

June 4, 1929.

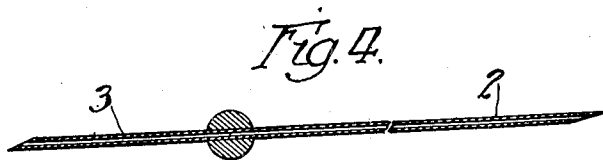
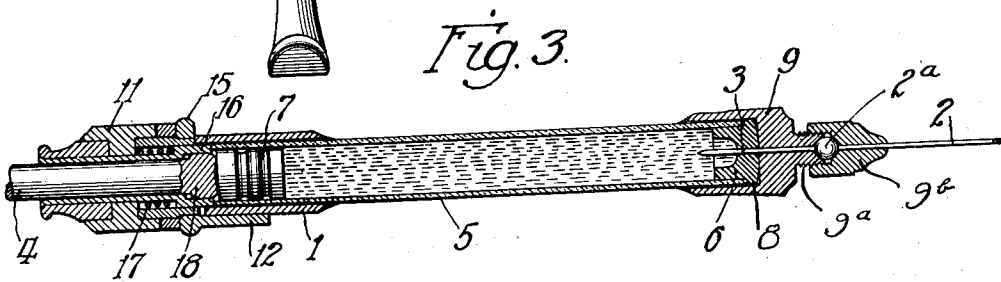
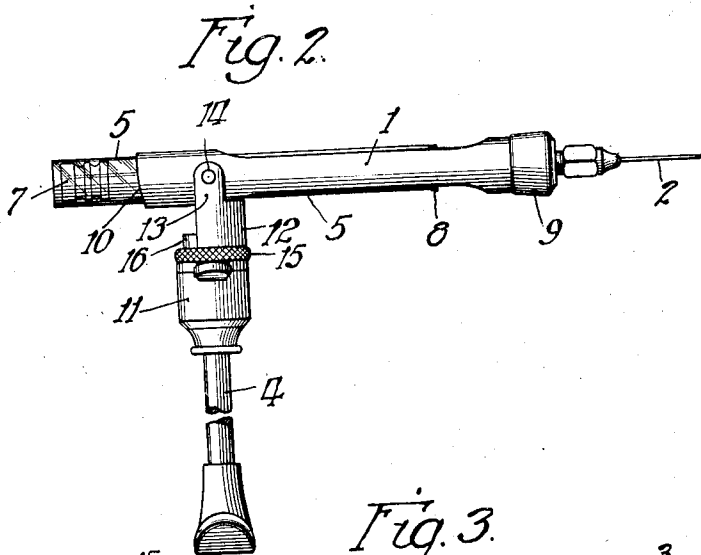
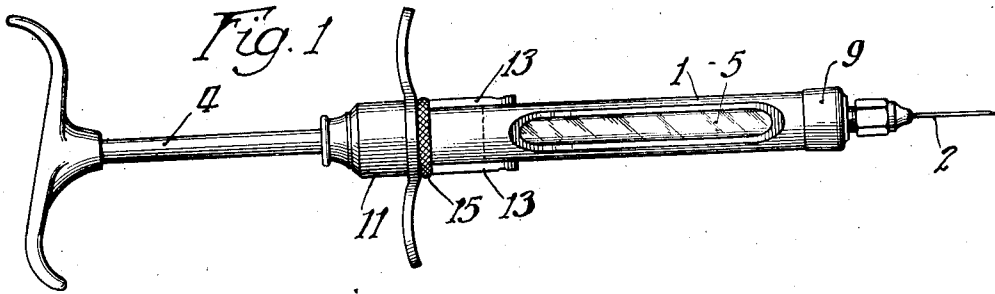
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1,715,771

HYPODERMIC SYRINGE AND CARTRIDGE THEREFOR

Filed May 17, 1924

2 Sheets-Sheet 1



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HYPODERMIC SYRINGE AND CARTRIDGE THEREFOR

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Fig. 5

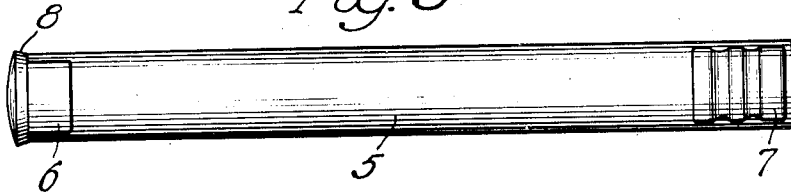


Fig. 6

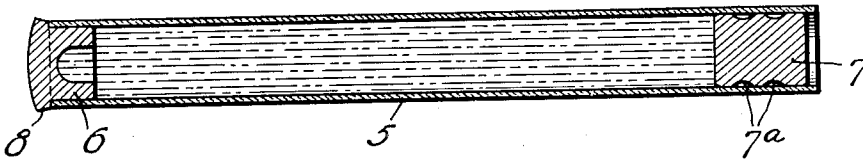


Fig. 7

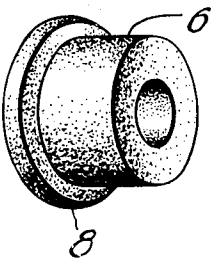
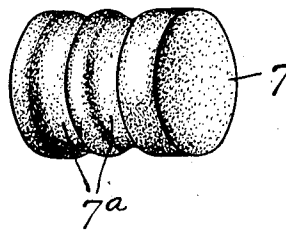


Fig. 8



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UNITED STATES PATENT OFFICE.

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HYPODERMIC SYRINGE AND CARTRIDGE THEREFOR.

Application filed May 17, 1924. Serial No. 713,903.

This invention relates to hypodermic syringes employing a cartridge or sealed medicament-container as a component. The invention aims to provide an improved cartridge and syringe or injection-administering organization embodying the same, having in view reliable functioning of the cartridge as an aseptic packaging and dispensing container of sterile fluid, and maintenance of desired sealing and protective conditions in the syringe organization especially during the cartridge-piercing and fluid-ejecting operations. The invention further aims to provide an improved holding and operating instrument for use with a cartridge and needle to make up the completed syringe organization of which the cartridge is a component, having in view facility for quick insertion of the cartridge in the syringe, releasably locking the syringe in operative condition, and convenience of manipulation. In general, the invention provides exceedingly convenient, efficient and trustworthy means for use in making hypodermic administrations and other similar injections.

By reference to an illustrative embodiment of the invention, shown in the accompanying drawings, the nature of the invention will be readily understood.

In said drawings:

Fig. 1 is a side elevation of a hypodermic syringe comprising or containing an embodiment of the invention, this view showing principally the exterior parts of one preferred form of instrument;

Fig. 2 is a side elevation taken at right angles to that of the preceding figure and showing the syringe open for insertion or withdrawal of the cartridge;

Fig. 3 is a longitudinal section on a slightly enlarged scale of the main portion of the syringe shown in condition for administering an injection;

Fig. 4 is a longitudinal section on a magnified scale of a double-pointed needle which is preferably employed in the illustrative syringe;

Figs. 5 and 6 are enlarged views, in side elevation and longitudinal section respectively, of the cartridge employed in the illustrative syringe, which cartridge in itself embodies a part of the invention;

Figs. 7 and 8 are perspective views on a

magnified scale of the cartridge stoppers or sealing closures.

The illustrative syringe is jointed to permit breaking or opening thereof for insertion or withdrawal of the cartridge which is an aseptic package of sterile hypodermic fluid and protects the fluid from contamination by contact with the syringe body. After inserting the cartridge and closing of the syringe, it is ready for service. To hold the syringe parts together at the joint, a lock is provided.

It is to be understood that the illustrative form shown in the drawings is a preferred embodiment of the invention; and that in the following explanation of that specific form, the described details of structure and organization are exemplary.

The syringe includes a cartridge holder or barrel 1; a hypodermic needle 2 having associated therewith a cartridge piercing canula 3 for conducting the contents of the cartridge to the needle; and a plunger rod 4 for expelling the medicament through the canula. The cartridge shown comprises a tubular glass body 5 sealed at opposite ends by rubber plugs or stoppers, one plug 6 being designed to be pierced by the canula, while the other plug 7 serves as a dispensing plunger, being movable through the tubular body by the plunger rod. The movable plug 7 preferably has both ends plane, as shown, and is provided with circumferential grooves to enhance its sealing effect while permitting free sliding. The plug 6 is shown as axially recessed or cup-shaped, to facilitate piercing, and to cause effectual sealing of the cartridge, particularly when the medicament is subjected to the pressure created during an injection. The plug 6 also has a flange 8 of substantial thickness overlapping the tube end to prevent accidental forcing of the plug into the tube, as in the piercing operation, and to protect the edge of the glass tube against breakage arising from a heavy thrust against one end of the cartridge when in its holder. The flange 8 preferably projects laterally somewhat beyond the periphery of the body 5 and is flared outwardly, as shown in Fig. 3, so that the cartridge snugly fits within the holder. The described cartridge exemplifies a medicament container which dispenses its contents upon reduction of its interior vol-

ume, and it also exemplifies a medicament container having a readily pierceable wall which is self-sealing upon withdrawal of the piercing instrumentality and which inhibits leakage around said instrumentality during ejection of the contents.

The cartridge holding barrel 1 is closed at one end by a head 9 and at the other end has an opening 10 for insertion of the cartridge. To close said open end a hinged head 11 is provided having an extension 12 with diametrically opposite arms 13 pivotally connected at 14 to the barrel. The swingable head carries the plunger rod 4, which slides therein and may freely swivel. When head 11 is swung to close the barrel, it brings the plunger into alignment with the axis of the barrel, ready to dispense the medicament; and when it is swung away from the barrel, the open end 10 is exposed for insertion of the cartridge.

To load the syringe, the user swings the barrel head 11 and plunger rod 4 to one side preferably until arrested by contact of the head extension 12 with the barrel, Fig. 2. Because of the necessary movement between the head and the barrel, the end 10 of the latter may be cut away on the side towards which the head swings, as shown in Fig. 2. The plunger rod may be grasped in one hand and employed as a handle; and as the barrel head swivels on the plunger rod, the barrel may be turned by the fingers of the hand which holds the plunger to present the open end of the barrel in the most convenient position for cartridge insertion. To facilitate such turning, the head 11 may be knurled as shown at 15. The head extension 12 fits around the barrel adjacent its open end to serve as a stop when the barrel is closed.

While the plunger when moved into the barrel will prevent opening of the syringe, it has been found desirable to provide separate locking means for this purpose. The lock shown comprises a hollow sleeve 16 slidable in the head 11 and normally projected forwardly by a spring 17 to interlock with the open end of the barrel, as shown in Fig. 3. The plunger rod slides through the hollow locking sleeve 16 and has an enlarged inner end 18 designed to engage the slidable cartridge plug 7 when pushed and to retract the locking sleeve 16 when pulled. Thus the plunger may control the lock carried by the swingable head. In practice, one of the parts, for example the barrel end 10 is cut away on one side, as shown clearly in Fig. 2, so that when the swingable head is moved to close the barrel the end of the lock will encounter the cut-away portion of the barrel which will cam the lock against the resistance of the spring until it automatically snaps into locking position, when the syringe is finally closed.

In the above description and in the appended claims, the syringe is referred to as a hypodermic syringe. It will be readily understood that the syringe disclosed herein may be used without change not only for hypodermic injections, but also for intraosseous and intravenous and other injections and for the application of fluid and semi-fluid medicaments to tissues generally. Hence the word "hypodermic", whenever used, is to be considered as used descriptively and not restrictively.

It will be observed that the structure illustrated exemplifies a hypodermic syringe or injection-administering organization of which the cartridge is an operative component, the said organization comprising said cartridge with a cartridge-piercing canula or needle in assembly with means to hold the needle and cartridge in operative relation and with means for operating the cartridge to discharge the fluid contents through the needle. In this instance the organization is made up of the cartridge and associated means embodied in a jointed cartridge-holding and operating instrument, adapted to be opened to permit introduction of the cartridge and to be closed for operative use, said instrument embodying a lock to secure it in the straight closed operative condition. The lock is provided in the breech head by a sleeve in which the plunger rod works, said sleeve in this instance being spring-actuated to interlock with the cartridge-holder or so-called barrel, so that the locking is automatic when the instrument is straightened. As before explained, the construction permits unlocking by retracting the plunger so as to draw back the spring-pressed locking sleeve 16.

The cartridge-piercing canula 3, in the specific construction illustrated, is provided by the inwardly protruding branch of a double-pointed or twin needle, the outer branch of which provides the injecting needle proper. The canula or inwardly protruding branch of the needle is inserted through an axial bore in the head 9 at the fore end of the instrument. As shown, this head is formed with a screw-threaded tip 9^a having a socketed end in which is seated a ball or enlargement 2^a secured on the needle at an intermediate point. The needle is secured in position by a cap nut 9^b screwed upon the threaded tip and clamping the ball or enlargement in place. Thus the injecting needle is held in rigid relation to the instrument with the inwardly protruding end of the needle in position to pierce the sealing stopper 6 in the fore end of the cartridge. This particular needle end construction is the subject-matter of my co-pending application filed May 17, 1924, Serial No. 713,905.

The cartridge shown and described is of practicable and reliable character as an

aseptic packaging and dispensing container for use as a merchandising package and as a syringe component. It will be understood that a sterile solution of anesthetic or other medicament to be dispensed is confined between the sealing stoppers or closures 6 and 7. The pierceable stopper 6 in the fore end of the cartridge tube is an imperforate plug of resilient material such as soft rubber or a suitable rubber composition, having the flange 8 overlying the end of the glass tube and an inwardly facing axial recess or cavity. The recess of the plug is of such depth and diameter as to provide a substantially thick-walled cup-shaped stopper which will fit tightly within and be self-binding in the smooth glass tube under ordinary conditions. The recess reduces the axial dimension of the plug as compared with its total length, so as to facilitate the piercing of the plug by the needle, which it will be understood is intended to be inserted through the plug at its axial portion. At the same time, the thickness of the outer closed wall of the plug is sufficient to cause the material of the plug to hug closely around and seal the needle or canula. Before insertion in the tube, the said plug 6 has a flat outer face, but when forced into the tube it is subjected to radial compression, manifested by a slight outward bulging of the outer face of the plug, as shown in Figs. 5 and 6, this being due to the radial compression and contraction of the portion of the plug within the glass tube. A maximum compression of the rubber plug then obtains at its central portion adjacent the recess, promoting a tight grip of the rubber plug around the needle or canula, thus minimizing the possibility of leakage around the canula even though the fluid in the cartridge be subjected to considerable pressure during ejection. The plug will also be immediately self-sealing if and when the needle or canula is withdrawn.

It will be observed that the pierceable plug or stopper 6 protrudes beyond the fore end of the glass cartridge tube so as to cushion the cartridge in the instrument, while by virtue of the flange 8 overlying the end of the tube, the said plug is mechanically interlocked therewith so as to prevent inward displacement of the plug by the piercing operation, or in other words to prevent the plug from being pushed inwardly when the needle or canula is thrust through the plug. Said flange 8 also protects the end of the glass tube and functions as a gasket and cushion therefor when the cartridge is used in a syringe instrument. In this instance the flange 8 is shown having an outwardly flaring edge of slightly larger diameter than the diameter of the cartridge tube, so that the said flange will fit snugly within a syringe barrel. A further advan-

tage of the flanged plug is that it is readily distinguishable by touch from the other end of the cartridge tube, so that a practitioner may easily ascertain, even in the dark, which is the discharge end of the cartridge.

The inwardly facing axial recess of the flanged plug provides an inwardly extending annular or substantially tubular wall on which the fluid pressure acts during the fluid-ejecting operation, tending to press said annular wall of the plug against the inner wall of the glass tube so as to promote or tighten the hold of the plug in the tube and promote the maintenance of good sealing conditions during the fluid-ejecting operation. Thus the flange and annular wall of the flanged recessed plug cooperate in that the flange engaging the end of the tube prevents the plug from being pushed too far into the tube, while the annular wall surrounding the recess receive hydrostatic pressure radially outward during the ejecting operation to promote the sealing of the tube to hold the plug against tendency to move out of the tube.

Referring to the rear piston plug 7, this plug may also be of soft rubber or the like and compressed or tightly fitted in the glass tube. It is shown formed with circumferential grooves 7^a, which increases the elasticity and compressibility of said plug and enhances its sealing quality. This plug 7 is well qualified to maintain a seal while sliding through a tube of ordinary commercial glass tubing, the bore of which is slightly variable although it may be considered substantially straight or uniform in the sense that it will permit the plunger plug 7 to slide therethrough.

Besides its manifest advantages for use as a merchandising package and as a syringe component, the cartridge also lends itself to convenient and aseptic practice in manufacture. In making the cartridge, the stoppers are forced in the opposite ends of the glass tube, after first having separately sterilized the several parts, and they are again preferably sterilized after assembly. The cartridge is then filled aseptically by withdrawing air from the cartridge and introducing liquid into the cartridge through sterilized needles inserted through the plug 6. In this process the flanged plug 6 affords the same opportunity for piercing by the needles, without liability or displacement of the plug, as in subsequent use of the cartridge in a syringe, and upon withdrawal of the needles the plug 6 immediately becomes hermetically self-sealed.

It will be understood that the invention is not restricted to the particular embodiment herein shown and described.

What is claimed is:—

1. A hypodermic syringe comprising, in combination, a barrel; a plunger; a remov-

able head closing one end of said barrel; a slidable hollow sleeve in said head through which the plunger slides; and a spring normally projecting the sleeve from the head to interlock with one end of the barrel; said plunger constructed and arranged to move the sleeve out of the barrel when pulled.

2. A hypodermic syringe comprising, in combination, a barrel; a hinged head mounted to close one end of said barrel; a plunger; and a spring-actuated locking member carried by the head and locking it in barrel-closing position; said plunger slidable in said locking member and constructed and arranged to move said member out of engagement with the barrel when pulled.

3. A hypodermic syringe comprising, in combination, a barrel; means hinging the syringe to facilitate access to one end of said barrel; and a spring-actuated lock for the hinged parts, said lock including a hollow sleeve designed to bridge the hinged joint and fit within the barrel.

4. A hypodermic syringe comprising, in combination, a barrel open at one end; a hinged head closing said end; a plunger carried by said head; and a spring-actuated head-locking member also carried by the head; the plunger being movable through said head-locking member.

5. A hypodermic syringe comprising, in combination, a hinged joint in said syringe to facilitate introduction of medicament into the syringe; a plunger for dispensing medicament from the syringe; and a lock for said joint releasable by the plunger and automatically locking when the hinged syringe parts are moved into their dispensing position.

6. A hypodermic syringe comprising, in combination, a barrel; a plunger pivotally mounted upon the barrel; and a lock carried by the plunger mounting and constructed and arranged to lock the plunger and barrel in operative relationship, said lock being plunger-controlled.

7. A hypodermic syringe comprising, in combination, means for hinging parts of the syringe; a barrel having an opening which is exposed for insertion of a medicament package when the syringe is broken at the hinge; and a lock releasably connecting the hinged parts and automatically locking when said parts are moved into their dispensing position.

8. A hypodermic syringe comprising, in combination, a barrel; a plunger; a head closing one end of the barrel; and means controllable by the plunger for locking the head to the barrel.

9. A hypodermic syringe comprising, in combination, a syringe-like structure; a cartridge for holding medicament; a joint in the syringe-like structure permitting it to be opened for refilling with a medicament car-

tridge; and an automatically closing lock for connecting the syringe parts at the joint when the syringe is closed.

10. A hypodermic syringe comprising, in combination, a barrel having relatively swingable parts, one of which is constructed and arranged to provide a carrier for a medicament-dispensing cartridge; and a lock carried by the other part for holding the syringe in operative position; said lock comprising a hollow sleeve shaped at one end to fit in one end of the cartridge carrier, and a spring projecting said sleeve into locking position; and a plunger slidable through said sleeve and having an enlarged end for engagement with one end of the cartridge to dispense its contents, said enlarged plunger end also engageable with the sleeve so that the plunger may withdraw the sleeve from its normal spring-projected position.

11. A hypodermic syringe comprising, in combination, a cartridge holding member; a member swingable relative to said cartridge holding member and carrying the syringe plunger; a spring lock on the plunger carrying member constructed and arranged to engage with an end of the cartridge holding member to secure the parts together; said cartridge holding member cut away at its end so that when the parts are moved toward secured position the spring lock is cammed by said cut-away end to snap into locking position automatically.

12. A hypodermic syringe comprising, in combination, a hollow hinged body; a combined medicament receptacle and dispensing package fitted within the body and having a pierceable end and a slidable plug sealing the opposite end; means at one end of the body for positioning a needle which is designed to penetrate the pierceable end of said package; a plunger at the other end of the body for moving said slidable plug to dispense the medicament through said needle; and resilient locking means to connect the hinged parts of said body together in package-enclosing position.

13. A syringe comprising, in combination, a syringe-like structure having a body, a plunger movable longitudinally of the body, and means for securing a canula on the body; said body being constructed and arranged to hold a tubular medicament-container; said container being constructed and arranged to have its interior volume reduced for expelling the medicament through a canula secured as aforesaid, and having an outlet; a resilient plug of solid, homogeneous material closing the outlet and having a flange of substantial thickness and stiffness to overlies the extremity of said outlet to prevent the plug from entering the container; the inner extremity of the plug, within the container, having a recess therein

facing inwardly of the container thus facilitating piercing by the canula, and also having a wall which is substantially parallel with the inner wall of the outlet, whereby hydrostatic pressure, during expulsion of the medicament, will act radially outwardly upon the recess wall aforesaid and thereby press the outer surface of the plug more firmly against the inner surface of the outlet, thereby more effectually sealing the outlet and more effectually holding the plug against outward movement due to the hydrostatic pressure of the medicament; the plug being of sufficient resiliency and of sufficient thickness in the direction of its axis and being under sufficient compression within the outlet to seal around the opening made by the canula by insertion of the same, so as to prevent air from entering the interior of the container when preparing the syringe for use.

14. A hypodermic syringe comprising, in combination, a medicament cartridge holder; a head pivotally connected to said cartridge holder at one end; and an extension of said head constructed and arranged to act as a stop to prevent relative swinging of the head and cartridge holder in either direction beyond certain predetermined positions, whereby the insertion and removal of a cartridge is facilitated.

15. A syringe comprising, in combination, a syringe-like structure having a body, a plunger movable longitudinally of the body, and means for securing a canula thereon; said body being constructed and arranged to hold a tubular medicament-container thereon and having a head hinged near the end of the body most distant from the canula end thereof and adapted to swing over the end of the body to open the same for insertion of a medicament container and subsequent locking of the container upon the body; means on the syringe to hold the hinged head in container-locking position; said container comprising a cylindrical glass tube having a resilient plug at each end spaced apart nearly the length of the tube so as to hold the medicament sealed against contamination; one of the plugs being substantially cylindrical in form and slidable within the tube to serve as a piston for expelling the medicament; the plug at the opposite or outlet end of the tube having a substantially cylindrical body closing the outlet end of the tube and a substantially thick flange beyond and overlying the end of the tube to serve as a cushion for the outlet end of the tube, thus protecting the glass edges against breakage from a longitudinal thrust of the container against the syringe body; said flanged plug also having at its inner end within the tube an inwardly facing recess whose wall is annular for a portion of its length; the flange and recess cooperating

in that the flange prevents the plug from entering the tube, thereby facilitating filling of the container and making piercing of the plug by a canula an easy and assured operation, while the annular wall of the recess transmits hydrostatic pressure radially outwardly to seal the tube and hold the plug against being forced out of the tube when the piston plug is pushed through the tube; the inner face of the piston plug being plane and constructed so that, when the piston plug has been thrust through the tube until it contacts with the outlet plug, the plane face of the piston plug will then close the mouth of the recess in the outlet plug.

16. A syringe comprising, in combination, a body; a medicament-containing cartridge carried by the body, and having one end sealed by a self-retained homogeneous flanged imperforate plug which may therefore, without inward displacement, be pierced by a canula to establish communication with the interior of the cartridge; and means to hold the cartridge on the syringe body in medicament dispensing position.

17. A syringe comprising, in combination, a body; a medicament-containing cartridge carried by the body, and having one end sealed by a flanged imperforate plug, which may therefore, without inward displacement, be pierced by a canula to establish communication with the interior of the cartridge; a plunger to decrease the interior volume of the cartridge to eject its contents; and a spring pressed locking sleeve controlled by the plunger to hold the cartridge on the syringe body in medicament dispensing position.

18. A syringe comprising, in combination, a body; a medicament-containing cartridge carried by the body, and having one end sealed by a flanged imperforate plug which may therefore, without inward displacement, be pierced by a canula to establish communication with the interior of the cartridge; said plug being of highly resilient material and being recessed axially with the recess facing inwardly of the cartridge, so that the plug is readily pierced axially and is easily inserted in the end of the cartridge without liability of breaking the cartridge, and so that the cartridge is more effectually sealed; the interior wall of the plug surrounding its recess being exposed to hydrostatic pressure in the fluid-ejecting operation.

19. A syringe comprising, in combination, a cartridge-holding body; a cartridge carried thereby comprising a sealed medicament container constructed to have its interior volume reduced and sealed at one end by an imperforate recessed thick-walled plug of resilient material tightly fitted and self-retained in the cartridge tube, said plug having a substantially thick flange overlying

ing the end of the cartridge tube and co-operating therewith to prevent inward displacement of the plug by the piercing with a needle or canula; the said needle or canula
5 mounted in position to pierce said flange plug; and means to operate said cartridge to expel the fluid contents through the needle.

20. A syringe comprising, in combination, a cartridge-holding body; a cartridge carried thereby comprising a sealed medicament containing tube constructed to have its interior volume reduced and sealed at one end by a flanged imperforate plug which may therefore, without inward displacement, be pierced by a canula to establish
15 communication with the interior of the cartridge, said plug embodying a body of resilient material having an inwardly-opening axial recess providing an annular wall exposed to the liquid and on which the hydrostatic pressure acts radially outward during the fluid-ejecting operation; the said canula mounted in position to pierce said flanged
20 plug; and means to operate the cartridge.

21. A syringe embodying a cartridge and cartridge-piercing canula in an injection-administering organization operative to reduce the interior volume of the cartridge to eject its fluid contents through the canula; said
30 cartridge comprising a sealed medicament container constructed to have its interior volume reduced and embodying a tube having a sealing plug of resilient material transfixed upon and forming a resilient seal
35 around the canula; said plug having a substantially thick flange overlying the end of the tube and serving as a gasket and to cushion the tube under the thrust of the medicament-expelling action; said flanged
40 plug also having an inwardly opening axial recess surrounded by an annular wall within the tube, which wall is exposed to the liquid in the tube; its flange and recess co-operating in that the flange prevents the
45 plug from being pushed too far into the tube, while the annular wall of said recess receives hydrostatic pressure radially outward to seal the tube and hold the plug against tendency to move out of the tube in the fluid-ejecting action.
50

22. A syringe comprising, in combination, a syringe-like structure having a body, a double-pointed canula and means for securing it rigidly to the body with a rear point projecting into the body; means for opening and closing that end of the body which is opposite to the canula to permit insertion and removal through said end of a medicament container; a medicament container
55 within the body comprising a sealed tube of glass or the like having a resilient plug at each end and spaced apart to seal a charge of medicament between them, one plug being slidable through the tube and serving
60 as a piston to expel the medicament, the

other plug being transfixed upon and forming a resilient seal around the rear part of the canula, and having a substantially thick flange interposed between the end of the tube and the canula-end of the body to
70 cushion the tube under the medicament-expelling thrust of the piston plug; said flanged plug also having at its inner end within the tube an inwardly facing recess surrounded by an annular wall; the flange and
75 recess cooperating in that the flange prevents the plug from being pushed too far into the tube, while the annular wall of said recess receives hydrostatic pressure radially outwardly to seal the tube and hold the plug
80 against a tendency to move out of the tube under the medicament-expelling thrust of the piston plug; and means for forcing the piston plug along the tube.

23. A syringe comprising, in combination, 85 a cartridge-holder; a cartridge therein; a needle secured in position to pierce the hereinafter mentioned plug of said cartridge; said cartridge comprising a sealed tube of glass or the like having a displaceable piston plug and a sealing plug of resilient material to be pierced by and form a resilient seal around the needle; said sealing plug having a substantially thick flange interposed between the end of the tube and the
90 fore end of the cartridge-holder to cushion the tube under the medicament-expelling thrust of the piston plug; said flanged plug also having at its end within the tube an inwardly opening axial recess surrounded
100 by an annular wall; the flange and recess cooperating in that the flange prevents the plug from moving too far into the tube while the annular wall of said recess receives hydrostatic pressure radially outwardly to
105 seal the tube and hold the plug against a tendency to move out of the tube under the medicament-expelling thrust of the piston plug; and means for forcing the piston plug axially in the tube.
110

24. A syringe comprising, in combination, 115 a sealed medicament container; a holder therefor; a double-pointed needle secured in position to pierce the hereinafter mentioned sealing plug in the fore end of said
120 container; means for opening and closing the rear end of the holder to permit insertion of the medicament container and movement thereof to transfix said sealing plug upon the rear end of the needle, and to permit removal of said container after use; said medicament container embodying a tube of glass or the like having a rear displaceable piston plug and the said sealing plug in its fore
125 end; said sealing plug having a substantially thick flange interposed between the end of the tube and the fore-end of the holder to cushion the tube under the medicament-expelling thrust of the piston plug; said flanged plug also having an inwardly
130

opening axial recess surrounded by an annular wall exposed to the liquid; the flange and recess cooperating in that the flange prevents the plug from moving too far into the tube while the annular wall of said recess receives hydrostatic pressure radially outwardly to seal the tube and hold the plug against a tendency to move out of the tube under the medicament-expelling thrust of the piston plug; and means for forcing the piston plug axially in the tube.

25. In a cartridge syringe, a jointed cartridge-holding and operating instrument, adapted to be opened to permit introduction of a cartridge and to be closed for operative use, and embodying a cartridge-operating plunger and means controlled by the plunger to lock the instrument in closed condition.

26. In a cartridge syringe, a jointed cartridge-holding and operating instrument, adapted to be opened to permit introduction of a cartridge and to be closed for operative use, and embodying a cartridge-operating plunger and means to lock the instrument in closed condition adapted to be released by the plunger.

27. In a cartridge syringe, a jointed cartridge-holding and operating instrument embodying a plunger, said instrument adapted to be opened to permit introducing the cartridge and to be closed for operative use and embodying means for automatically locking the instrument closed.

28. In a cartridge syringe, a jointed cartridge-holding and operating instrument embodying a plunger, said instrument adapted to be broken by disalignment to permit introducing a cartridge, and to be straightened for operative use, and embodying means to lock the instrument in operative condition.

29. In a cartridge syringe, a jointed cartridge-holding and operating instrument embodying a plunger and a sleeve in which the plunger is slidable, to lock the instrument in operative condition, said sleeve movable to position to release the instrument to permit opening for introduction of a cartridge.

30. In a cartridge syringe, a jointed cartridge-holding and operating instrument comprising hinged tubular parts, one of which carries a plunger, and embodying a movable locking sleeve carried by one of said parts and cooperable with the other to hold the instrument parts in alinement for operative use.

31. In a cartridge syringe, a breech-loading cartridge-holding and operating instrument embodying a plunger mounted in its breech portion, and embodying in its fore portion a head affording an abutment for the fore end of the cartridge and having an opening to accommodate a cartridge-piercing canula, the said instrument jointed to

permit lateral displacement of the plunger out of alinement with the normal axis of the instrument, with accompanying opening of the breech end.

32. In a cartridge syringe, a jointed cartridge-holding and operating instrument adapted to be opened by disaligning the front and rear parts thereof to permit introduction of a cartridge and to be closed for operative use by straightening the instrument, said instrument having its fore end constructed to receive a cartridge-piercing canula and having a plunger in its breech portion.

33. A hypodermic syringe adapted to receive and to discharge a sterile medicine package comprising end members adapted to be passed over the ends of such package, a tying device pivoted to one of said members and adapted to embrace the medicine package and tie the other of said end members to the first member, a hypodermic needle carried by one of said end members adapted to make communication with the interior of the package when so assembled, and an injector associated with the other end member, the package having a plunger adapted to be displaced by said ejector for expelling the contents of the package.

34. A medicament-dispensing package comprising a body having an opening; and a resilient rubber plug inserted in and closing said opening; said plug having a cavity of substantial length to provide a zone wherein it is readily compressible radially of the plug to facilitate insertion of the plug and an adjoining zone which is also compressible radially but less easily; the second-named zone extending between one end of the plug and the first-named zone; and means integral with the plug to engage the end of the package to determine the extent to which said plug may enter the package.

35. A sealed package for hypodermic medicaments comprising, in combination, a cylindrical glass tube; a slidable imperforate rubber plug sealing one end of the tube; and a second imperforate plug closing the opposite end of the tube; said second plug comprising a cylindrical section which has an axial cavity extending for a substantial portion of the length thereof; whereby a substantial section of the plug is made more flexible for secure sealing and to facilitate insertion of the plug; said cavity also facilitating piercing of the plug longitudinally by a canula or the like; and said plug also having an integral annular flange at the outer end thereof, said flange overlapping the end of the glass tube to prevent movement of the plug through the tube; the plug at its flanged end having a smooth and unbroken outer face, whereby the plug does not gather contaminating matter.

36. A dispensing cartridge for medication constructed and arranged to have its interior volume reduced for expelling the medicament, and having a tubular outlet end; a plug closing the tubular outlet end and having a flange of substantial thickness and stiffness to overlie the extremity of said tubular outlet to prevent the plug from being pushed into the container and to present an exterior cushion of substantial thickness at the end of said tubular outlet; the inner extremity of the plug, within the container, having a recess therein having a wall substantially parallel with the inner wall of the tubular outlet whereby hydrostatic pressure, during expulsion of the medicament, will act radially outward upon said wall of said recess and thereby press the outer surface of the plug against the inner surface of the tubular outlet, tending to seal the outlet and to hold the plug against being forced out of position by the hydrostatic pressure during expulsion of the medicament.

37. A medicament cartridge comprising, in combination, a cylindrical glass tube having a plug at each end spaced apart to receive between the plugs and within the tube a predetermined volume of medicament; the plug at one end of the tube being slidably mounted therein to serve as a piston for expelling the medicament, said piston plug having a circumferential groove to enhance its resiliency and serve as a circumferential chamber; the plug at the opposite or outlet end of the tube having a cylindrical body closing the outlet end of the tube and a substantially thick flange beyond and overlying the end of the tube to protect the same and to serve as a cushion for the outlet end of the tube when it experiences the thrust from the piston plug as it is pushed through the tube, said plug at the outlet end of the tube having also, at its inner end within the tube, a tubular recess having its wall substantially parallel with the inner wall of the glass tube,—the flange and the annular wall of the recessed plug cooperating in that the flange holds the plug against being pushed into the tube while the annular wall transmits hydrostatic pressure radially outward to seal the outlet of the tube and hold the plug against being thrust out of the tube under hydrostatic pressure when the piston plug is thrust through the tube and at the same time the flange cushions and protects the outlet end of the tube; the inner face of the piston plug being plane and constructed so that, when the piston plug has been thrust through the tube until it contacts with the outlet plug, the plane face of the piston plug will then close the mouth of the recess in the outlet plug.

38. A cartridge for use in hypodermic syringes embodying a rigid tubular portion adapted to contain liquid and stoppers in

opposite ends of said cartridge; one of the stoppers comprising an imperforate plug of resilient material adapted to be pierced by a needle and recessed axially with the recess facing inwardly of the cartridge and open to the liquid, said stopper having an integral flange extending over the corresponding end of the rigid tubular portion and adapted to cooperate therewith as a gasket and to protect the end of the cartridge against breakage.

39. A syringe cartridge comprising a tube adapted to contain liquid and stoppers in its opposite ends, including a thick-walled cup-shaped imperforate plug of resilient material tightly fitted in and self-retained in the tube and having a flange overlying the end of the tube, said flange being of sufficient thickness to serve as a cushion for the end of the tube and sufficiently stiff to prevent pushing in the plug by the piercing operation; said flanged plug adapted to be pierced by a needle and the opposite plug adapted to be forced inward to eject the contained liquid through the needle.

40. A syringe cartridge comprising a tube adapted to contain liquid and stoppers in its opposite ends, one adapted to be pierced by a needle and the other to be forced inward to eject the liquid through such needle; said pierceable stopper comprising an imperforate plug of resilient material mechanically interlocked with the tube to prevent inward displacement by the piercing operation and having an inwardly opening axial recess providing a surrounding wall exposed to the liquid and on which the hydrostatic pressure acts radially outward in the fluid-ejecting operation so as to press said wall more tightly against the interior of the tube and promote the maintenance of a good seal.

41. A syringe cartridge comprising a sealed medicament container constructed to have its interior volume reduced and embodying a tube having a sealing plug of resilient material adapted to be pierced by a canula and to seal around the same; said plug having a substantially thick flange overlying the end of the tube to protect and cushion the tube, and having an inwardly opening axial recess surrounded by an annular wall within the tube, which wall is exposed to the liquid in the tube; the flange and recess cooperating in that the flange prevents the plug from being pushed too far into the tube, while the annular wall of said recess receives hydrostatic pressure radially outward to seal the tube and hold the plug against tendency to move out of the tube in the fluid-ejecting operation.

42. A medicament package for use as a cartridge in a cartridge syringe, comprising a rigid tube of substantially uniform bore having end sealing closures, including a pierceable closure, and embodying a piston

by which the fluid contents may be forcibly expelled through a canula or needle thrust through the pierceable closure; said pierceable closure comprising a flanged cup-shaped imperforate stopper of resilient material, the flange of which overlies the end of said tube and is adapted to cooperate therewith as a gasket, as well as to prevent pushing in the stopper by the piercing operation, while the cavity of the stopper opens inwardly and presents a substantially tubular wall adapted to receive hydrostatic pressure radially outward to tighten the hold of the stopper in the tube during the medicament-exPELLING thrust of the piston plug.

In testimony whereof, I have signed my name to this specification.

JOHN MacGREGOR.