Sept. 29, 1953 A. E. SMITH 2,653,611

CLOSURE

Filed Nov. 24, 1950

Fig. 1.

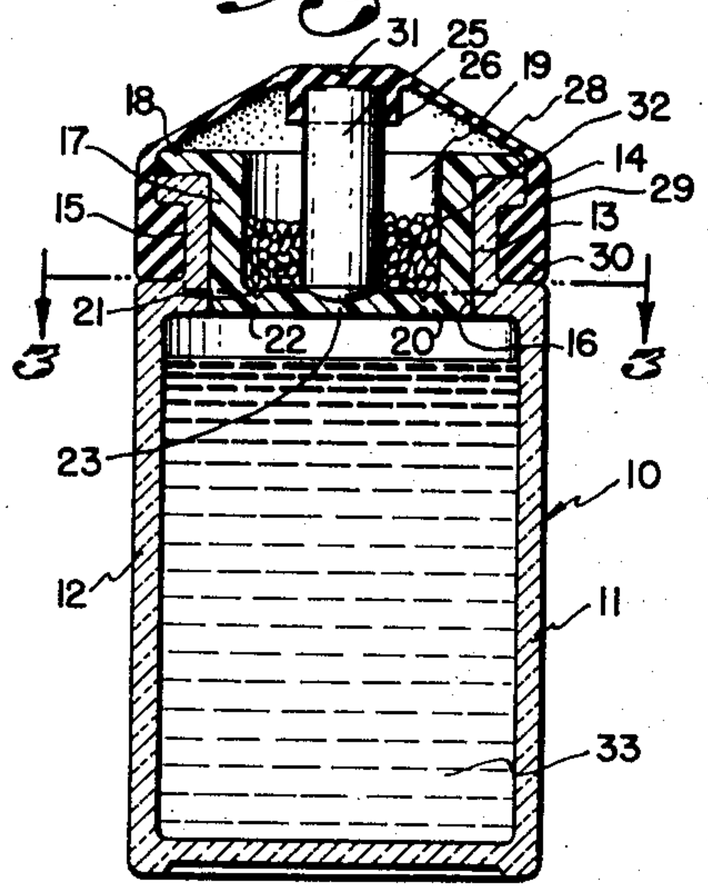


Fig. 2.

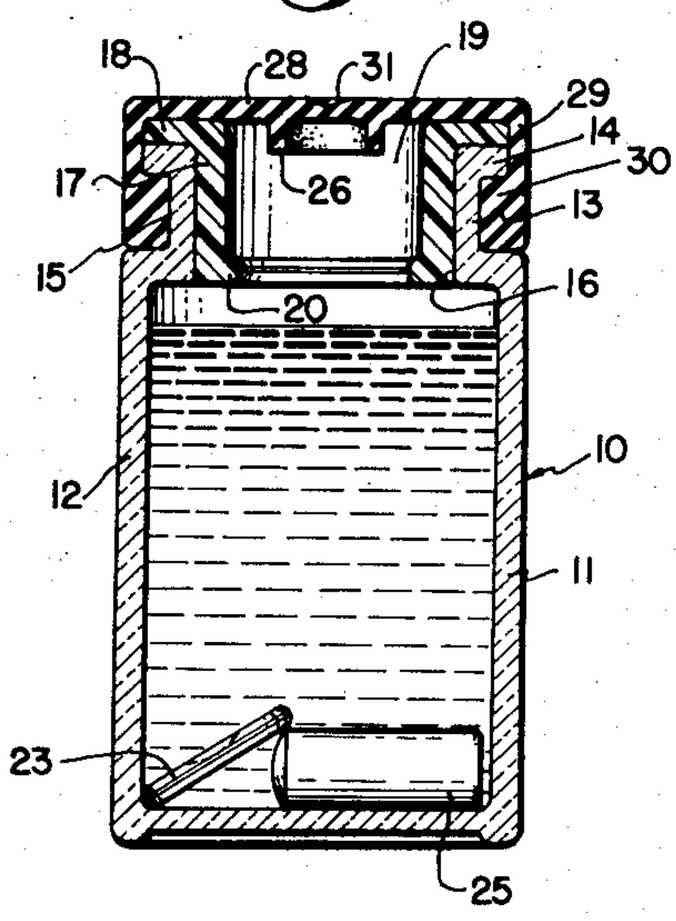


Fig. 3.

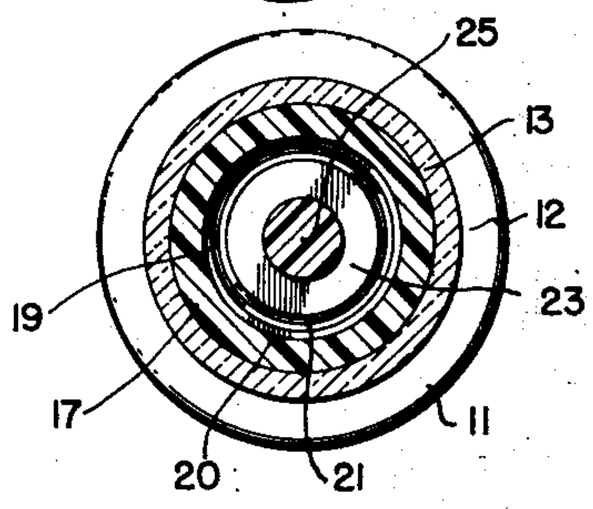


Fig. 4.

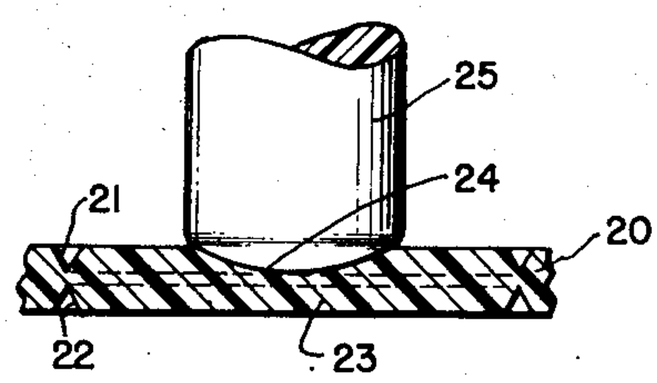


Fig. 5.

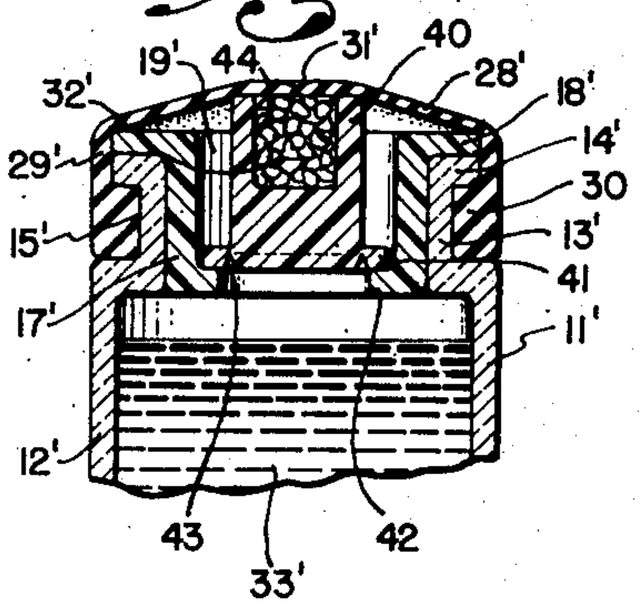
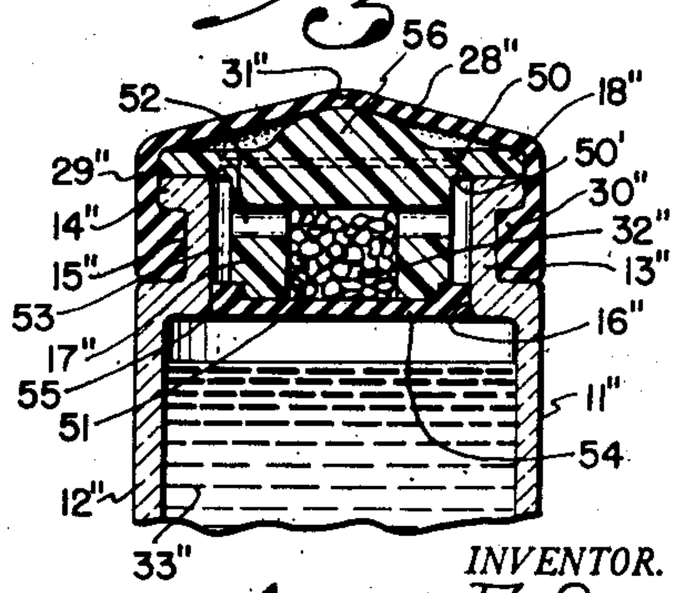


Fig. 6.



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CLOSURE

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4 Claims. (Cl. 128—272)

1

This invention relates to a closure for a container whereby a fresh drug solution may be prepared easily, quickly, accurately and may be maintained in a sterile condition.

Heretofore, it has been the practice among physicians, surgeons and nurses to prepare a fresh drug solution such as penicillin, or the like, by injecting a measured quantity of a solvent such as water or normal saline solution through a resilient bottle cap and into a bottle wherein a quantity of the dry drug had been placed. This process of mixing necessary fresh solutions permits considerable error in that not always does the preparer know or remember the exact amount of solvent to be used, the correct type of solvent, or does he necessarily maintain the solvent in a sterile condition. These measurements must be rigidly complied with to maintain the fresh drug solutions in their correct concentrations, a factor vital in the administration of such drugs.

The problem of sterility of the solution is one that must be taken into consideration. Often a quantity of solvent is withdrawn at many different times from the same container. In so doing it is practically impossible to maintain the solvent in a sterile condition. This condition is also aggravated by the fact that often there is poor sterilization of the syringes and needles in the mixing.

Therefore, it is the main object of this invention to provide a novel closure for a container whereby a fresh drug solution may be prepared rapidly and accurately and may be maintained in a sterile condition.

Another object of the present invention is to provide a novel container closure including a novel removable portion.

A further object of the invention is to provide a novel closure including a drug holding cavity.

A still further object of the present invention is to provide a novel closure including a drug holding cavity and a novel opening member for removing a wall of the cavity.

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

Fig. 1 is a sectional view of a container with the closure of this invention thereon;

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

Fig. 3 is a transverse sectional view taken as indicated by line 3—3, Fig. 1;

Fig. 4 is an enlarged, fragmentary, sectional view of the actuating rod, together with the diaphragm and its associated frangible portion;

Fig. 5 is a fragmentary, sectional view of a modification of the invention, and

Fig. 6 is a view similar to Fig. 5, showing a further modification of the invention.

Referring to the drawing by reference characters, wherein like characters indicate like parts, the invention is shown as embodied in a container which is indicated generally at 10. As shown the container includes a bottle 11 having a body portion 12 and a reduced neck portion 13. The upper end of the neck portion 13 is provided with an outwardly directed flange 14 which forms the upper end of an annular groove 15. The opening 16 in the bottle neck receives a stopper 17 which has an outwardly directed annular flange 18, adapted to rest on the flange 14.

2

The stopper 17 has an opening 19 which is closed at the lower end by a diaphragm 20 which has a pair of opposed, upper and lower annular V-shaped grooves 21 and 22, which define a frangible or breakable portion 23. The portion 23, as shown, has a centrally positioned indentation 24 which is adapted to receive the lower end of an actuating member or rod 25, the upper end of which is retained in a collar which depends from a resilient, inverted, cup shaped closure member 28.

The closure member 28 has a downwardly extending side wall or skirt 29 which surrounds the flanges 14 and 18 of the bottle and the stopper and at its lower end has an inwardly directed annular bead 30 which lies in the groove 15 of the bottle neck 13 to retain the closure 28 in place. The central upper surface of the closure member 28 is provided with a slight indentation 31, the use of which will be later described.

In use, the container is delivered to the user in the condition shown in Fig. 1, with a quantity of a drug 32 in the space surrounding the rod 25 within the opening 19. The body 12 of the container is filled with the correct amount of the proper solvent or vehicle 33 for the drug being used.

To effect mixing of the drug and the solvent, pressure is applied on the upper end of the closure 28, thus forcing the actuating member 25 downwardly and, due to its engagement with the frangible or breakable portion 23 of the diaphragm 20, causes the portion 23 to break away from the diaphragm 20 at the annular grooves 21 and 22. The rod 25, frangible portion 23 and the drug 32 will then fall into the solvent 33 to prepare a fresh solution. To obtain the required quantity of the prepared solution, a hypodermic needle connected to a syringe is inserted through the indentation 31 in the closure 28 and the required amount of solution is withdrawn into the syringe.

Thus it may be seen that the container of the invention is of such a nature that a fresh drug solution may be quickly, easily and accurately prepared and that the solution will remain sterile in the container.

Referring now to Fig. 5, wherein a modification of the invention is shown and wherein like parts are indicated by single primed reference numerals, the opening 19′ in the stopper 17′ receives

an actuating member or insert 40 which has, adjacent its lower end, an annular, outwardly extending flange 41 which is adapted to rest on an inwardly directed flange 42 of the stopper 17'. An annular, V-shaped groove 43 is provided in the insert 40 adjacent the flange 41 to provide a frangible area therefor. The flange 41 and groove 43 form a diaphragm. The insert 40 is held in contact with the flange 42 by pressure on its upper end by the resilient closure 28'. The insert 40 has an upwardly directed recess 44 wherein the drug 32' may be placed.

Pressure on the upper end of actuating member 40 will cause the flange 41 to break from the insert 40 at the annular groove 43, whereupon the insert 40 together with the drug 32' will fall into the solvent 33' to be dissolved therein.

Referring now to the further modification of Fig. 6, wherein like parts are indicated by double primed reference numerals, the stopper 17'' is provided with annular V-shaped opposed grooves 50 and 50' adjacent its upper flange 18''. The flange 18'' and V-shaped grooves 50 and 50' provide a diaphragm. A recess 51 is provided in the lower portion of the stopper 17'' to receive the drug 32''.

Horizontal bores 52 connect the recess 51 with the outer periphery of the stopper. The recess 51 and the space 53 formed between the stopper 17'' and the neck 13'' of the bottle are sealed by a resilient closure 54 adapted to engage the opening 16'' in the bottle neck and a groove 55 in the lower outer edge of the stopper 17''.

The stopper 17'' is also provided, at its upper end, with a raised actuating member portion 56 which may be engaged by a closure 28''. Pressure on the closure 28'' and the portion 56 will cause the stopper 17'' to break away from its flange 18'' at the annular grooves 50 and 50', thus causing the stopper, lower closure 54 and the drug 32'' to fall into the solvent 33'', whereupon the solvent will pass through the bores 52 to be mixed with the drug 32''.

Having thus described my invention, I claim:

1. In a container wherein a fresh drug solution may be prepared, a bottle having a body portion and a neck portion of reduced diameter, 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 removable diaphragm integral with said annular wall and closing said recess, an actuating rod in the stopper recess, said rod having a cross sectional area less than the area of the stopper recess, said actuating rod extending upwardly to a location above the upper end of said stopper flange, and an inverted cup shaped resilient closure member having a skirt portion engaging the stopper flange and engaging said bottle neck portion, said diaphragm and said closure having centering means thereon engaging the lower and upper ends, respectively, of the rod.

2. 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 closing said recess, there being a weakened portion on said diaphragm forming a removable section, an actuating rod in the stopper recess and having its lower end engaging said diaphragm, said rod having a cross sectional area less than the area of the stopper recess, means to center the lower end of said rod on said diaphragm, said actuating rod extending upwardly to a location above the upper end of said stopper flange, and an inverted cup shaped resilient closure member having a skirt portion engaging the stopper flange, said skirt portion having an inwardly directed bead thereon engaging in said groove about said bottle neck portion, said closure having means thereon engaging the upper end of said rod to center the rod.

3. 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 and closing said recess, there being a pair of opposed annular V-shaped grooves on opposite sides of said diaphragm and forming a removable section, said removable section having a central indentation, an actuating rod in the stopper recess, said rod having a cross sectional area less than the area of the stopper recess and having its lower end arranged in said indentation, said actuating rod extending upwardly to a location above the upper end of said stopper flange, and an inverted cup shaped resilient closure member having a skirt portion extending over the stopper flange, said skirt portion having an inwardly directed bead thereon engaging in said groove about said bottle neck portion, said closure having a depending collar engaging the upper end of said rod.

4. 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 removable diaphragm integral with said annular wall and closing said recess, an actuating rod in said stopper recess, said rod having a cross sectional area less than the area of the stopper recess, said actuating rod extending upwardly to a location above the upper end of said stopper flange, and an inverted cup shaped resilient closure member having a skirt portion engaging the stopper flange and the bottle neck portion.

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