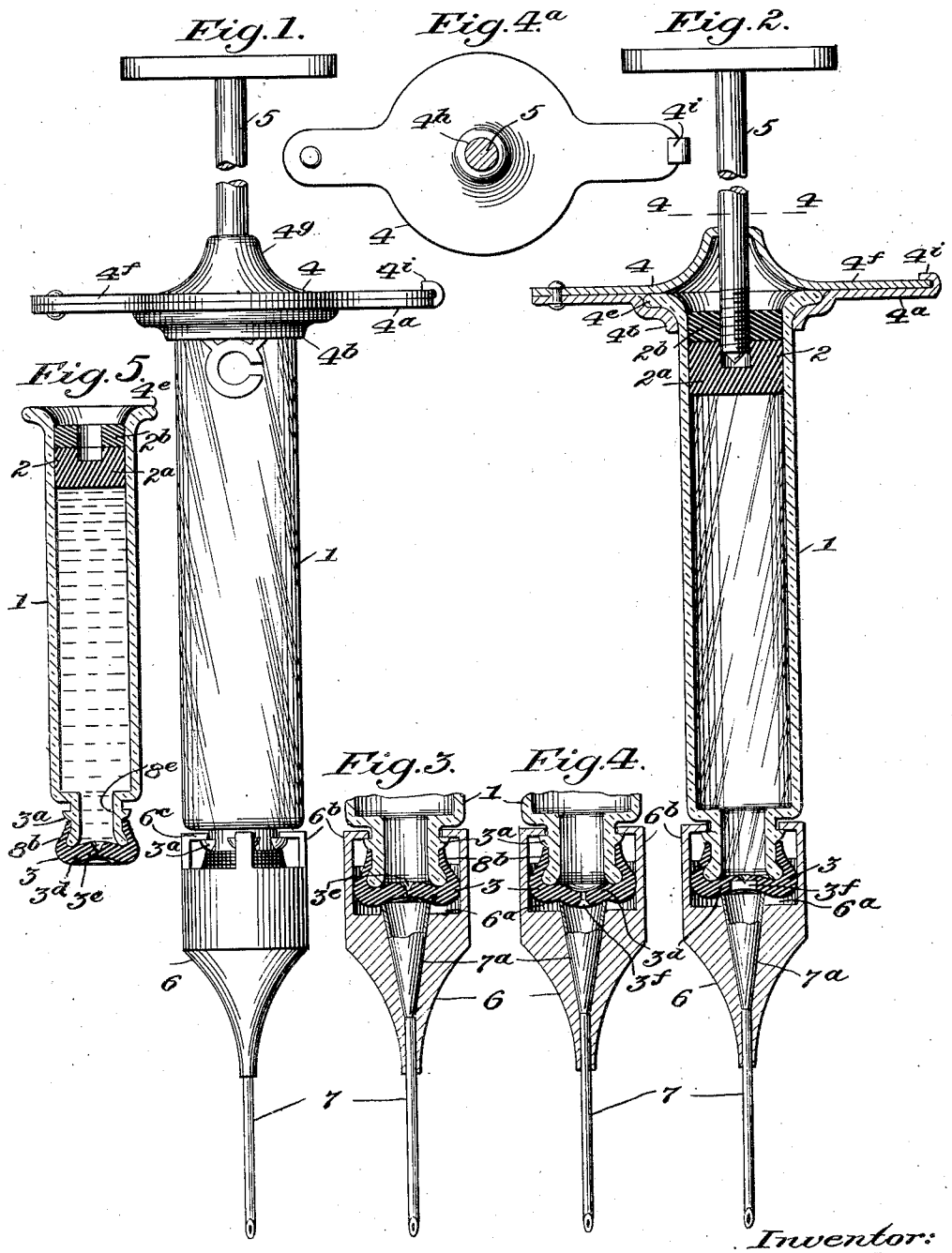
May 7, 1929. E. P. CRESSLER 1,712,070

SYRINGE

Filed Jan. 30, 1924 2 Sheets-Sheet 1



Inventor:
E. P. Cressler,
By P. T. Dodge
Atty.

May 7, 1929. E. P. CRESSLER 1,712,070

SYRINGE

Filed Jan. 30, 1924 2 Sheets-Sheet 2

Fig. 6.

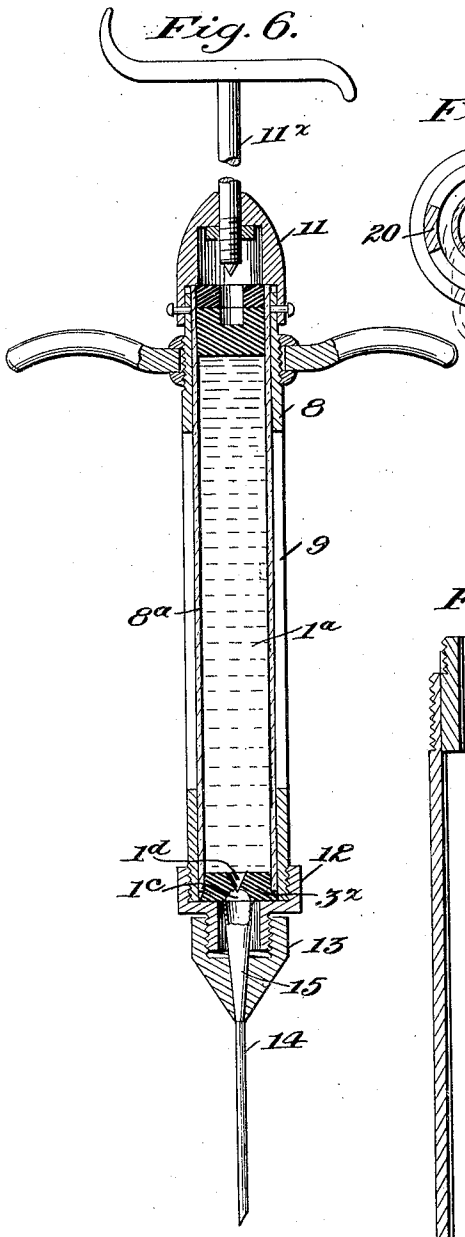


Fig. 9.

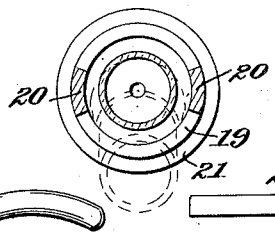


Fig. 7.

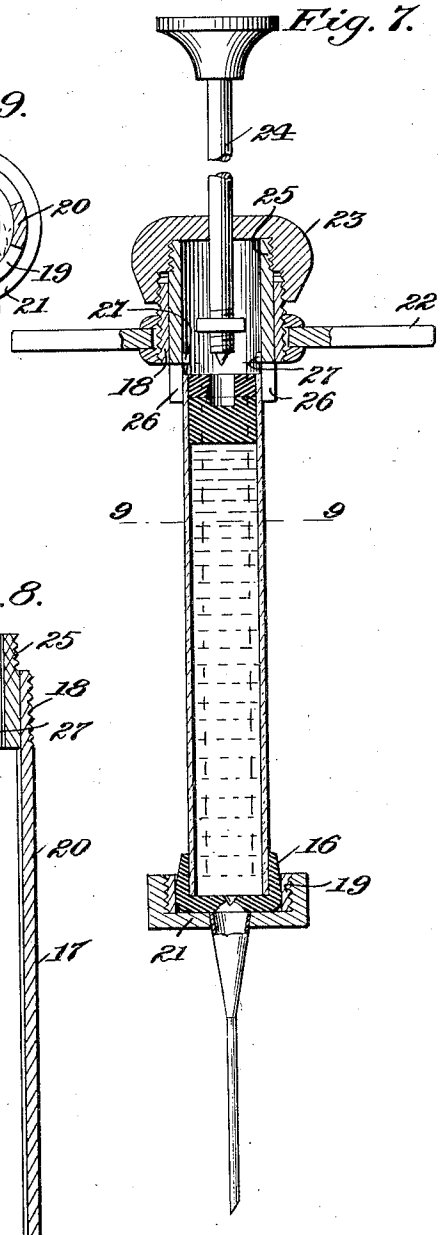


Fig. 8.

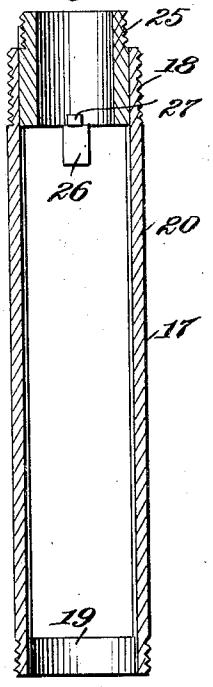
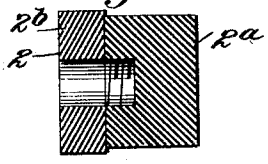


Fig. 10.



Inventor:
E. P. Cressler,
By P. T. Sodge
Att'y.

Patented May 7, 1929. 1,712,070

UNITED STATES PATENT OFFICE.

EDWARD P. CRESSLER, OF NEWTON, KANSAS, ASSIGNOR TO COOK LABORATORIES, INC., OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

SYRINGE.

Application filed January 30, 1924. Serial No. 689,518.

This invention relates to hypodermic or other syringes for injecting serums, vaccines, drugs, or other solutions, and the invention is particularly concerned with that type of syringe in which the liquid to be injected is contained in a portable ampule or container which, when the injection is to be made, is assembled or inserted in the syringe structure.

In the operation of such syringes, it sometimes happens that the plunger at the end of its injecting stroke will retract slightly and draw into the needle blood or other foreign matter from the punctured tissue, and the chief aim of the present invention is to prevent this objectionable action.

The invention may be understood by reference to one illustrative embodiment shown in the accompanying drawings, in which:

Figure 1 is a view in side elevation of a syringe structure and my improved ampule designed especially for injecting vaccine;

Fig. 2 is a view in longitudinal section through the same showing the controlling valve closed;

Fig. 3 is a view in longitudinal section of the discharge end of the ampule and the attached needle, the section being taken at right angles to that represented in Fig. 2;

Fig. 4 is a view similar to Fig. 3 with the controlling valve open;

Fig. 4^a is a sectional plan view on an enlarged scale, on the line 4—4, Fig. 2;

Fig. 5 is a view in longitudinal section of the ampule detached from the syringe structure;

Fig. 6 is a view in longitudinal section of my improved ampule adapted more particularly for the injection of drugs, and showing the same connected with a syringe structure of a form different from that shown in the preceding figures;

Fig. 7 is a view in longitudinal section of my improved ampule in still another form and associated with another type of syringe structure;

Fig. 8 is a view in longitudinal section of a portion of the syringe structure with the parts in a different position from that occupied in Fig. 7;

Fig. 9 is a view in horizontal section, on the line 9—9, Fig. 7; and

Fig. 10 is an enlarged sectional view of the plunger separated from the ampule.

Referring more particularly to Figs. 1 to 5, 1 designates an ampule or container for the substance or liquid to be injected, which container is in the form, as usual, of a glass tube or capsule, open at both ends, the substance to be injected being confined therein by a plug or closure 2 inserted in the rear end of the tube and by a cap or closure 3 applied over the front end of the tube.

The ampule is adapted to have attached to it a syringe structure consisting, in the present instance, of a plunger rod guiding member 4 adapted to be detachably connected with the rear end of the ampule and sustaining a plunger rod 5, and a needle carrying member 6 supporting a hollow needle 7 and adapted to be detachably connected with the front or discharge end of the ampule.

The guiding member 4, which forms in effect the handle of the syringe structure, consists of a supporting plate 4^a having a central opening to receive the ampule, and which opening is surrounded by an axial boss 4^b fitting against the front face of a peripheral flange 4^c on the end of the ampule. To this plate a confining and clamping plate 4^f is pivoted at one end and is formed with an axially extending boss 4^g having a guiding opening 4^h to receive and guide a plunger rod 5. In assembling these parts, the confining plate is swung laterally to expose the opening in the supporting plate, and the ampule is then inserted in the opening and the flange thereon seated against the boss on the supporting plate. The confining plate is now swung back on the supporting plate and the guiding opening 4^h therein brought into registration with the axis of the ampule, in which position it is confined by a lip 4^i on the supporting plate beneath which the edge of the confining plate is adapted to engage. The plunger rod 5 is now pushed down through the guiding opening and its end engaged with the plug or stopper 2, the latter operating as a plunger, as will be presently described, to discharge the contents of the ampule.

The needle carrying member consists of a sleeve, chambered at its inner end as at 6^a to surround the discharge end of the ampule, and formed solid at its outer end to receive and firmly support the needle. The needle

projects a short distance into the solid portion of the carrying member and communicates at its inner extremity with the inner contracted end of a conical passage formed by a conical shell 7^a fixed to and extending axially within the member 6, with its inner enlarged end projecting some distance beyond the wall of the chamber 6^a where it is adapted to cooperate with the cap 3 on the ampule, as will be presently described.

The detachable connection of the needle carrying member with the discharge end of the ampule is effected in the present instance by means of fingers 6^b extending longitudinally from the inner edge of the member 6 at intervals and provided on their extremities with inwardly extending locking lips 6^c adapted to seat behind lugs 3^a projecting from the side of the discharge end of the ampule. In attaching the needle carrying member to the ampule, the chamber 6^a is passed over the end of the ampule and the ends of the fingers inserted in the spaces between the lugs, and the member 6 thereupon turned to cause the lips to pass behind and engage the locking lugs.

The cap 3 for closing the discharge end of the ampule is, in the present instance, made of rubber, and comprises the cylindrical side wall 8^b which is tightly clasped around the reduced neck 8^e on the discharge end of the ampule, and an end wall 3^d which closes across the mouth of the neck. The cap is of such form that the end wall will extend into the mouth of the neck with a slight curvature or concavity, as shown in Figs. 2 and 3, when there is no pressure on its inner side tending to deform it; and is adapted to be deformed and flexed to the opposite curvature so as to become convexed, as shown in Fig. 4, when subjected to pressure from the inside, as when the plunger is advanced to expel the contents of the ampule. The end wall of the cap is formed in its inner side at its center with the conical cavity 3^e which extends part way through it, and it is formed at its opposite side with an elongated slit 3^f which meets the cavity 3^e, the form and relation of the cavity and slit being such that when the wall is relieved of pressure and is curved inwardly, as shown in Figs. 2 and 3 the walls of the slit will be pressed tightly together and the end of the ampule will be sealed by the cap, and when the end wall is subjected to pressure and is convexed, as shown in Fig. 4, the walls of the cavity will become parallel to each other, the walls of the slit will separate from each other, as in Fig. 4, and the end of the ampule will be opened for the discharge of the contents. The end wall of the cap, with its cavity and slit related as described, constitutes in effect an outwardly opening check-valve controlling the discharge of the contents of the ampule, the said valve being adapted to be opened to permit the discharge of the contents when subjected to pressure from the inside, and being adapted to automatically close and prevent the return of the injected substance or other foreign substance when the pressure from the inside is relieved.

The cap 3, with the valve thus formed, will preserve the cotnents of the ampule from escape in the handling and transportation of the same, and when the ampule is connected with the syringe parts as described the movement of the plunger rod 5 will act to advance the plunger in the ampule and will place the contents of the same under pressure and this pressure will act to deform the end wall of the cap and force the same outwardly, as shown in Fig. 4, thereby opening the valve and permitting the contents to flow through the needle in the injecting action. At the end of the injecting stroke, when the plunger is relieved of pressure and before any retraction, the end wall of the closure cap will automatically flex to the opposite concaved position, as shown in Figs. 2 and 3, thereby instantly closing the valve and preventing any blood or other foreign matter, or any of the injected substance, from being drawn back into the needle. In other words, due to the prompt closure of the valve, it is not possible for any suction effect exerted in the ampule by the plunger to be communicated to the needle passage, and consequently there will be no tendency of the injected matter or other foreign matter to be drawn back into the needle.

It will be observed that the inner end of the conical shell 7^a with which the hollow needle communicates seats against the end wall of the cap and surrounds the valve opening therein. The conical shell in this way constitutes an abutment for the wall of the cap and controls its flexing movements. Furthermore, the engagement of the end of the conical shell with the yielding material of the cap, produces a tension on the locking lips 6^c in their engagement with the lugs 3^a on the neck of the ampule, and tends to hold the parts firmly connected without looseness.

The plug or stopper 2 forms in effect, as above described in the operation of the syringe, a plunger for the discharge of the contents of the ampule, and, in accordance with my invention, it is of a peculiar form which will now be described and which, while insuring a uniform advance of the plunger free from jerks or intermittent action, will offer resistance to the retraction or back movement of the plunger. To accomplish this object, the plunger is in the form of two connected sections or portions, a relatively thick and a relatively hard section 2^a, preferably of hard rubber, and a relatively

thin and relatively soft section 2^b, which may be of soft rubber, see Fig. 10, the hard section 2^a fits less snugly in the ampule than does the section 2^b, but they move together in the operation of the syringe, the two sections being formed with registering holes into which the end of the plunger rod is adapted to screw, or may be otherwise engaged when the latter is to be operated. In the action of the plunger when the same is advanced, the thick and harder section 2^a will act as a guide for the softer section 2^b, and the latter will follow the harder body and the external surface and the softer section will be free to move or trail along the inner surface of the ampule without tendency to bind thereon. When, however, the direction of movement is reversed and the plunger retracted, the soft body traveling in advance will be expanded and spread by the pressure on it of the harder section and its frictional contact with the interior of the ampule will retard its movement and act with a braking effect. This action of the plunger is of advantage in the operation of the syringe in that there is less liability of the plunger to rebound or jerk back at the end of the injecting stroke, and therefore there is less liability of back-suction.

In Fig. 6, the ampule 1^a instead of being of the form shown in Fig. 1 with the reduced neck embraced by a closure cap, is straight and cylindrical from end to end, its discharge end being closed by a soft rubber disk 3^x constructed with a slit 1^c and a hole 1^d, as in the first instance described, to constitute an outwardly opening check-valve operating substantially similar to the valve of Figs. 1 to 4 in controlling the discharge of the contents. The syringe structure in this case consists of a tubular frame 8 having longitudinal slots 9 providing windows through which the ampule may be viewed. At its rear end the frame has fixed to it a handle, and it has a plunger rod guiding member 11 carrying a plunger rod 11^x, detachably connected with the rear end of the frame by means of a bayonet joint constituted by pins 11^a secured on the frame entering slots in the member 11. At its opposite end, the frame has secured on it a cap 12 having a central and externally threaded neck, and on this neck is screwed a needle carrying member 13 in which is mounted a hollow piercing needle 14 terminating in a conical shell 15, the enlarged end of which when the member 13 is screwed on the neck, will abut against the outer face of the closure disk and will surround the valve opening therein. In the assemblage of the parts, the plunger rod guiding member 11 is removed from the upper end of the tubular frame and the ampule is set into place in the frame. The member 11 is now applied and locked in position and the needle carrying member screwed on. To operate the syringe, the plunger rod is engaged with the plunger in the upper end of the ampule, and being pushed inwardly, the plunger will be advanced and will compress the fluid and force the rubber closure disk outwardly and thereby open the valve and permit the contents to be discharged. On the relief of the pressure, the closure disk, resuming its former condition, will automatically close the valve and prevent any substance from being sucked back. The form of the ampule above described and illustrated in Fig. 6 is better adapted than that first described, for the injection of drugs and the like.

In the form of the device shown in Figs. 7, 8 and 9, the ampule like that shown in Fig. 6 is straight and cylindrical from end to end, but the closure for the discharge end in this case is in the form of a rubber cap 16 fitting tightly over the end of the ampule and formed, similarly to the closures of the preceding figures, with a valve adapted to be opened from pressure within and to close when such pressure is relieved. The syringe structure in this case consists of a frame 17 comprising a rear collar 18 and a front collar 19 connected together by two longitudinal bars 20 (see Fig. 8) between which the ampule may be inserted laterally into place in the frame 2 and its (front) discharge end seated on the needle carrying member 21, which is screwed on the collar 19. The collar 18 has a handle 22 fixed to it and a plunger rod guiding member 23, in the form of a cap containing a guiding opening for the plunger rod 24, is screwed on the end of the collar 18, and has depending from it a sleeve 25 which fits loosely within the collar 18 and terminates at its inner end flush with the lower edge of the collar. Two tongues 26 extend from the end of the sleeve at diametrically opposite sides and are adapted, by the turning movement of the cap 23 and, consequently, the sleeve, to be registered with the bars 20 or to be moved out of registration with the same, as shown in Fig. 8. When in register with said bars, the ampule may be inserted laterally into place in the frame, the space between the bars being unobstructed from end to end. When the sleeve is turned, after the ampule is inserted, and the tongues on the sleeve moved out of register with the bars and positioned in the spaces between the bars, they will act to lock and confine the ampule in place. At its free edge, the sleeve is provided with two pins 27 which project inwardly from the inner side of the sleeve in such position that when the cap 23 is turned to move the tongues out of register with the bars in locking the ampule against escape, the pins will engage the upper end of the ampule, and will, as the sleeve is moved endwise in the screwing action of the cap, force

the ampule down on its seat in the lower end of the frame and will hold the same tight and free from wobbling.

The operation of the parts in making an injection is the same as in connection with the other constructions described, the movement of the plunger inwardly causing the plunger to be advanced and applying pressure to the contents of the ampule, which pressure will act to open the check-valve, which will automatically close on the relief of such pressure.

Referring again to the closure 2 in the rear end of the ampule or container, it will be understood that this closure acts in the handling and transportation of the container, as a true stopper, without regard to its other function as a plunger, for by reason of its form and construction as described, it will effectually resist any tendency of the contents of the container to force it out. Due to this characteristic, it is well adapted to serve as a cork or stopper for bottles and the like.

Obviously the present invention is not restricted to the particular embodiment thereof herein shown and described. Moreover, it is not indispensable that all the features of the invention be used conjointly since they may be employed advantageously in various combinations and subcombinations as defined in the claims.

In this application I claim subject-matter generic to the several syringes illustrated and subject-matter specific to Figs. 1 to 5; while subject-matter specific to Fig. 6 is claimed in a divisional application filed by me March 22, 1928, Serial No. 263,670, and subject-matter specific to Figs. 7, 8 and 9 is claimed in a divisional application filed by me March 22, 1928, Serial No. 263,671.

What I claim is:

1. A syringe ampule for use as an operative component of an assembled syringe organization, comprising a sealed liquid-containing tube constructed to have its interior volume reduced for ejecting the liquid and embodying at its discharge end a normally closed valve adapted to be opened by the hydrostatic pressure induced by such reduction of interior volume and to close when such pressure is relieved.

2. A syringe ampule comprising a sealed liquid-containing tube constructed to have its interior volume reduced for ejecting the liquid and embodying at its discharge end a flexible sealing closure having a normally closed passage adapted to be opened by deflection of said closure by hydrostatic pressure induced by such reduction of interior volume, said closure oppositely deflecting to close said passage when such pressure is relieved.

3. An improved ampule for injection syringes, said ampule provided at its discharge end with a closure of deformable material provided with a valve passage consisting of a slit in its outer side and a hole in its inner side communicating with the slit, the walls of said slit adapted, under normal conditions of the closure, to abut against each other and close the valve passage, and being adapted, when the closure is deformed, to separate from each other and open the valve passage.

4. In combination with an ampule provided at its discharge end with an outwardly opening check-valve, a needle carrier adapted to be connected with the discharge end of the ampule, a hollow needle sustained by the carrier, and a hollow conical member connecting at its reduced end with the needle and having its enlarged end positioned to receive the substance discharged by the check-valve.

5. In combination with an ampule provided at its discharge end with a deformable closure having a valve passage through it which is adapted to be opened when the closure is deformed by pressure from within, a needle carrier adapted to be connected with the discharge end of the ampule, a hollow needle sustained by the carrier, and a conical shell communicating at its reduced end with the needle and seated at its enlarged end against the closure and surrounding the valve passage therein.

6. A syringe ampule comprising a sealed liquid-containing tube adapted for communication with a needle and operable to discharge to the needle, said tube embodying a plunger comprising an inner relatively hard section and an outer soft section to engage the tube and resist retraction of the plunger, said outer section having an opening to admit a plunger rod to engage the inner section.

7. A medicament package constructed and arranged to have its interior volume reduced for dispensing of its contents and having an opening; and a resilient cap closing said opening, said cap extending into the opening with a slight convexity when the pressure from the contents within the package is normal, and being so constructed and arranged that it is flexed so as to become concave inwardly when subjected to supernormal pressure from the inside of the package; said cap having a valve passage normally closed but opened by said flexing.

8. A medicament container having a flexible rubber closure sealing one end thereof; said closure provided with a substantially axial cavity extending part way through the closure from the inner wall, and provided with an axial slit extending from the cavity to the outer wall of the closure; the closure being so constructed and arranged that the cavity is normally open, while the slit is normally closed, but under

the pressure created during an injection, the body of the closure flexes and the slit is opened to permit discharge of the medicament through the passageway provided by the cavity and slit together.

9. A medicament container having a flexible rubber closure closing one end thereof; said closure provided with a substantially axial conical cavity extending part way through the closure from the inner wall, and also provided with a straight-walled slit extending from the bottom or small end of the cavity to the outer wall of the closure; the closure being so constructed and arranged that the slit is normally closed to seal the container, but is opened by flexure of the closure from pressure within the container.

10. A hypodermic syringe comprising, in combination, an ampule or sealed medicament-container, comprising a tube having a fore sealing closure embodying a normally closed valve openable by internal pressure and adapted to close to seal the ampule when the pressure is relieved, said tube having a rear closure comprising a plug adapted to be forced inwardly to cause the opening of said valve and the injection of the fluid contents from the ampule; associated means comprising a holder in which the container is removably mounted having a plunger arranged to enter said tube to force in said rear plug; an injecting needle through which the fluid is discharged from the ampule; and means in which the needle is removably mounted holding the needle in operative relation to the discharge end of the ampule.

11. A hypodermic syringe embodying an ampule or sealed medicament-container and an injecting needle connected to the fore end thereof, the needle being normally out of communication with the medicament; said ampule comprising a tube having sealing closures confining the medicament therebetween, the rear ampule closure adapted to be forced into the tube and the fore closure adapted to be actuated by internal pressure to establish communication between the needle and the medicament; and a holder in which the ampule is removably held having a plunger arranged to enter the ampule tube and drive in the rear closure thereof to cause establishment of the aforesaid communication and then to eject the medicament through the needle.

12. A hypodermic syringe embodying an ampule or sealed medicament-container and an injecting needle connected to the fore end thereof, the needle being normally out of communication with the medicament; said ampule comprising a tube having sealing closures confining the medicament therebetween, the rear ampule closure adapted to be forced into the tube and the fore closure adapted to be actuated by internal pressure to establish communication between the needle and the medicament; a holder detachably engaging the rear end of the ampule tube, said tube being formed for cooperative engagement with said holder; and a plunger carried by said holder adapted to enter the ampule tube and drive in the rear closure thereof to cause establishment of the aforesaid communication and then to eject the medicament through the needle.

13. A hypodermic syringe comprising, in combination, a sealed medicament-dispensing container comprising a tube having a fore sealing closure and a rear closure comprising an inwardly-displaceable plug; an injecting needle associated with the fore end of the tube; the syringe constructed and arranged to permit establishing the communication between the interior of the container and the needle; a needle-holder separably connected with the fore end of the tube; a holding device separably connected with the rear end of the tube; and a plunger associated with the holding device arranged to enter the tube to drive in the rear plug for ejecting the fluid contents through the needle; said holding device and needle-holder being connected by the tube.

14. A hypoderimc syringe comprising, in combination, a sealed medicament-container constructed to have its interior volume reduced and having a fore sealing closure of elastic or compressible material embodying a normally closed valve adapted to be opened by internal pressure and to close when such pressure is relieved; an injecting needle with a funnel extension at the inner end thereof; a needle-holder securing said needle in operative relation to the medicament-container and clamping said funnel extension against the outer face of said closure; and means for operating the container to reduce its interior volume to cause opening of the valve and ejection of the medicament fluid through the needle.

15. A hypodermic syringe comprising, in combination, a sealed medicament-container constructed to have its interior volume reduced and having at its fore end a flexible sealing closure, said closure having a normally closed passage adapted to be opened by outward flexing of said closure under internal pressure and to be closed by reflexing of the closure when the pressure is relieved; an injecting needle with a funnel extension at the inner end thereof; a needle-holder securing said needle in operative relation to the medicament-container with the inner end of the funnel extension bearing against the outer face of said flexible closure; and means for operating the container to reduce its interior volume to cause opening of the passage in said closure and ejection of the medicament fluid through the needle.

16. A hypodermic syringe embodying an ampule or separable sealed medicament-

container and a hypodermic injecting needle in operative relation thereto, said ampule comprising a tube having an inwardly displaceable piston plug and a fore sealing closure responsive to pressure imposed on the liquid in the ampule to establish communication with the needle, with holding means in which the ampule is immovably secured having means to force in said piston plug, and means holding the needle in operative relation to the ampule.

17. A hypodermic syringe embodying an ample or separable sealed medicament-container and a hypodermic injecting needle in operative relation thereto, said ampule comprising a tube having an inwardly displaceable piston plug and a fore sealing closure of elastic material such as soft rubber or the like embodying a closed passage openable by flexing of the central portion of the closure, and there being a funnel extension of the needle held with its mouth against said closure around said passage, with means holding said parts in operative relationship, and means to force in said piston plug.

In testimony whereof I hereunto set my hand.

EDWARD P. CRESSLER.