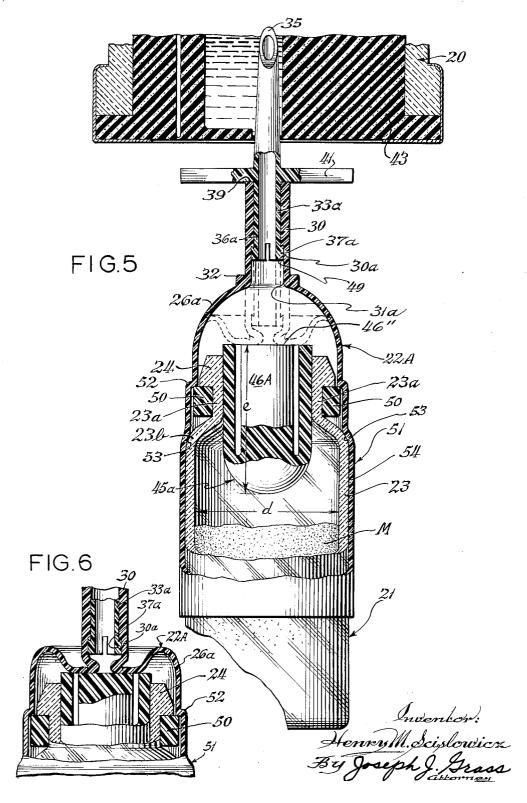


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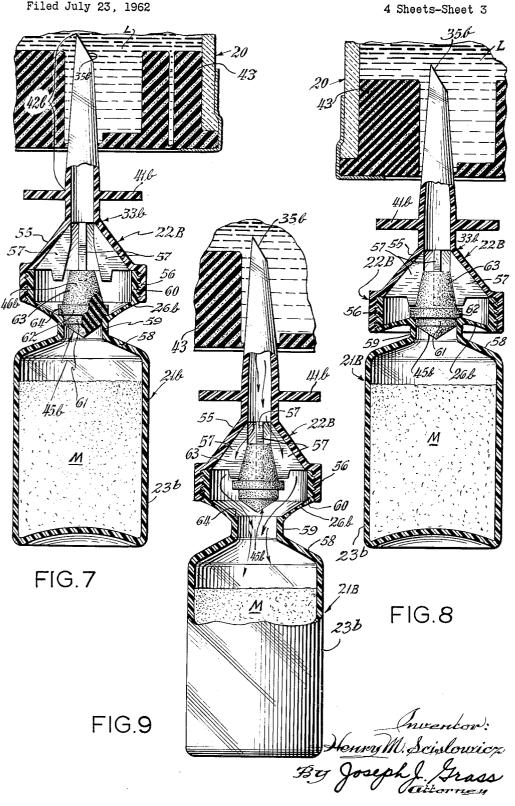
Sept. 14, 1965

H. M. SCISLOWICZ

3,206,080

Filed July 23, 1962

DISPENSING ASSEMBLY



Sept. 14, 1965

3,206,080

Filed July 23, 1962

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FIG.10 FIG.12 FIG.11 43 43 41c 43 $\overline{}$ 3**3**c 22C 33C 22**C** 57c 51 56c 🕖 //// 60 C 3**3**c 26 c 22C 60 z.59c 26c 57c 460 21c 21c 58c 45c 65 23c 58c 2 45c 23C Inventor; rislowicz EAL 'Brj

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3,206,080 DISPENSING ASSEMBLY

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Filed July 23, 1962, Ser. No. 211,660 3 Claims. (Cl. 222-383)

This invention relates to a dispensing assembly and in particular the invention relates to a dispensing assembly $_{10}$ which is particularly adapted to serve as a pump. In the art it is sometimes necessary to store a substance such as powdered medicament or the like in the dry state until the time arrives when it is ready to be used. At that time it is necessary to bring the medicament into contact $_{15}$ with the liquid, for example a parenteral solution, for purposes of parenteral administration. The primary purpose of storing a medicament or the like in the dry state is to preserve its medicinal characteristics.

In accordance with the invention there is provided a 20 dispensing assembly which includes a flexible diaphragm to which there is suitably connected a dispensing cannula. The container with which the dispensing assembly of the invention is to be employed has a tubular neck in which there is slidably seated a closure plug. In one embodi- 25 ment of the invention the closure plug is unseatable and displaceable into the container in response to the sufficient flexure of the flexible diaphragm, when the proximal terminal end of the dispensing cannula is forced or pushed against the closure plug. The closure plug cannot, how- 30 ever, be reseated. In another embodiment of the invention the closure plug is releasable and displaceable into the container when the flexible diaphragm is forced or pushed against the closure plug. The dispensing assembly of the invention is adapted to be suitably connected 35 to the dispensing container. When it is desired to mix the dry medicament in the dispensing container with the liquid, in the liquid container, the dispensing cannula is brought into communication with the inside of the liquid container. When an actuating force is exerted upon the 40 dispensing container by the user, the flexure of the flexible diaphragm causes the inward displacement of the closure plug into the dispensing container so that liquid communication is thereby established between the dispensing container and the liquid container. When the closure plug 45 has been displaced from its seating engagement in the tubular neck of the dispensing container in response to the flexure of the flexible diaphragm into the flexed position, it is readily apparent that the dry medicament, for example powder, is pumped into the liquid container from the 50 dispensing container during each forward movement of the dispensing container toward the liquid container and that liquid, for example parenteral solution, is sucked from the liquid container into the dispensing container upon each backward movement of the dispensing con- 55 tainer away from the liquid container. Therefore, once the closure plug has been displaced into the dispensing container, there is free interchange of the medicament in the dispensing container and the liquid in the liquid 60 container.

In accordance with another embodiment of the invention there is provided a dispensing container having a flexible diaphragm to which the dispensing cannula is secured. The dispensing container has a restricted neck in which there is slidably seated a closure plug. The 65 dispensing cannula has at least one gripper which grips the closure plug to unseat the same in response to the inward flexure of the flexible diaphragm. Once the closure plug has been gripped by the gripper or grippers, the closure plug is held out of seating engagement with the 70 restricted neck of the dispensing container. There is at least one opening around the gripper or grippers so that

communication is able to be established between the dispensing container and the dispensing cannula and vice versa.

In accordance with another embodiment of the invention there is provided a dispensing container having a flexible diaphragm to which a dispensing cannula is secured. The dispensing container is provided with a restricted neck in which there is seated for sliding movement a closure plug. The closure plug is slidably displaceable to uncover a port in the closure plug in response to the sufficient flexure of the flexible diaphragm to establish communication between the dispensing container and the dispensing cannula and vice versa.

It is a purpose of the invention to provide a dispensing assembly which is adapted to serve as a pump, which is provided with a plug-type closure and which is simple, economical to manufacture and effective and dependable in use.

In the diagrammatic, illustrative drawings:

FIGURE 1 is a perspective view showing the manner in which the dispensing assembly of the invention is adapted to be employed;

FIGURE 2 is a side elevation view, mainly in crosssection, of the embodiment shown in FIGURE 1 of the illustrative drawings, showing the closure plug seated in the tubular neck of the dispensing container;

FIGURE 3 is a side elevation view of the dispensing assembly of the invention, the dispensing container, and a fragmentary portion of the liquid container, with the closure plug shown to be displaced into the dispensing container;

FIGURE 4 is a cross-sectional view taken along line 4-4 of FIGURE 2 of the illustrative drawings;

FIGURE 5 is a side elevation view, mainly in crosssection, of another embodiment of the dispensing assembly of the invention, the dispensing container, and a fragmentary portion of the liquid container;

FIGURE 6 is a fragmentary side elevation view, mainly in cross-section, showing the flexible diaphragm in the flexed position to urge the closure plug into the dispensing container;

FIGURE 7 is a side elevation view, mainly in crosssection, of another embodiment of the dispensing assembly of the invention, showing the closure plug seated in the restricted tubular neck of the dispensing container;

FIGURE 8 is a side elevation view, mainly in crosssection, of the dispensing assembly and a fragmentary portion of the liquid container, with grippers shown to be gripping the closure plug just prior to unseating of the closure plug from within the restricted tubular neck of the dispensing container;

FIGURE 9 is a cross-sectional view similar to FIG-URES 7 and 8 of the illustrative drawings, but showing the grippers gripping the closure plug after it has been unseated from within the restricted tubular neck of the dispensing container;

FIGURE 10 is a side elevation view, mainly in crosssection, of another embodiment of the dispensing assembly of the invention and a fragmentary portion of the bottle stopper, showing the closure plug in its closed position and showing the flexible diaphragm in the relaxed position;

FIGURE 11 is a side elevation view, mainly in crosssection, of the dispensing assembly of the embodiment of FIGURE 10 of the illustrative drawings and a fragmentary portion of the bottle stopper, showing the closure plug in its open position and showing the flexible diaphragm in the flexed position; and

FIGURE 12 is a side elevation view, mainly in crosssection, similar to FIGURE 11 of the illustrative drawings but showing the flexible diaphragm in the relaxed 3

position after the closure plug has been slid into the open position.

Throughout the specification like reference characters are employed to designate components having the same construction, function and relative location.

Referring now to the embodiment of FIGURES 1 through 4 of the illustrative drawings, there is shown in a liquid container 20 which is adapted to contain a liquid, for example, a parenteral solution. There is also shown a dispensing container 21 which is provided with a dis-10 pensing assembly generally indicated at 22. The dispensing container 21 is provided with a container body 23 and a tubular neck 23a joined by an inclined portion The tubular neck 23a is shown to have an annular 23b. bead 24 as seen, for example, in FIGURE 2 of the illus-15 trative drawings. The tubular neck 23a of the container 21 defines an opening 25 through which the medicament M is filled into the container 21. The dispensing assembly 22 is shown to comprise a flexible dome-shaped diaphragm 26 from which there depends an annular flange portion 27. The annular flange portion 27 is shown to have an internal bead 28 which is adapted to engage an annular shoulder 29 defined by the bead 24. The flexible diaphragm 26 is provided with a socket portion 30 which extends axially therefrom. The internal intersection of the diaphragm 26 and the socket portion 30 defines an aperture 31 in the flexible diaphragm 26. An annular bead 32 reinforces the flexible diaphragm and the socket portion 30 externally at their place of intersection. A dispensing cannula 33 is shown to extend inwardly and outwardly beyond the aperture 31 and to be provided at its distal marginal end 34 with a sharpened portion 35, while the proximal marginal end 36 of the dispensing cannula 33 is shown to be provided with an external annular flange 37. The proximal marginal end 36 of the 35dispensing cannula 33 is shown to be provided with an axially extending transverse slot 38. The slot 38 enables the proximal marginal end 36 of the dispensing cannula 33 to flex sufficiently to enable the external annular flange 40 37 to be inserted through a terminal end 39 of the socket portion 30 to the position shown, for example, in FIG-URE 2 of the illustrative drawings. The socket portion 30 being somewhat resilient, also flexes, as the annular flange 37 is passed therethrough. The annular flange 37 is inclined inwardly and downwardly to aid the insertion 45of the dispensing cannula 33 through the socket portion The dispensing cannula 33 is provided with a flange 30. 41 which serves the dual function of limiting the inward movement of the dispensing cannula 33 with respect to the socket portion 30 and of providing a convenient fin-50ger stop to enable the user to insert a free length portion 42 of the dispensing cannula 33 into a pierceable stopper 43 of the liquid container 20.

In accordance with the invention, there is provided a closure generally indicated at 45 which is shown to take 55the form of a closure plug 46 slidably fitted in the tubular neck 23a. It is readily apparent that the closure plug 46 remains slidably fitted in the tubular neck 23a until it is displaced into the container body 23 of the container 21 by the user. The user establishes communication between the container 21 and the container 20 by means of the free-length portion 42 of the dispensing cannula 33. The user then grasps the dispensing container 21 and the container 20 in the manner illustrated in FIGURE 1 of the illustrative drawings and begins to move the container 21 65 rapidly toward and away from the container 20, or vice versa, by short pumping strokes. Upon the first inward movement of the dispensing cannula 33, the flexible diaphragm 26 temporarily flexes inwardly sufficiently in the manner illustrated in FIGURE 3 of the illustrative draw-70 ings to enable a proximal terminal end 36' of the dispensing cannula 33 abut a projection 46' of the closure plug 46 to displace and release the slidably and releasably seated closure plug 46 from the tubular neck 23a. After

21, the user continues the inward and outward pumping strokes of the container 21 so that the dry medicament M is pumped from the container 21 on the inward movement and liquid in the container 21 is sucked into the container 21 during the backward stroke. The closure 45 helps to retain the medicament M dry and sterile, but the closure 45 is also useful to prevent the medicament M from falling out through a passage 47 of the dispensing cannula 33 after a sheath 48 is removed and as the freelength portion 42 of the dispensing cannula 33 is being inserted into the pierceable stopper 43 of the container 20.

The closure plug 46 is provided at its upper end with an opposed pair of upwardly extending projections 47 and The upwardly extending projections 47 and 48 are 47'. provided on the closure plug 46 for the purpose of preventing the closure plug from rotating more than 180° when it is displaced into the container body 23 of the container 21 and consequently prevents the closure plug 46 from resealing in the tubular neck 23a. The overall extent e of the closure plug 46 is greater than the transverse inside extent or diameter d of the container body 23. It is seen therefore that since the overall extent e of the closure plug is greater than the distance d, a rounded portion 46a of the closure plug 46 is not capable of causing 25 the closure plug 46 to be reseated in the tubular neck 23a. The rounded end 46a is provided so that the closure plug 46 may be easily inserted into the tubular neck 23a.

The diameter of closure plug 46 is equal to or slightly greater than the diameter of neck 23a to provide a friction fit between the plug and neck and thereby prevent the plug 46 from falling into the container body 23 without the application of an external force. The effective diameter of projections 47 and 48 is the same as that of the closure plug 46, as best seen in FIGURES 2 and 3. Since the effective diameter of projections 47 and 48 is therefore equal to or greater than the diameter of neck 23a, the projections cannot be seated in the neck without the application of an external face. In the event that the container 21 is inverted and the projections 47 and 48 abut the inclined portion 23b of container 21, flow between container body 23 and cannula 33 is still maintained through the spaces between the projections 47 and 48.

Referring now to the embodiment of FIGURES 5 and 6 of the illustrative drawings, there is shown a dispensing assembly generally indicated at 22A having a construction somewhat similar to that shown in the embodiment of FIGURES 1 through 4 of the illustrative drawings. The dispensing assembly 22A is shown to have a dispensing cannula 33a, a proximal marginal end 36a of which is disposed slightly above an aperture 31a in a flexible dome-shaped diaphragm 26a. The proximal marginal end 36a of the dispensing cannula 33a is shown to be provided with a barb-shaped flange 37a which fits into a corresponding annular recess 49 in a socket portion 30a. As the dispensing container 21 is urged toward the liquid container 30, the flexible diaphragm 26a flexes into the flexed position shown by phantom lines in FIG-URE 5 of the illustrative drawings and solid lines in FIGURE 6 of the illustrative drawings to abut a projection 46" of the closure plug 46A to displace a closure 45A in the form of a closure plug 46A into the container body 23 of the dispensing container 21. The basic difference between the embodiment shown in FIGURES 1 through 4 and the embodiment of FIGURES 5 and 6 of the illustrative drawings is that in the former embodiment the dispensing cannula acts upon the closure plug 46 to displace it into the container body 23 of the container 21 while in the latter embodiment the flexible diaphragm 26a serves to displace the closure plug 46A into the container body 43 of the dispensing container 21 when the flexed diaphragm 26a is pushed against the closure plug 46a.

seated closure plug 46 from the tubular neck 23*a*. After There is shown in the embodiment of FIGURES 5 the closure plug 46 has been displaced into the container $_{75}$ and 6 of the illustrative drawings a collar 50 which re-

mains after a tamper-proof closure (not shown) is removed. Dispensing assembly 22*a* is provided with a sleeve-like flange portion 51 having a first annular internal shoulder 52 which abuts against the collar 50 and a second annular internal shoulder 53 which abuts against the inclined portion 23*b* of the dispensing container 21. Extending downwardly of the second internal shoulder 53 is a sleeve portion 54 which has a slightly downward and outward taper to enable the flange portion 51 to be snugly received by the container body 23 of the dispensing container 21. The flange portion 51 enables the dispensing assembly 22A to be employed on various types of containers, for example, those not having an annular collar 50.

Referring now to the embodiment of FIGURES 7 15 through 9 of the illustrative drawings there is shown a dispensing assembly generally indicated at 22B. The dispensing assembly 22B includes both a dispensing cannula generally indicated at 33b and a dispensing container 21b. The dispensing cannula 33b has a freelength portion 42b terminating at a sharpened portion **35***b*. At the proximal end of the free-length portion 42b, there is disposed a flange 41b. The dispensing cannula 33b has a downwardly and outwardly inclined portion 55 terminating at an annular internally threaded 25 portion 56. The dispensing cannula is shown to be provided with a plurality of grippers 57, preferably four in number, which are formed as an integral part thereof. The dispensing container 21b is provided with a container body 23b which is joined to an annular upwardly and inwardly inclined portion 58. The upwardly and inwardly inclined portion is joined to a tubular neck 59 while the tubular neck in turn is joined to an annular outwardly and upwardly inclined flexible diaphragm 26b. The flexible diaphragm 26b terminates at its marginal 35 edge in an annular externally threaded portion 60. A closure 45b in the form of a closure plug 46b is shown to have a closure portion 61, an annular stop portion 62 and a grippable portion 63. The closure portion 61 of the closure plug 46b before use is normally seatingly 40 and slidably engaged in the tubular neck 59 while the stop portion 62 is normally seated against an upper end 64 of the tubular neck 59. When it is desired to provide communication between the liquid L in the liquid container 21 and the medicament M in the dispensing $_{45}$ container 21b, the free-length portion 42b is inserted into the bottle stopper 43 and the dispensing container 21bis urged toward the liquid container 21 thereby flexing the flexible diaphragm 26b so that the grippers grip the grippable portion 63 of the closure plug 46b to un- 50seat and hold the closure plug 46b out of seating engagement with the tubular neck $\overline{59}$ as best shown in FIGURE 8 of the illustrative drawings. As the flexible diaphragm is relaxed into the position best shown in FIGURE 9 of the illustrative drawings, the closure plug 46b remains 55 gripped by the grippers 57. The flexible diaphragm 26b can be repeatedly flexed upon the pumping movement of the dispensing container 21b toward the liquid container 20 or vice versa until the liquid L and the dry medicament M have been brought into a solution. Dur-60 ing the pumping movement of the dispensing assembly 22B, the grippable portion 63 remains wedged between the grippers 57. The closure plug 46 is preferably resilient so that gripping engagement with the grippers 57 is facilitated. 65

Referring now to the embodiment of FIGURES 10 through 12 of the illustrative drawings, there is shown a dispensing assembly generally indicated at 22C which includes both a dispensing cannula 33c and a dispensing container 21c. The dispensing cannula has a flange 41c 70 formed integrally therewith. The dispensing cannula 33c has a downwardly and outwardly inclined portion 55c terminating at an annular internally threaded portion 56c. The dispensing container 21c has a container body 23c, an upwardly and inwardly inclined portion 75

58c joined thereto and a tubular neck portion 59c joined to the portion 58c. An annular upwardly and outwardly extending flexible diaphragm 26c is joined to tubular neck portion 59c. The flexible diaphragm 26c terminates at its marginal edge in an annular threaded portion 60c. The dispensing cannula 33c is shown to be provided with axially and downwardly extending projections 57c, preferably four in number. Slidably fitted within the tubular neck portion 59c is a closure 45c which is shown to take the form of a closure plug 46c. The closure plug 46c is shown to be cored-out as indicated at 65. There are shown to be provided a plurality of ports 66 in the closure plug 46c which extend only a portion of the length of the closure plug 46c, although one is sufficient for the purposes of the invention. An annular stop 67 at the upper portion of the closure plug 46c serves to limit the axial inward movement of the closure plug 46c in the tubular neck 59c. FIGURE 10 of the illustrative drawings shows the closure plug 46c to be in the closed po-20 sition. When the user first actuates the dispensing assembly 22C of the invention, the closure plug 46c is actuated into the open position, shown in FIGURE 11 of the illustrative drawings. The closure plug 46c is actuated by the user into the open position so that liquid from the liquid container 20 can pass through the dispensing cannula 33c, through the ports 66 in the closure plug 46c and into the dispensing container 21c, and so that the medicament M in the dispensing container 21c can pass through the ports 66, through the dispensing cannula 33c into the liquid container 20. Normally, however, the operator continues to pump the dispensing assembly 22C thereby causing the interchange of the liquid L in the liquid container 20 and the medicament \hat{M} in the dispensing container 21c.

The dispensing assembly 22 exclusive of the dispensing cannula 33 is preferably composed of a flexible plastic such as polyethylene, vinyl or rubber. The dispensing cannula 33 is preferably composed of somewhat more rigid material such as polypropylene or nylon.

In the embodiments of FIGURES 1 through 4 and 5 and 6 of the illustrative drawings, the dispensing assemblies 22 and 22A are preferably composed of polyethylene, vinyl or rubber except that the dispensing cannula 33a is preferably composed of a more rigid material such as polypropylene or nylon.

In the embodiment of FIGURES 7 through 9 of the illustrative drawings, the dispensing container 21b is preferably composed of a flexible material such as polyethylene or vinyl, while the dispensing cannula 33b is preferably composed of more rigid material, for example polypropylene. The closure plug 46b is preferably composed of rubber although other materials possessing sufficient resilience for the stated purpose are employable. In the embodiment of FIGURES 10 through 12 of

In the embodiment of FIGURES 10 through 12 of the illustrative drawings, the dispensing cannula 33c and the dispensing container 21c are preferably composed of the same materials as the dispensing cannula 33b and the dispensing container 21b in the embodiment of FIG-URES 7 through 9 of the illustrative drawings. However, the closure plug 46 is preferably composed of plastic such as polyethylene or polypropylene.

The above-described embodiments being exemplary only, it will be understood that modifications in form or detail are within the purview of the invention. Accordingly, the invention is not to be considered as limited save as is consonant with the scope of the following claims. What is claimed is:

1. In a dispensing assembly for a dispensing container: a flexible diaphragm having an aperture therein, a flange portion depending from said diaphragm and engageable with said container, a dispensing cannula connected to said diaphragm and extending outwardly beyond and inwardly beyond said aperture in said diaphragm, a closure plug slidably fitted in a tubular neck of said container, said closure plug being releasable and displaceable into said container in response to the inward flexure of said diaphragm and the pushing of said dispensing cannula against said closure plug, said closure plug including means for preventing said closure plug from being reseated in said tubular neck and for permitting flow from 5 said container through said neck when said closure plug is dispaced into said container.

2. In a dispensing assembly for a dispensing container; a flexible diaphragm having an aperture therein, a flange portion depending from said diaphragm and engageable 10 with said container, a dispensing cannula connected to said diaphragm and extending outwardly beyond and inwardly beyond said aperture and said diaphragm, a closure plug slidably fitted in a tubular neck of said container, said closure plug having a top face and a plurality 15 of peripherally located spaced projections extending from the top face thereof toward said cannula, each said projection having an outer face, the contour of which is substantially equal to the contour of said closure plug at said top face, said closure plug being releasable and dis- 20 placeable from said neck in response to the inward flexure of said diaphragm and the pushing of said dispensing cannula against said closure plug, the total extent of said closure plug being greater than the transverse inside extent of said dispensing container.

3. A dispensing assembly for a dispensing container, a flexible diaphragm having an aperture therein, a flange portion depending from said diaphragm and engageable with said container, a dispensing cannula connected to said diaphragm and extending outwardly beyond and inwardly beyond said aperture in said diaphragm, a closure plug slidably seated in a tubular neck of said container, said closure plug being releasable and displaceable into said container in response to the inward flexure of said diaphragm and the pushing of said dispensing cannula against said closure plug, said closure plug having a plurality of peripherally spaced projections at the top face thereof, each said projection having an outer face substantially conforming to the peripheral contour of said top face of said closure plug, the total extent of said closure plug being greater than the transverse inside extent of said dispensing container.

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