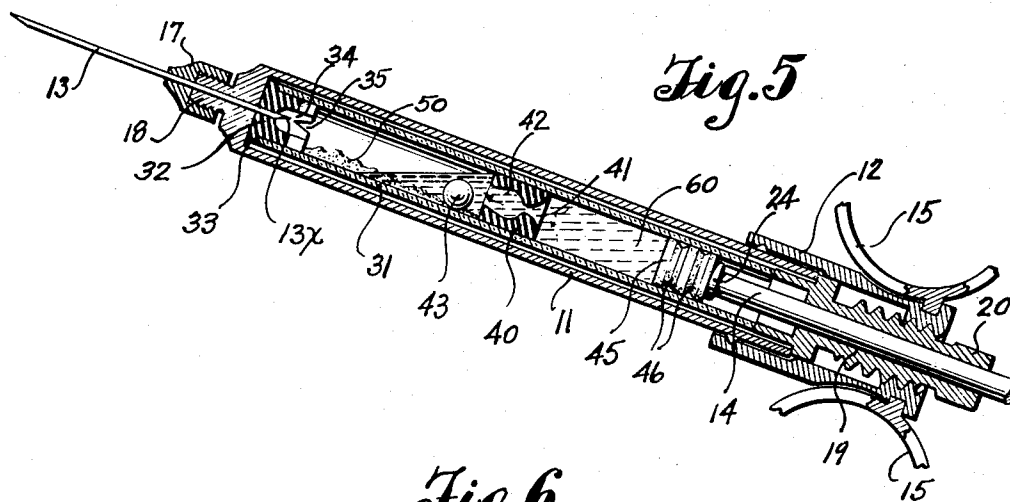
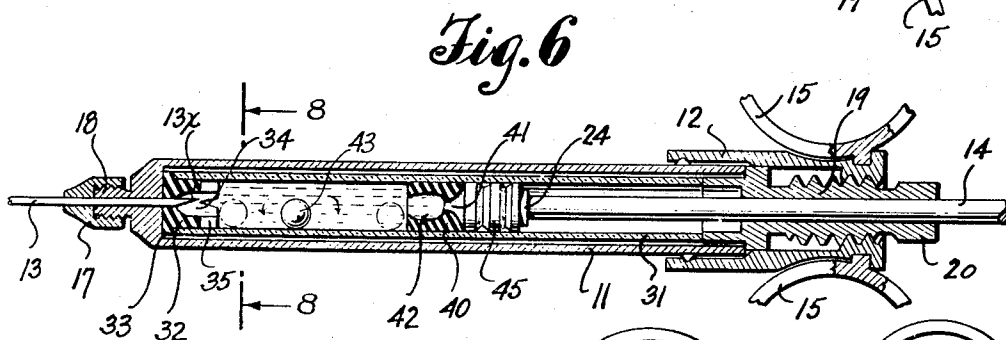


Fig. 8

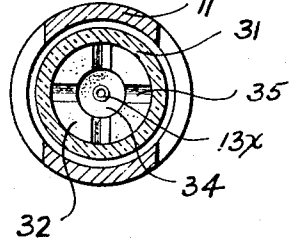
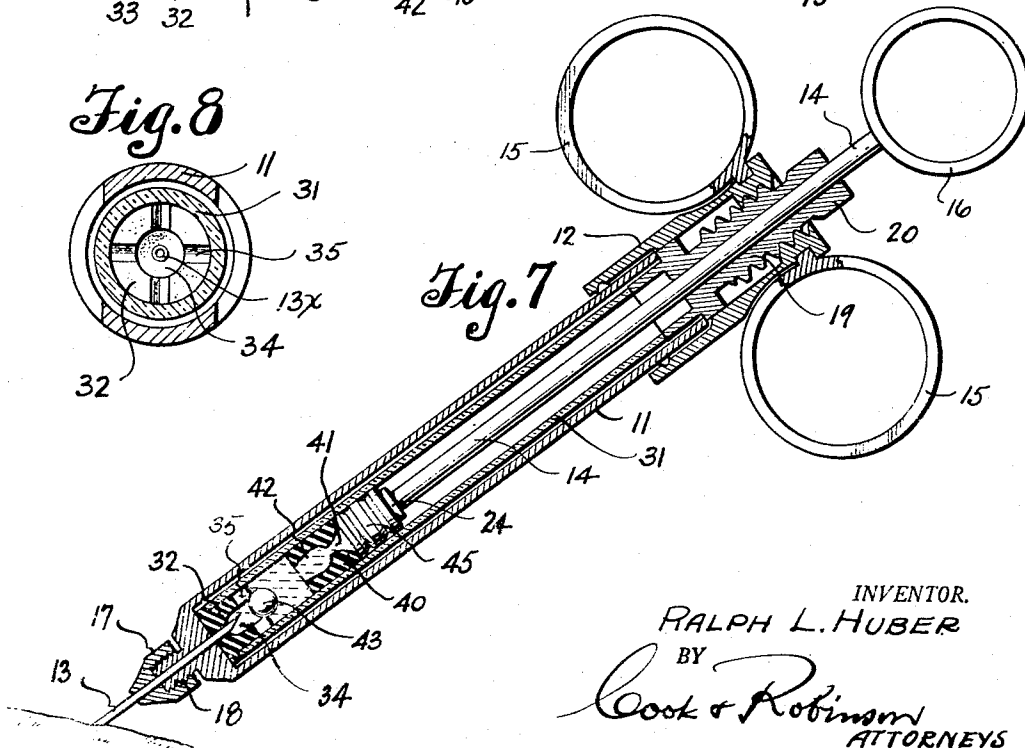


Fig. 7



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COMPARTMENTED AMPOULE

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6 Claims. (Cl. 128—218)

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This invention relates to ampules or cartridges, used as containers for medicinal solutions, from which the solutions may be directly injected into a patient by use of a hypodermic syringe.

More specifically stated, the present invention has reference to what is designated as a "compartmented ampule," that is, an ampule divided into compartments for the containing therein of different substances which prior to injection, are mixed one with the other in order to provide a liquid medicament that is suitable for hypodermic injection; it being anticipated that, in most instances, one of the segregated substances will be in the form of a dry powder, crystals or granular substance, and the other material will be a liquid solvent therefor.

It is the principal object of this invention to provide a compartmented ampule of the above character, that can be readily applied to a hypodermic syringe for the injection directly therefrom of the solution that results from the mixing of the normally segregated substances; the invention being characterized, in part, by the novel features of construction and use of the compartment separating member as used in the ampule, which makes possible the displacement of the liquid solvent from its compartment, through a passage in the partitioning or compartment separating member into the compartment containing the dry material, and then the hypodermic injection of the resultant solution directly from the latter compartment of the ampule.

It is also an object of the invention to provide an ampule that is divided into the separate compartments, for the dry substance and the solvent therefor, by means of a partitioning stopple of piston-like character having a compartment connecting passage therethrough that is normally closed by a stopper, preferably of bead or ball-like character that can be displaced into the compartment containing the dry material by creating a displacing pressure thereagainst through the mediacy of the liquid as contained in the other compartment; the bead or ball, upon being displaced, becoming immediately effective as an agitator for the loosening or pulverizing of the dry material and later is effective for the agitating and mixing of the solution.

Yet another object of the invention is to provide simple and effective means in ampules of the present character for the agitating of the ampule contained liquid and for reducing of dry material as contained in a compartment of the ampule.

Still another object of the invention is to provide a compartmented ampule which can be scientifically, aseptically and accurately charged with the dry and liquid materials.

Further objects of the invention reside in the details of construction of the ampule and the

various stopples as applied thereto, and particularly to the details of the compartment separating stopple with its passage and displaceable, bead-like stopper member for the passage.

Finally, it is an object of the invention to provide a compartmented ampule, equipped with inner and outer end stopples, and a dividing stopple of the character previously stated, that may be made, filled and assembled at a relatively small cost, and which is usable in present day types of syringes.

Further objects of the invention reside in the details of construction and combination of parts of the ampule, as will hereinafter be fully described.

In accomplishing these and other objects of the invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Fig. 1 is a perspective view of a hypodermic syringe of common type, wherein an ampule embodying the present invention is disposed for the injection of a medicinal solution therefrom.

Fig. 2 is an enlarged perspective view of the charged ampule, or cartridge, which embodies my invention, ready for use.

Fig. 2a is a fragmental view illustrating the ampule as fitted with an alternative form of outer end stopple.

Fig. 3 is a central, longitudinal section of the syringe barrel, illustrating an ampule of the present invention as disposed therein preparatory to the application of the plunger to the stem of the inner end stopple.

Fig. 4 is a similar view illustrating the outer end stopple after being pierced by the injection needle, and showing the inner end of the plunger after being threaded onto the projecting stud of the inner end stopple.

Fig. 5 is a longitudinal section of the syringe showing the bead-like stopper after being unseated from the passage through the partitioning stopple, and the liquid being displaced from its compartment into the dry medicament compartment through the open passage.

Fig. 6 is an illustration, similar to that of Fig. 3, but showing the liquid completely displaced from its compartment and the normally dry medicament completely dissolved thereby.

Fig. 7 is a longitudinal section of the syringe, illustrating the injection of the solution from the ampule into a patient and illustrating the bead as retained in the notches of the outer end stopple.

Fig. 8 is an enlarged cross-section taken on line 8—8 in Fig. 6.

Fig. 9 is a sectional detail showing an alternative form of stopple for the outer end of the ampule.

It is a common practice to prepare medicines for hypodermic injection by the dissolving of a dry medicine of powdered, crystalline, or granular form, in a liquid solvent. Usually it is required or at least it is desirable that the dry substance and the solvent therefor be mixed immediately before use. Due to the fact that some mixtures soon begin to decompose, or break down when mixed prior to immediate usage, it is usual in hospitals that supplies of the dry materials and their solvents be stored in separate receptacles. Then, when a hypodermic injection is to be made using a dry material, a designated quantity of dry medicine is placed in an ampule of conventional kind and the selected solvent is discharged into the ampule and the mixture agitated until the dry material has been completely dissolved and made ready for needle injection.

Such procedure has disadvantages from the aseptic standpoint and also permits inaccuracies in the proper proportioning of amounts of the ingredients used. Furthermore, it is a time consuming operation that is undesirable. The present invention overcomes entirely the time consuming features; it insures the aseptic use of the materials and syringe and also makes possible accuracy in the proportioning of ingredients that are used.

Referring more in detail to the drawings—

10 designates a conventional type of hypodermic syringe adapted to receive an ampule embodying the features of the present invention, for the needle injection of a medicament directly from the ampule. The syringe, as shown, comprises a cylindrical barrel 11, with side openings of substantial size, equipped with a locking cap 12 at the inner or open end of the barrel, a needle 13 that is secured in the outer end wall of the barrel, a plunger 14 that is slidable through a guide bushing 19 secured in the cap, finger receiving rings 15—15 secured to the opposite sides of the cap and a thumb ring 16 fixed on the outer end of the plunger. This particular kind or make of syringe, and the details of its construction, are not material except to the extent hereinafter noted.

The needle 13 is here shown to be secured coaxially of the barrel by an adapter nut 17 that is threaded onto a hub 18 on the end wall of the barrel. Also, the needle extends through these parts, into the barrel and at its inner end is beveled to a sharpened point as at 13a for piercing the outer end stopple of the ampule as seen in Fig. 4 and as later explained. The needle equipped end of the barrel will be referred to as the "outer end" and the plunger mounting end will be referred to as the "inner end" of the barrel.

The essence of my invention resides in the specific details of construction of the parts which are comprised by the compartmented ampule, which will now be described.

The ampule as shown in Fig. 2 in enlarged form, is designated in its entirety by reference numeral 30. It comprises a straight cylinder or tube 31, of uniform diameter, and preferably made of glass or transparent plastic in order that the mixing of materials thereon can be observed. Such ampules may be made in various lengths and diameter as desired or required, depending upon the construction or size of the syringe in which they are to be used. The outer end of the ampule 30 is closed by a stopple 32 of rubber or a like material, and this is formed with an outer end flange 33 which abuts against the end

of the tube 31. The diameter of the body portion of the stopple is substantially equal to the inside diameter of the ampule, so that a tight, leak proof fit is achieved. The inner end portion of the stopple is formed with a deep, axially located socket or recess 34, through the open end of which crossed channels 35 are formed as seen in Figs. 6 and 8. The purpose of the well and the notches will later be explained.

10 A partitioning stopple 40 divides the ampule into two compartments. This also is made of rubber, or a similar material, and is of such diameter as to insure a close sliding fit and prevent liquid under pressure from passing from one compartment to the other. This stopple is formed 15 one end portion with a relatively small, axial channel 41 which has a funnel-like flare opening into the liquid compartment. The channel 41 extends approximately to the middle of the stopple and the remaining portion is formed with a channel 42 of substantially increased diameter in which a channel closing member 43, in the form of a glass ball or bead is fitted to normally close the passage. This channel is slightly 25 smaller than the diameter of the bead so that the bead, when pressed thereinto, will be held tightly in a relatively fixed position as noted in Figs. 3 and 4 and the outward pressure caused by the oversize bead will cause the stopple to be compressed against the glass wall thereby preventing the stopple from moving until the bead is forced out as presently explained. The inner end of the channel 42 provides a valve seat in which the bead is disposed when functioning as a channel 30 closing member.

The stopple 45 which I provide in the inner end of the ampule is of rubber, or a like material, and is of slightly greater diameter than the interior diameter of the ampule barrel when not under compression. It is formed with a series of encircling grooves 46 as shown in Fig. 5, to assure a better sealed joint with the barrel. Molded 40 into the outer end of this stopple and projecting therefrom is a threaded stud 47. This stud is adapted to be threaded into a threaded bore 25 in the inner end of the plunger rod 14. In assembling the ampule, the stopple 40 is first placed into the ampule barrel, and forced to the desired location approximately near the center thereof, and with the bead receiving end in functional 50 direction as in Fig. 6. The stopple 45 is then placed within the inner end of the ampule, with its outer end surface flush with the tube end. With stopples 40 and 45 so disposed, the vehicle or solvent 60 is then delivered by suitable means through axial channel 41 of stopple 40 into the inner chamber end compartment of the ampule in that predetermined amount which had determined the location of stopple 40 in the ampule. 60 After the liquid solvent 60 has been placed, the bead 43 is pressed into channel 42 of stopple 40, where it serves as a complete obstruction to axial channel 41 thusly sealing up the liquid containing inner compartment. With the bead 43 so disposed in the stopple 40, a dry medicament of powdered or granulated form, as designated at 50, is then deposited in the outer end compartment of the ampule in the desired or required amount. After the medicament has been deposited, the 70 stopple 32 is then pressed into position in the outer end of the ampule as has been shown in Fig. 3.

With the ampule so loaded and assembled, it may then be packaged and/or stored until ready 75 for use or shipment and the dry medicament 50

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and the liquid solvent therefor will be retained in their separate compartments.

When it is desired to administer an injection of the medicament, the ampule is placed in the barrel 11 of a syringe of that type previously described. With the ampule disposed in the barrel, the locking cap 12 is then adjusted to the holding position of Fig. 3 and the plunger guide 19 adjusted inwardly to the maximum distance as in Fig. 4. By reason of making this inward adjustment of the bushing 19, its inner end portion will be engaged against the outer end of the ampule as illustrated in Fig. 4, and a continued advancement of the ampule by threading the bushing inwardly, will cause the stopple 32 to be pierced by the sharpened inner end of the needle 43 and the stopple ultimately to be engaged flatly against the closing end wall of the barrel. The plunger 14 is then threaded onto the threaded stud 47 which extends outwardly from the stopple 45. The position of the several parts after the above adjustment is best shown in Fig. 4. This is done, however, without the stopple 45 being moved in the ampule and without the bead 43 being displaced from the channel in the stopple 40.

The syringe and ampule, assembled in functional relationship as in Fig. 4, are ready for the delivery of the solvent 60 into the dry material 50, to prepare the solution for injection into the patient. The first step is for the operator to apply inward pressure to the plunger 14 by placing his thumb in the ring 16 and the first two fingers in the rings 15-15. The initial pressure applied will cause the stopple 45 to be pressed inwardly into the ampule barrel. This will transmit pressure through the liquid 60 against the bead, or ball 43, to displace the latter from the stopple 40 through the enlarged channel 42. With the bead displaced, the continued pressure against the stopple 45 will force the liquid through the open channel of the stopple into the compartment containing the dry medicament.

In Fig. 5 I have illustrated the syringe as being pointed upwardly and the liquid entering the dry medicament compartment. It is advantageous to point the syringe upwardly so as to prevent the liquid from running out through the needle, also it permits the air to be forced from the compartment through the needle without discharge of liquid. By continued pressure against the stopple 45, it will be caused finally to abut against the stopple 40 and cause all of the liquid to be forced into the outer compartment. The powdered medicament is then caused to be completely mixed and dissolved in the solution by shaking or agitating the syringe. This mixing is expedited by reason of the bead being free in the compartment. When the powder has been completely dissolved, the solution then is ready for injection into the patient.

It is desirable when injecting a hypodermic medicament into a patient to be assured that the point of the needle has not pierced into a blood vessel. I have, therefore, constructed the present ampule so as to permit aspiration prior to the actual injection. To aspirate, the person administering the injection merely retracts the plunger and stopple 45 a short distance thereby creating a partial vacuum in the ampule. This vacuum will cause blood if present to be sucked through the needle and deposited in the ampule thereby indicating that the needle is in a blood vessel. If desired, or necessary this same aspiration may be accomplished several times to assure that the point of the needle after being shifted

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is in proper position without having to painfully repuncture the patient.

Upon completion of the step of aspirating, the medicament may then be injected into the patient in the desired amount. This is accomplished by the operator merely applying forward pressure to the plunger thereby pushing the stopple 45 and the stopple 40 toward the inner end of the ampule. This is illustrated in Fig. 6. The pressure applied and movement of the stopples forces the liquid medicament into the patient through the needle and continued pressure is maintained until the desired quantity of the medicament has been injected.

In Fig. 7, it is illustrated that the bead or ball 43 has been lodged back of the notches 35 formed in the inner end of the stopple 32. The positioning of the bead against the stopple will occur due to the pressure applied against the solution by the stopple 40. To insure a free flow of the liquid medicament to the needle, I have provided the cross notches 35 in the stopple through the outer end of the channel 34, through which the medicament may pass. It is to be noted that the bead is of somewhat larger diameter than the well or recess 34 so that the bead only abuts against the end of the stopple and is not projected into the recess. This particular construction is a safety precaution to assure that the bead will not interfere with the flow of the medicament from the ampule to the needle.

Though I have illustrated and described in detail the particular construction of the ampule which embodies my invention, it is not my desire that the invention be limited only to the construction shown. The essence of my invention resides in providing an ampule wherein a powdered or granular medicament may be stored separate from a liquid dissolving solution and a means of opening the passage between the compartments. I do not desire to be limited to the specific means or manner in which I have accomplished this result.

It is further anticipated as a part of this invention that one or more glass beads or pellets be placed in the inner compartment with the liquid material 60 which may contain a precipitate requiring agitation before being forced through the axial channel 41 of the stopple 40. Such additional pellets have been designated by reference numeral 43x in Fig. 3.

Some of the most important medicaments do not remain stable for any length of time after being mixed, therefore, it is necessary to mix them at the time of their use instead of at the time of storage. Consequently the compartmented ampule is very necessary to prevent decomposition or resort to the use of unnecessary preservatives.

The factory or laboratory loading of an ampule is known to be a common practice and it is known that the prior art teaches compartmented ampules. However, my invention provides an ampule of novel construction which may be readily adapted for use in all conventional hypodermic syringes. It is simple in its construction and easy to load or charge and assemble. It is relatively inexpensive in its cost of manufacture and requires no special equipment, machines or dies for its production. Also the simplicity of construction and function of the various parts assures the desired and proper results in the mixing of the medicament solution and preparation for a hypodermic injection. A preloaded or pre-charged ampule has many advantages in that it

permits the work to be done under the most advantageous and scientific conditions, it substantially reduces the cost and further it reduces the time required to prepare for the injection.

The alternative form of stopple 45 as applied to the ampule barrel shown in Fig. 2a, is like that previously described except that the threaded stem 47 has been omitted therefor. This form of stopple is used when provision for aspiration is not desired.

The alternative form of stopple shown in Fig. 9 shows the stopple 32 as formed with a well or socket 34x that is equipped along one side with a longitudinally extending rib or flange 34z that operates to retain the bead against effecting a closure of the well; this being for the same purpose for which the channels 35 are applied to the inner end of the stopple 32 seen in various other views.

Having thus described my invention, what I claim as new therein and desire to secure by Letters Patent is:

1. In a compounding ampule having a cylindrical barrel, a piston stopple closing the barrel at one end, and a stopple that can be pierced by a hypodermic needle applied to its opposite end; a partitioning stopple fitted in the barrel and dividing it into two separate compartments, the compartment at the end which is closed by the piston stopple being adapted to contain a liquid ingredient; said partitioning stopple having a passage axially therethrough formed at that end which opens into the compartment closed by the needle pierceable stopple with a cylindrical enlargement terminating at its inner end in a valve seat, from the bottom of which the passage continues to the other end of the stopple, a glass bead stopper fitted in the enlarged end of the passage against said seat, and adapted to be displaced therefrom into the adjacent compartment under pressure of the liquid ingredient as effected by an inward movement of the piston stopple in the barrel

2. An ampule as recited in claim 1 wherein the needle pierceable stopple is formed with an axial, inwardly opening socket extended from its inner end to near the outer end, and into which socket the inner end portion of the hypodermic needle when applied to the ampule, will be contained, and the walls of the stopple surrounding the socket are channeled for ready flow of liquid to the needle under injecting pressure.

3. A compounding ampule comprising a cylindrical barrel, a partitioning stopple, slidably fitted therein and dividing it into two ingredient-containing compartments, and formed with a passage through which the ingredient of one compartment may be forced into the other compartment, a spherical stopper normally containing within the passage as a sealing closure therefor, and adapted to be displaced from the passage by an application of displacing force from the ingredient applied thereagainst through the passage, means associated with the ampule for manual application of pressure against the ingredient as contained in one of the compartments thereby to cause an application of pressure through the ingredient against the stopper for its functional displacement and the ejection of said ingredient into the other compartment and the hypodermic injection of the mixed ingredient; said partitioning stopple being composed of a resilient material and the diameter of said stopper being greater than the greatest diameter of the passage and the stopper being forced thereinto and thereby

retained in place under normal conditions and whereby an expanding force is exerted on the stopple that normally retains it against movement in the ampule prior to the stopper being unseated.

4. A compounding ampule comprising a cylindrical tube and a partitioning member separating the tube into two compartments; said partitioning member comprising a resilient stopple that is applied within the tube intermediate its ends in a slidable, pressure and liquid-tight fit, a passage axially through the stopple and a valve seat formed in the passage intermediate its ends, a stopper disposed in the valve seat as a closure for the passage; means associated with the ampule adapted to apply pressure against ingredient in a compartment of the ampule whereby the stopper is displaced from the passage into the other compartment.

5. A compounding ampule as recited in claim 4 wherein the said stopper is in the form of a spherical bead, and the said passage is enlarged at one end to receive and contain the stopper therein, and said stopper having a diameter that is greater than the enlarged diameter of the passage to cause the stopper to be yieldingly held against displacement from the resilient stopple and to effect a radial expanding pressure to be applied thereby to the surrounding walls of the stopple for added holding effect, but which expanding pressure is relieved by the functional displacement of the stopper from the passage.

6. A cylindrical container equipped with a resilient partitioning member separating two ingredient containing compartments and formed with an axial passage through which the ingredient of one compartment may pass into the other compartment, a stopper applied within the passage as a closure therefor and the stopper being of a diameter substantially greater than the diameter of the passage wherein the stopper is disposed and whereby the wall of the partitioning member is compressed against the container wall when the stopper is seated in the passage, a piston stopple at one end of the container as a closure therefor and adapted, by inward movement, to apply pressure against the ingredient confined in one of the compartments to cause it to transmit a displacing force to the stopper whereby the stopper is functionally displaced from the passage in the partitioning member into the other ingredient compartment, the end of the container that is opposite that closed by the piston stopple being closed by a stopple that is adapted to be pierced by a hypodermic needle for the hypodermic injection of the compounded ingredients, and said piston stopple is inwardly movable in the container after displacement of the stopper from the passage to effect the ejection for the compounded ingredients through a needle that has been projected through the pierceable stopple.

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