Oct. 15, 1957 M. L. LOCKHART 2,809,635

HYPODERMIC SYRINGES

Filed Feb. 9, 1954 2 Sheets-Sheet 1

Fig. 1.

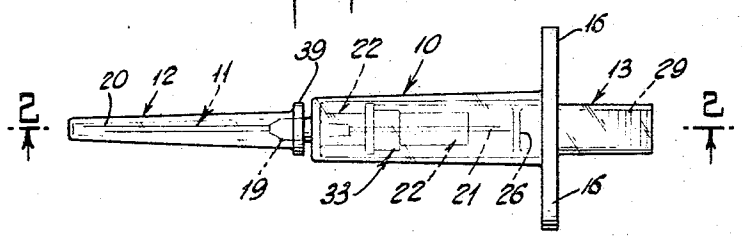


Fig. 2.

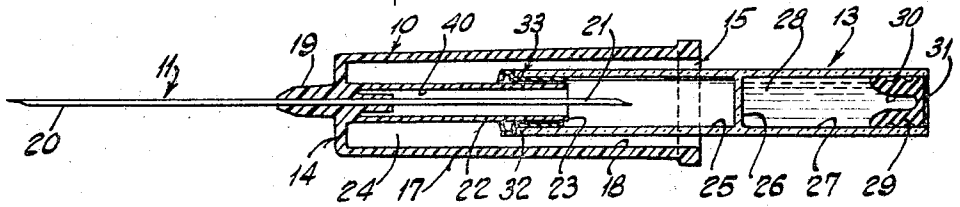


Fig. 3.

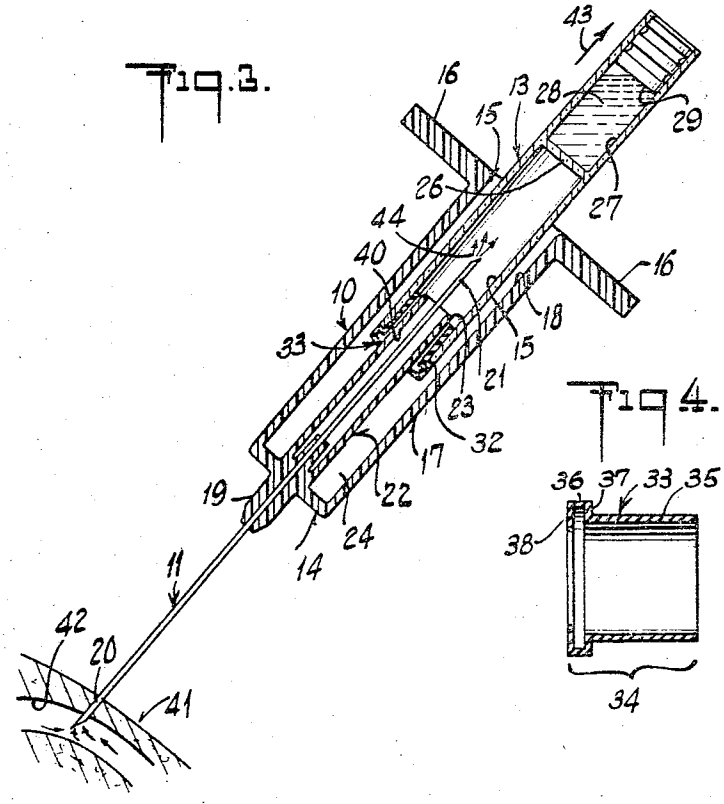
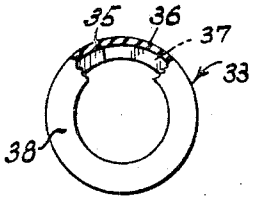


Fig. 4.

Fig. 5.



Oct. 15, 1957 M. L. LOCKHART 2,809,635

HYPODERMIC SYRINGES

Filed Feb. 9, 1954 2 Sheets-Sheet 2

Fig. 6.

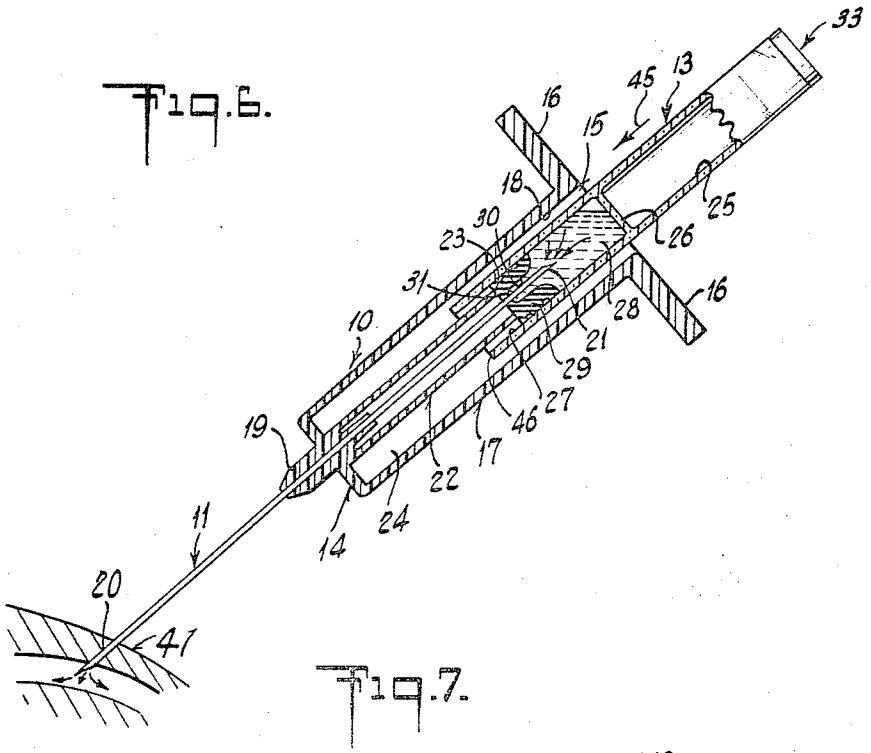


Fig. 7.

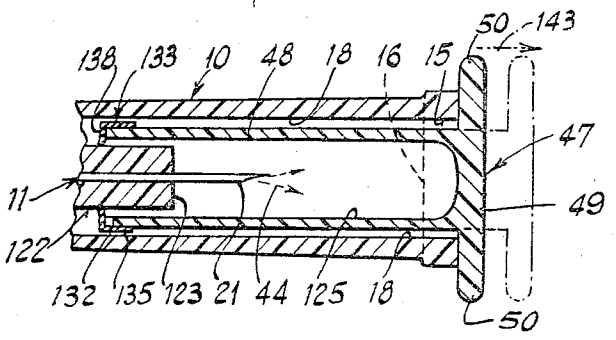
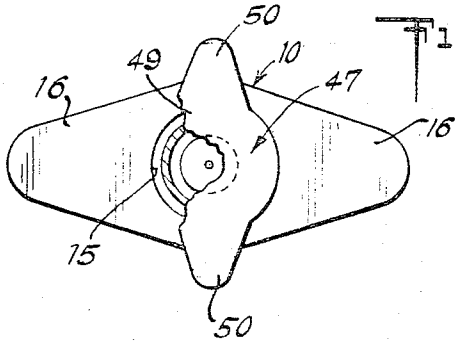


Fig. 8.



United States Patent Office 2,809,635 Patented Oct. 15, 1957

2,809,635

HYPODERMIC SYRINGES

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Application February 9, 1954, Serial No. 409,052

6 Claims. (Cl. 128—218)

The present invention relates to hypodermic syringes of the type illustrated in my prior U. S. Patent No. 2,556,331 of June 12, 1951, and, more particularly, to a type having an ampule-receptive barrel fitted with a thrust post through which an injecting cannula extends for piercing through a piston plug in one end of a loaded ampule to permit expulsion of the contents of the latter through the cannula when the ampule is telescoped into the barrel with inward thrust of the piston plug by the post.

A general object of the present invention is to provide such a hypodermic syringe which effectively maintains the inner plug-piercing end of the cannula sealed off to assure sterile condition thereof while efficiently permitting application of suction on the cannula for a show of fluid, such as blood, at its inner end without likelihood of accompanying parenteral injection by undesirable and dangerous injection of quantities of air.

A more specific object of the invention is to provide such a hypodermic syringe in which a thrust post is traversed longitudinally by an injecting cannula having an inner piston plug-piercing end extending beyond the free rear end of the post and protective cover means for the plug-piercing end of the cannula slidably sealed to the post for piston action effectively to create suction upon the cannula upon cover retraction.

Another object of the present invention is to provide such cover means in the form of an unloaded compartment of a double-ended loaded ampule whereby the unloaded portion of the ampule effectively serves to protect a sterile condition of the plug-piercing end of the cannula during distribution and handling while efficiently providing immediately manipulatable means to obtain a show of blood upon communication of the cannula with a blood vessel, injection of the loaded medicament contents of the ampule then being simply possible by reversal of the ampule without danger of injecting air with the medicament.

A further object of the invention is to provide structural embodiments of the syringe device which may be readily constructed and permit efficient and safe use and operation thereof.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a side elevational view of an embodiment of the hypodermic syringe of the present invention showing the relationship of the parts of the assembly as distributed;

Fig. 2 is an enlarged axial section of the embodiment shown in Fig. 1, illustrating a possible initial preparatory step prior to insertion of the outer injecting end of the needle after the protective cap for the latter has been removed;

Fig. 3 is an axial section of the embodiment shown in Figs. 1 and 2, illustrating use of the assembly as conditioned in Fig. 2 for obtaining a show of blood prior to injective use;

Fig. 4 is an enlarged axial section of gasket means employed in the embodiment of Figs. 1, 2 and 3 to permit the obtainment of a showing of blood, as illustrated in Fig. 3;

Fig. 5 is an end elevation, with parts broken away and in section, of the gasket means shown in Fig. 4;

Fig. 6 is a view similar to Fig. 3 but illustrating injection of parenteral liquid medicament with the use of the device after it had been used for obtaining a show of blood in the manner proposed in Fig. 3;

Fig. 7 is an enlarged axial section, with parts broken away, illustrating a modified form of the invention; and

Fig. 8 is an end elevational view, with parts broken away and in section, of the structure shown in Fig. 7.

Prior to the present invention, it has been proposed to provide a double-ended ampule for a hypodermic syringe of the type illustrated in my above-identified Patent 2,556,331 so equipped with gasketing means as to permit aspiration for a show of blood for determining whether or not the injecting end of the needle is communicated with a blood vessel after thrust into a patient's flesh. Such gasketing means converted the loaded end of an ampule into a piston relative to the casing barrel thereby entrapping air in the latter which would be injected into the patient preceding injection of the parenteral liquid medicament. Such injection of air is undesirable and can be dangerous. This and other problems attendant upon use of prior art devices are effectively eliminated by the present invention.

Referring to the drawings, in which like numerals identify similar parts throughout, it will be seen from Figs. 1 to 6 incl. that an embodiment of the present invention comprises a tubular casing barrel **10**, a cannula which may be in the form of a double-ended needle **11**, a cover **12** for the injecting end of the needle structure, and a loaded double-ended ampule **13**. The casing barrel **10** preferably is molded from relatively rigid material, such as glass or suitable plastic, e. g. polystyrene, or the like. The tubular casing barrel **10** preferably is in the form of an elongated cylindrical tube having a closed front end provided by a cross head structure **14** and an open back end **15**, with the latter preferably carrying diametrically-located, laterally-extending, finger-engaging wings **16**, **16** which may be molded integral with the barrel. The barrel **10** includes a substantially cylindrical sidewall **17** preferably of uniform and certain internal diameter which, together with the cross head **14**, defines an open-ended chamber **18**. The cross head **14** coaxially carries a hub **19**, preferably in the form of an elongated cylindrical element molded integral with the barrel structure, through which the cannula or double-ended needle **11** is received and in which the latter is fixed in fluid-tight manner. That portion of the needle **11** which extends outwardly from the hub **19** constitutes an outer injecting end **20** and its other end, which projects into the chamber **18**, constitutes a plug-piercing inner end **21**. The cannula **11** may be a double-ended needle structure, either unitary in form with a through bore or two elements comprising the inner and outer hollow ends suitably connected and communicated together.

Cross head **14** also carries, preferably coaxially thereof and molded integral with the barrel **10**, an elongated thrust post **22** which may be in the form of a tubular member having a free outer end **23** extending toward the open back end **15** of the barrel **10** but appreciably short

thereof, as is best seen in Fig. 2, for engagement of a piston plug in an ampule or loaded cartridge when the latter is inserted in the back end of the barrel. The thrust post **22** also is preferably cylindrical and of certain external diameter so as to be laterally spaced from the barrel side wall **17** to define therewith an intervening circumambient tube-receiving space **24** which is annular when the defining elements are cylindrical. As shown in Figure 2, the inner end **21** of the needle **11** is concentric with and traverses longitudinally or axially the post **22** so that a tip portion of appreciable length extends beyond the free end **23** of the thrust post but short of the open end **15** of barrel **10**, for a purpose to be explained later.

In accordance with the present invention, capping means are provided for protectively covering the inner end **21** of the needle **11** and maintaining a sterile condition thereof. In the embodiment illustrated in Figs. 1 to 6 incl., such capping means may be in the form of a tubular empty or unloaded end compartment **25** of the double-ended ampule **13**. The double-ended ampule **13** may comprise a substantially cylindrical tube of certain internal and external diameters and having a mid-partition **26** sub-dividing its interior into two end compartments. This provides in addition to the empty compartment **25** another compartment **27** which is loaded with a quantity **28** of parenteral liquid medicament confined therein by an end-closing piston plug **29**, preferably of elastic material, such as a rubber-like composition.

As is usual, the piston plug **29** is of an external diameter, when free, somewhat larger than the internal diameter of the cylindrical ampule **13** or its compartment **27** so as to be compressed when inserted in the end of the latter so as to assure its secure frictional retainment while being slidable hterein. The piston plug **29** also, as is usual, may be provided with a recess **30** extending axially from its inner end toward its outer end to define a relatively thin closing diaphragm or end wall **31**, which is readily pierceable by the inner end **21** of the double-ended needle **11** for commuication of the bore of the latter with the loaded compartment **27**.

The internal diameter of the empty compartment **25** is larger than the external diameter of the thrust post **22** so that the latter may be telescoped readily into the former, and the outer end **32** of the tubular ampule **13**, which defines an open end for compartment **25**, is of an external diameter appreciably less than the internal diameter of chamber **18** so as to be readily telescoped into the annular space **24**, as will be understood from Figs. 2 et seq. The open end **32** of the ampule **13** is, in accordance with the present invention, equipped with gasket means which intervene it and the thrust post **22** so that the latter may have piston action relative to the empty or unloaded compartment **25** to perform a liquid-sucking action for a showing of blood, as explained hereinafter.

As is best seen from Figs. 2, 3, 4 and 5, the gasket means may comprise a collar **33**, preferably formed of elastic material, such as a rubber-like composition, an elastic plastic, e. g., polyethylene, and the like. In the preferred form, the elastic collar **33** has a stepped cylindrical skirt **34**, consisting of a major reduced inner end section **35** and a minor enlarged outer end section **36** to form therebetween an annular shoulder **37** substantially arranged in a transverse plane. The reduced inner end section **35** preferably is of an outer diameter slightly larger than the internal diameter of the unloaded ampule compartment **25** so as to be compressed to snug frictional fit therein and with the outer end edge of the open end **32** of the ampule **13** abutted against the annular shoulder **37**, as will be understood from Figs. 2 and 3. Preferably, though not necessarily, the outer diameter of the minor outer end section **36** of the collar **33** is substantially equal to the outer diameter of the ampule tube **13** so as to assure no gasketing between the latter and the sidewall **17** of the barrel **10**. This avoidance of such a gasketing to the barrel sidewall is an important feature

of the present invention in avoiding possibility of injecting air into a patient. The enlarged outer end section **36** of the elastic collar **33** is provided with a laterally-extending, internal, annular, flexible flange **38**, as is best seen in Figs. 4 and 5, to provide an elastic circular lip having an internal diameter somewhat less than the external diameter of the thrust post **22**, so as to have fluid-tight contact with the latter when slidably fitted thereover to assure piston action of the thrust post relative to the unloaded compartment **25**.

It will thus be seen that the lateral dimensions of the barrel chamber **18**, the piston post **22**, the ampule compartments **25** and **27**, the piston plug **29**, and the gasketing collar **33** all bear certain definite relations to each other. Both ends of the ampule **13** must be readily receivable in the space **24** between the barrel wall **17** and the thrust post **22** and the latter must be readily receivable within the compartments **25** and **27** for telescopic action. Also, the collar **33** carried by the unloaded end of the ampule **13** must be readily receivable in the chamber **18** without gasketing to the inner wall thereof and must be securely held in the open end of the ampule compartment **27** and have fluid-tight sliding contact with the external surface of the thrust post **22** for gasketing the empty end of the ampule to the thrust post for piston action. This is true whether or not these elements are cylindrical so as to be circular in cross-section or of other desired cross-sectional shapes, such as oval, etc., as will appear more fully hereinafter in connection with the description of the operation of the device.

In order to use the embodiment illustrated in Figs. 1 to 6 incl., one who is to administer an injection of the parenteral liquid medicament **28** with which compartment **27** of the double-ended ampule is loaded, will select one of the assemblies, such as that illustrated at Fig. 1. He is assured that both ends of the double-ended needle have been retained in sterile condition since the elongated cap **12** has protectively covered the needle injecting end **20**, and the ampule compartment **25**, together with the gasket collar **33**, has protectively housed the needle inner end **21**. The elongated cap **12** has its open end **39** frictionally fitted on the elongated hub **19** of the barrel head **14** to provide this protection for the needle injecting end **20**; the bore **40** of the thrust post **22** and the ampule compartment **25**, together with the gasketing provided by collar **33** between the post and unloaded end of the ampule, form a sterile-protective compartment housing the plug-piercing end **21** of the needle. The operator removes the cover **12** from the injecting end **20** of the needle and, in the event that he wishes to create a relatively small amount of suction on the needle bore so as to minimize the amount of blood that will be drawn through the needle in testing to determine if the needle is communicated with a blood vein, retracts the ampule **13** to, for example, the position illustrated in Fig. 2. The device is thus conditioned for use.

The operator then thrusts the injecting end **20** of the needle into the patient's flesh, such as is diagrammatically illustrated at **41** in Fig. 3, and determines if its bore is in communication with a vein, as is illustrated at **42**, by further retracting the ampule **13** in the direction of the arrow **43** in Fig. 3. This will enlarge the sterile-protective compartment housing the plug-piercing end **21** of the needle, comprising post bore **40** and unloaded compartment **25**, to give to the thrust post a blood-sucking piston action so that blood may appear at the tip of the needle inner end **21**, such as is illustrated at **44** in Fig. 3. If the parenteral liquid medicament **28** is intended for intravenous injection, the operator then proceeds with the following manipulations for injection thereof, but should it be intended for intramuscular or subcutaneous injection, he will withdraw the needle injecting end **20** and relocate it with further testing for a show of blood in the indicated manner until he is satis-

fied that the needle bore is not communicated with a vein.

After so locating the needle injecting end **20** in the patient's flesh to his satisfaction, the operator then withdraws the ampule **13** from the barrel **10**, reverses it, and inserts the loaded end of the ampule into the barrel chamber **18** through the open end **15** to move the piston plug **29** toward the plug-piercing inner end **21** of the needle, as will be understood from Fig. 6. With telescope of the reversed ampule **13** in the direction of the arrow **45** indicated in Fig. 6, the needle inner end **21** pierces through the relatively thin end wall or diaphragm **31** of the piston plug **29** to bring the needle bore to communication with the interior of the loaded compartment **27** or the body **28** of liquid medicament therein.

With further forward thrust or telescope of the reversed ampule **13** into the barrel chamber **18**, the outer end of the piston plug **29** will be engaged against the free end **23** of the thrust post to cause the plug to be slid back into the compartment **27** for reducing its capacity and causing expulsion of the liquid medicament through the needle bore with free reception of the end **46** of the ampule in the annular space **24** between the barrel sidewall **17** and the thrust post **22**. During such action, the other end of the ampule, in which the unloaded compartment **25** is located and which carries the gasketing collar **33**, of course, serves as the thrust-applying means to telescope the loaded compartment into the barrel chamber.

It will thus be seen that the unloaded compartment of the ampule serves as a capping means which, by virtue of being gasketed to the thrust post **22**, protectively houses the plug-piercing inner end **21** of the needle **11** so as to maintain a sterile condition thereof during distribution and handling. A like function is performed for the outer injecting end **20** of the needle **11** by the protective cap **12**. Upon removal of the protective cap **12** and adjustment of the telescopic position of the ampule **13** in the barrel chamber **18**, as proposed in Fig. 2, the operator is then assured of effective means for applying blood-sucking piston action of the thrust post **22** to the unloaded compartment **25** of the ampule so as to test for a show of blood after the needle injecting end **20** has been thrust into a patient's flesh. Therefollowing, the charge of parenteral liquid medicament in the loaded compartment **27** of the ampule **13** may be hypodermically injected without any danger of injecting any air therewith, since no air is entrapped in the device to be injected ahead of or along with the liquid medicament.

As illustrated in Fig. 7, the capping means which cooperates with the thrust post and the intervening gasket means to form the sterile-protective compartment for the plug-piercing inner end of the needle may, if desired, be in the form of a separate telescopic cover **47** in substitution for the unloaded compartment end of the double-ended ampule **13** of the Figs. 1 to 6 incl. embodiment. As indicated in Figs. 7 and 8, the protective telescopic cover **47** may be in the form of a cylindrical tube **48** closed off at the back end by a wall **49** to form a housing compartment **125**. The open end **132** of the telescopic cover **47** may be gasketed by any suitable means to thrust post **122** which, if desired, may be solid rather than hollow, as in the first embodiment. The means gasketing the leading end **132** of the cover **47** to the exterior of the thrust post **122** may be in the form of an elastic collar **133** which has a substantially cylindrical skirt **135** frictionally fitted over the exterior surface of the tubular portion **48** of the cover **47**. For this purpose, the internal diameter of the collar skirt **135** may, when free, be slightly less than the exterior diameter of the tubular section **48** of the cover **47**, thus requiring stretching of the skirt for reception therein of the leading end **132** of the cover to assure secure mounting of the gasketing collar to the cover. The gasketing collar **133** also has a laterally-extending, internal, annular, flexible flange **138**, similar to that of the collar **33** illustrated at **38** in Figs. 4 and 5, so that it has a fluid-sealing sliding fit with the external cylindrical surface of the thrust post **122**.

Preferably, the protective cover **47** is provided with diametrically-opposed, laterally-extending, finger-engaging projections or ears **50**, **50** so that it may be readily engaged manually for retraction of the cover, as indicated in Figs. 7 and 8. After thrust of the injecting end of the needle **11** into a patient's flesh in the manner proposed in Fig. 3, the operator then tests for a show of blood at **44**, as illustrated in Fig. 7, by retracting the cover **47** in the direction of the dot-dash arrow **143** to move it to the dot-dash position there illustrated, so as to increase the capacity of the sterile-protective compartment **125** and create suction by retractive piston action of the piston post **122** in the manner previously described in connection with the Figs. 1 to 6 incl. embodiment. The ears **50**, **50** facilitate finger engagement of the cover **47** for such retractive movement thereof. When the injecting end of the needle **11** has been inserted in the patient's flesh to the satisfaction of the operator as dictated by the testing for a show of blood at the inner end of the needle, such as at **44**, the operator then completely withdraws the protective cover **47** and inserts in the barrel chamber **18** a loaded ampule closed at one end by a piston plug similar to that illustrated at **29** in the first embodiment, and injects the charge of liquid medicament in a manner similar to that described above.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A hypodermic syringe comprising, in combination, a tubular casing barrel having a closed end and an open end, an elongated thrust post of certain outside lateral dimension having one end fixedly mounted in said barrel to said closed end of the latter, said post having its other end free and extending toward the open end of said barrel with said post being spaced laterally-inward from said barrel to provide a circumambient tube-receiving space, an injecting cannula mounted longitudinally through said post and barrel closed end with an inner end thereof extending beyond the free end of said post and constituting an ampule piston plug-piercing end, an elongated tubular protective capping means having only one open end with the latter telescoped into the tube-receiving space to house said connula inner end and with said capping means accessible at the open end of said barrel for manual engagement, and gasket means carried by said capping means and intervening the latter and said post, said gasket means having a flexible flange arranged about and extending laterally-inward to substantially edge contact of said post with slidable mount on the latter effectively to seal the capping means to said post for maintenance of sterile condition of the cannula inner end while permitting manual retraction of said capping means to create suction on said cannula for a show of fluid at its inner end.

2. A hypodermic syringe comprising, in combination, a cylindrical casing barrel of certain inner diameter and having a closed end and an open end, an elongated cylindrical thrust post of certain outside lateral dimension coaxially arranged in said barrel and having one end fixedly mounted to said closed end of the latter, said post having

its other end free and extending toward the open end of said barrel with said post being spaced laterally-inward from said barrel to provide an anular tube-receiving space, an injecting cannula mounted longitudinally through said post and barrel closed end with an inner end thereof extending beyond the free end of said post and constituting an ampule piston plug-piercing end, an elongated cylindrical protective capping tube having a closed end and an open end with the latter telescoped into the tube-receiving space to house said cannula inner end and with its closed end accessible at the open end of said barrel for manual engagement, and a gasket collar having a stepped cylindrical skirt providing a reduced section having a snug frictional fit in the open end of said cylindrical capping tube with an annular shoulder provided by the stepping seating against the open end edge of the capping tube, the remaining section of said skirt being of an outer diameter less than the inner diameter of said barrel and having a circular flexible flange extending laterally-inward to snug sliding contact of said post, said circular flexible flange being of less internal diameter than the outer diameter of said post so as to flex when slidably fitted over the latter to assure fluid-sucking piston action of said post in said capping tube.

3. The hypodermic syringe structure as defined in claim 2 characterized by said capping tube being one end of a double-ended ampule sub-divided into a capping compartment and a medicament storage compartment with the latter loaded and closed off at its outer end by a slidable piston plug of cannula-pierceable material, said post being of an outer diameter less than the internal diameter of the storage compartment to permit said piston plug to be thrust inward in the latter by said post when the loaded end of said ampule is telescoped into said barrel.

4. A hypodermic syringe comprising, in combination, an elongated casing barrel having a closed end and an open end with the intervening sidewall being tubular of certain internal lateral dimension, an elongated tubular thrust post of certain outside lateral dimension appreciably less than the internal lateral dimension of said barrel and fixedly mounted inside the latter to the closed end thereof in lateral spaced relation to the barrel sidewall to provide a circumambient tube-receiving space, the interior of said tubular post being sealed off at one end by said barrel closed end with its other end open, a double-ended hollow needle structure mounted through said barrel closed end in a fluid-tight manner with one end projecting from said barrel as an injecting end and the other end projecting up through said tubular post and beyond the open end of the latter to serve as a piston plug-piercing end, an elongated double-ended tubular ampule of an internal lateral dimension greater than the outer lateral dimension of said post and of an outer lateral dimension less than the internal lateral dimension of said barrel to be slidably telescoped into the circumambient space, said ampule having a mid-partition dividing it into two compartments with one being unloaded and the other being loaded with parenteral medicament and closed off at its outer end by a needle-pierceable piston plug to be pierced by said needle inner end and thrust by said post into the loaded compartment for expulsion through the needle structure of the contents of the loaded compartment, the unloaded end of said ampule being telescoped into said tube-receiving space with the unloaded compartment housing the plug-piercing end of said needle structure, and gasket means carried by said unloaded end of said ampule and intervening the latter and the exterior of said post, said gasket means having a flexible flange arranged about and extending laterally-inward to substantially edge contact of the exterior of said post and slidably engaging the latter to seal off the plug-piercing end of the needle structure in a sterile-protective compartment defined by the interiors of said post and unloaded ampule end and to allow obtainment of a show of blood at the plug-piercing end of the needle with enlargement of the protective compartment on retraction of said ampule.

5. The hypodermic syringe structure as defined in claim 4 characterized by the provision of said barrel, post and ampule as cylindrical elements with said gasket means being in the form of a collar of elastic material.

6. A hypodermic syringe comprising, in combination, an elongated cylindrical casing barrel having a closing cross head at one end and an open end with the intervening tubular sidewall being of certain internal diameter; an elongated, cylindrical, hollow thrust post of certain outside diameter appreciably less than the internal diameter of said barrel and fixedly mounted inside the latter to the cross head thereof in lateral spaced relation to the barrel sidewall to provide an intervening annular tube-receiving space, the interior of said hollow post being sealed off at one end by said cross head with its other end open; a double-ended hollow needle having a through bore and mounted through said cross head in a fluid-tight manner with an outer end projecting from said cross head as an injecting end and an inner end projecting up through said hollow post and beyond the open end of the latter to serve as a piston plug-piercing end; an elongated, double-ended, substantially cylindrical ampule of an internal diameter greater than the outer diameter of said post and of an outer diameter less than the internal diameter of said barrel to be slidably telescoped into the annular space, said ampule having a mid-partition dividing it into two compartments with one being unloaded and the outer end of the latter being open, the other compartment being loaded with parenteral medicament and closed off at its outer end by a needle-pierceable, cylindrical piston plug to be pierced by said needle inner end and thrust by said post into the loaded compartment for expulsion through the needle of the contents of the loaded compartment, the unloaded end of said ampule being telescoped into said tube-receiving space with the unloaded compartment housing the inner end of said needle; and an elastic collar having a stepped cylindrical skirt to provide a reduced inner end section having a snug frictional fit in the open end of said cylindrical ampule with an annular shoulder provided by the stepping seating against the open end edge of said ampule, the remaining outer end section of said skirt being of an outer diameter appreciably less than the internal diameter of said barrel sidewall; and a laterally-extending, internal, annular flexible flange of an internal diameter less than the external diameter of said post slidably fitted over said post to seal off the unloaded ampule compartment and to give blood-sucking piston action of said post in said unloaded compartment.

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