Sept. 29, 1953 A. E. SMITH 2,653,610

DISPENSING CLOSURE

Filed Oct. 28, 1950

Fig. 1.

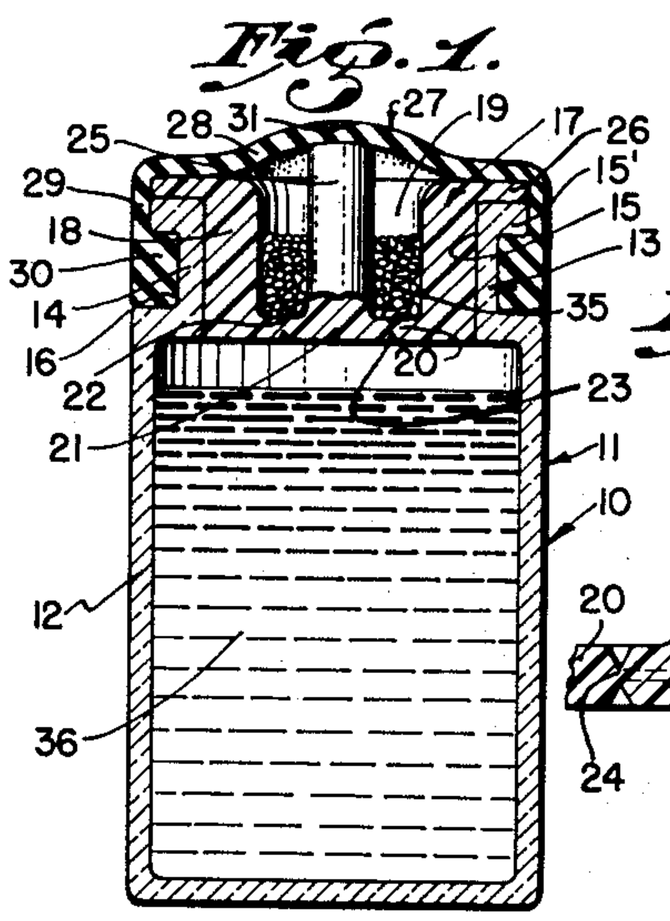


Fig. 2.

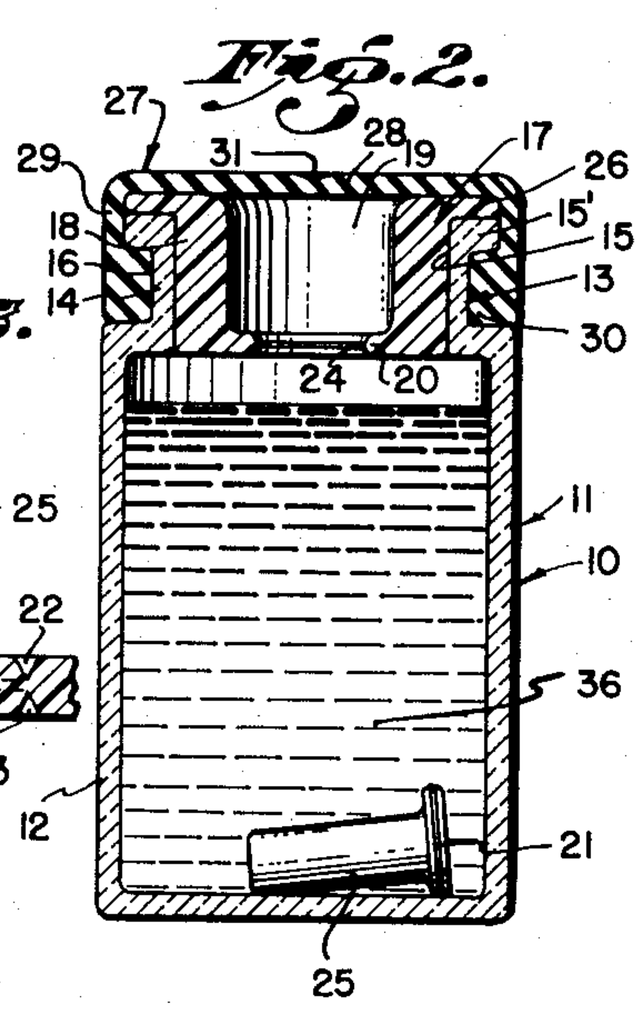


Fig. 3.

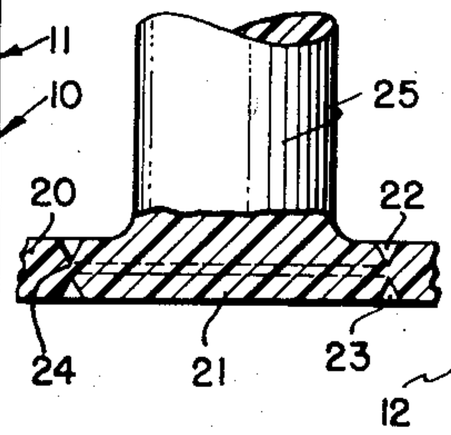


Fig. 4.

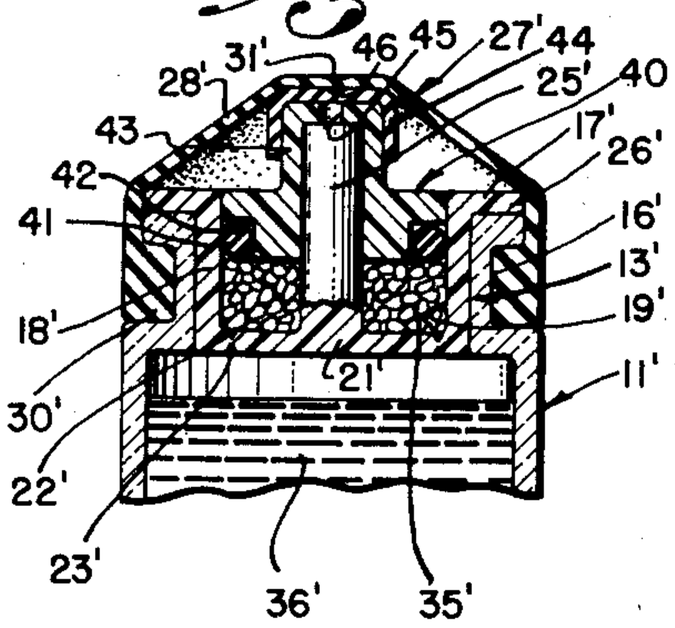
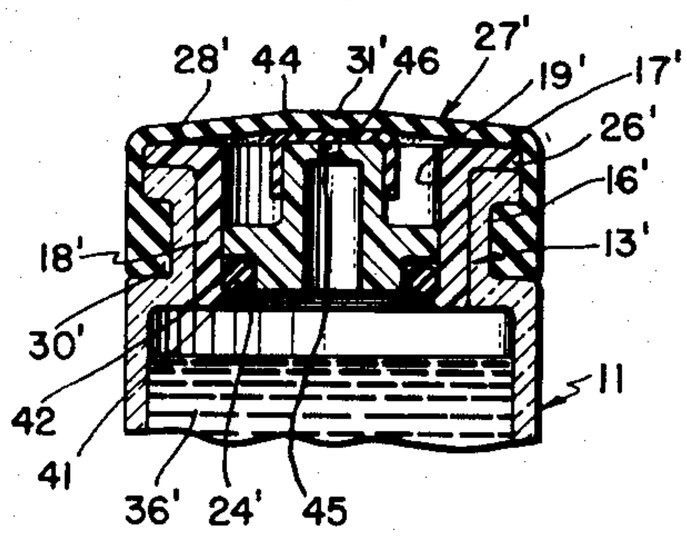


Fig. 5.



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DISPENSING CLOSURE

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6 Claims. (Cl. 128—272)

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This invention relates to a container by means of which a user may prepare a fresh solution easily, quickly and without contamination of the solution.

Many drugs, such as, for example, penicillin, are supplied in powder or crystal form and do not retain their stability, strength and effectiveness for long after they have been mixed in solution, a condition necessary for administration. Therefore, physicians generally do not mix more of the required drug than is immediately needed, and then discard any solution left over.

Heretofore it has been a problem to enable physicians and nurses to easily mix drugs such as penicillin and still keep them in their original sterile condition. Formerly such drugs were supplied in their dry form in a container large enough to receive the required amount of either water or a saline solvent. This solvent was measured in a syringe and usually injected through the container cap into the container to thereupon be mixed with the drug. When the drug was completely dissolved, the required amount was withdrawn with a syringe for administration. Unless extreme care was taken in the maintenance of the sterility of the solution used, the syringe, needles and container cap, contamination of the solution was likely to result, a condition that might be harmful to a patient receiving an injection of the prepared solution.

Another problem arising in the preparation of a fresh solution by injecting the solution into a bottle containing a dry drug has been in the selection and measurement of the required solution. Often physicians, and more often nurses, do not remember the correct amount or the type of solvent required with various drugs. Incorrect dilution of drugs will, many times render the drugs less effective, and possibly harmful, or create a solution of such concentration as to waste a portion of the drug. In addition, with some drugs a concentration greater than normal does little or nothing more for the patient than the normal dosage; therefore a correct mixture is necessary.

When making a call at a patient's home, physicians do not always have means to sterilize their syringes and needles to prepare a solution, making it necessary to premix the solution with the drug, whereupon the time interval between mixing and administration is lengthened and the subsequent deterioration of the mixed solution results. As with contaminated and improperly mixed solutions, the administration of

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an old solution of many drugs will often cause the patient to develop toxic symptoms together with other possibly harmful or uncomfortable conditions.

Therefore it is the main object of the invention to provide a novel container closure for the preparation of a fresh drug solution.

Another object of the invention is to provide a novel container or package for the mixing and storing of a fresh drug solution in which a solution may be prepared with little or no danger of contamination.

Another object of the invention is to provide a novel container or package for mixing and storing a fresh drug solution which may be used with a minimum of time and effort.

Other and further important objects of the present invention will become apparent from the following description taken in connection with the accompanying drawings, wherein:

Fig. 1 is an elevation sectional view of the container closure and package of the present invention, shown before the fresh solution is prepared;

Fig. 2 is a view similar to Fig. 1, showing the container after the fresh solution has been prepared;

Fig. 3 is an enlarged, fragmentary view, partially in section, showing the construction of the frangible portion of the container stopper;

Fig. 4 is a fragmentary, elevation, sectional view of a modified form of the invention, and

Fig. 5 is another view of the modification of Fig. 4 after the movement of the elements to effect mixing of the solution.

Referring to the drawing by reference characters, the invention is shown as embodied in a container indicated generally at 10. The container includes a bottle 11 having a body portion 12 and a reduced neck portion 13. The vertical annular wall 14 of the neck portion defines an opening 15 through the neck portion 13 which communicates with the interior of the body portion 12. The neck portion 13, adjacent the upper end of the body portion 12, is provided with an end flange 15' which provides an annular groove 16.

The opening 15 receives a stopper, indicated generally at 17, which may be made of flexible, resilient plastic. The stopper 17 includes an annular wall 18 which defines an axial opening 19, the lower end of which is closed by a diaphragm 20 integral with the wall 18. The diaphragm 20 has a central weakened portion 21 defined by a pair of upper and lower annular,

opposed, V-shaped grooves 22 and 23 providing a frangible area 24, the purpose of which will later be described.

A central, integral, vertical stem 25, rising from the diaphragm 20, extends above the upper end of the stopper 17. The stopper 17 further includes an annular flange 26 which is adapted to rest upon the upper end of the bottle neck 13.

A resilient closure 27 for the package includes a top 28 having a skirt 29. The skirt 29 has an inwardly directed annular bead 30 on the lower end thereof, which fits in the groove 16. An indentation 31 is provided in the center of the top 28. The upper portion of the top 28 is engaged by the upper end of the stem 25.

In use a dry, powdered or crystalline drug 35 is placed in the opening 19 of the stopper 17. The stopper 17 is then inserted in the opening 15 in the bottle, which contains a solvent 36 such as water. The closure 27 is next placed over the stopper and bottle to form a package as shown in Fig. 1.

When it is desired to prepare a fresh drug solution the top 28 and stem 25 are pushed downwardly, thus fracturing the diaphragm 20 at 24 and permitting the stem 25, together with the section 21 of the diaphragm 20, to fall into the solution 36. This action may also be accomplished by inverting the package and striking the end 28 on a suitable surface. The package is then shaken, causing the drug 35 to be mixed and dissolved in the solution 36. A needle connected to a syringe may then be inserted through the closure 27, at the indentation 31, to withdraw the desired amount of drug solution.

Thus it may be seen that a fresh drug solution may be easily, quickly and accurately prepared with a minimum of time and effort. The fact that the amount of drug and quantity of solution is predetermined makes errors arising from incorrect mixing and measuring of these component parts practically non-existent as the measuring is done by the manufacturer in preparing the package.

In Figs. 4 and 5, I show a modification of the invention wherein parts like those previously described are indicated by like single primed reference numerals. In this modification the stem 25′ has a plunger 40 arranged thereon. The plunger 40 is slidable within the opening 19′ in the stopper 17′. The plunger 40, at its lower end, is provided with an annular piston ring rubber seal 41 arranged in a groove 42 and adapted to engage the side wall of the opening 19′. The upper end of the stem 25′ is covered by an integral raised portion 43 on the plunger 40 and has thereon an inverted cup shaped resilient cap 44. An opening 45 is provided in the portion 43 and an indentation 46 is formed in the center of the cap 44.

In use, the upper end of the package of Fig. 4 may be pushed or tapped lightly to thereby force the stem 25′ and the portion 21′ into the solution 36′, and causing the plunger 40 to move downwardly and the drug 35′ to fall into the solution, as shown in Fig. 5. A needle connected to a syringe may then be inserted through the closure 27′ and the cap 44, through the indentations 31′ and 46 and pass through the opening 45 and into the solution to enable the desired quantity of mixed solution to be withdrawn.

This modification, among other uses, would enable the manufacturer to package different types of drugs in a container consisting of a stopper 17′, a plunger 40 and cap 44, the unit to be inserted in a bottle containing the required solvent by the physician.

Having thus described my invention, I claim:

1. A stopper including a body having an outwardly directed annular flange and having an annular wall defining a recess adapted to hold a quantity of a drug, a diaphragm integral with said annular wall and closing said recess, a pair of opposed grooves on opposite sides of said diaphragm and forming a frangible removable section and a rigid stem formed integral with the central area of said diaphragm and extending upwardly to a location above the upper end of said stopper flange.

2. In a container wherein a fresh drug solution may be prepared, a bottle having a body portion and a neck portion, a stopper arranged within said neck portion, said stopper having a recess adapted to hold a quantity of a drug, said stopper including a weakened portion defining a removable part, means integral with said weakened portion and accessible for operation to remove said weakened portion, and a closure secured on the neck portion of said bottle and extending over the stopper.

3. In a container wherein a fresh drug solution may be prepared, a bottle having a body portion and a neck portion, a stopper arranged within said neck portion, said stopper having a recess adapted to hold a quantity of a drug, a diaphragm closing said recess and having a weakened portion defining a removable part, means integral with said diaphragm and operable to cause said diaphragm to fracture at said weakened portion, and a closure secured on the neck portion of said bottle and extending over the stopper.

4. In a container wherein a fresh drug solution may be prepared, a bottle having a body portion and a neck portion, a stopper arranged within said neck portion, said stopper having an annular wall defining a recess adapted to hold a quantity of a drug, a diaphragm closing said recess and having a weakened portion defining a removable part, a stem integral with said diaphragm and operable to cause said diaphragm to fracture at said weakened portion, and a puncturable, resilient closure secured on the neck portion of said bottle and extending over the stopper.

5. In a container wherein a fresh drug solution may be prepared, a bottle having a body portion and a neck portion, a stopper within said neck portion and having an outwardly directed annular flange resting on the upper end of said neck portion, said stopper having an annular wall defining a recess adapted to hold a quantity of a drug, a diaphragm integral with said annular wall and extending across said recess, there being a groove on said diaphragm forming a removable section, an integral stem formed from the central area of said diaphragm and extending upwardly to a location above the upper end of said stopper flange, and an inverted cup shaped resilient closure member having an end portion extending over the stopper flange and having a skirt engaging said bottle neck portion.

6. In a container wherein a fresh drug solution may be prepared, a bottle having a body portion and a neck portion of reduced diameter, the upper end of said neck portion having an annular peripheral flange defining an annular groove about said neck portion adjacent to said body portion, a stopper within said neck portion and having an outwardly directed annular flange

resting on the upper end of said neck portion, said stopper having an annular wall defining a recess adapted to hold a quantity of a drug, a diaphragm integral with said annular wall and extending across said recess, there being a pair of opposed annular V-shaped grooves on opposite sides of said diaphragm and forming a removable section, an integral stem formed from the central area of said diaphragm and extending upwardly to a location above the upper end of said stopper flange, and an inverted cup shaped resilient closure member having an end portion extending over the stopper flange and having a

skirt with an inwardly directed bead thereon engaging in said groove about said bottle neck portion.

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