Nov. 29, 1955 M. L. LOCKHART 2,725,057

ASPIRATING HYPODERMIC SYRINGE STRUCTURES OF THE PISTON TYPE FEATURING MEANS FACILITATING BLOOD SHOWINGS

Filed Nov. 23, 1951 2 Sheets-Sheet 1

Fig. 1.

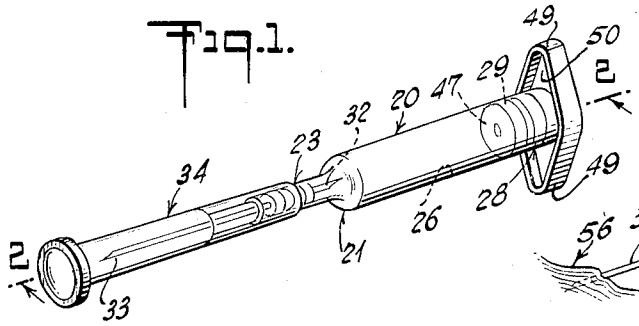

Fig. 4.

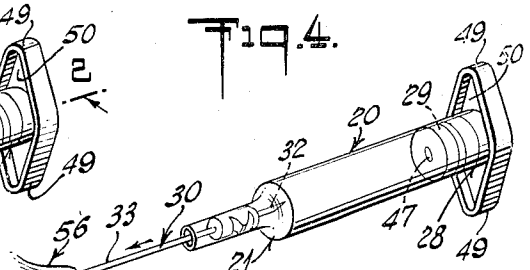

Fig. 2.

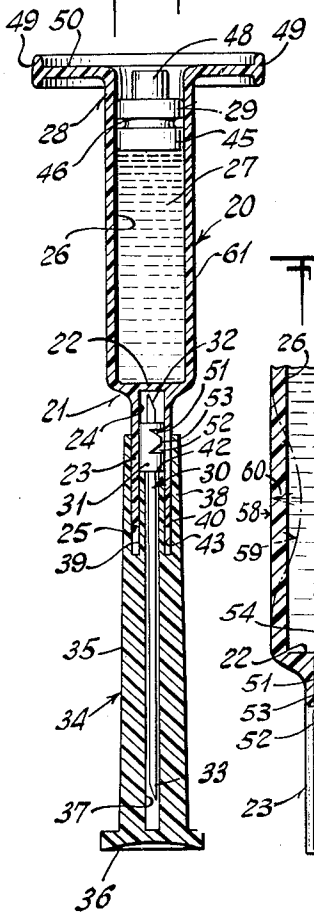

Fig. 3.

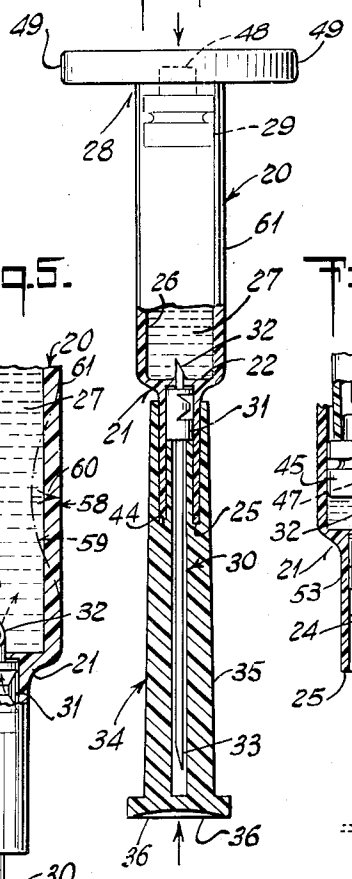

Fig. 5.

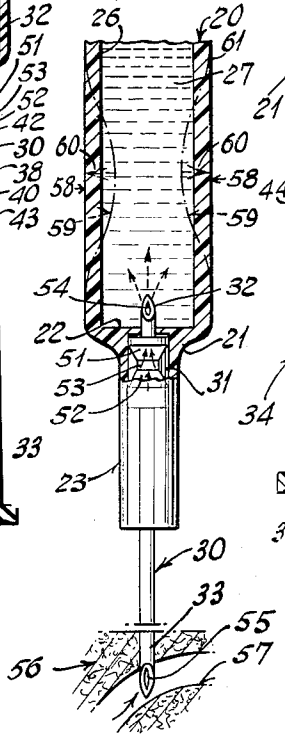

Fig. 6.

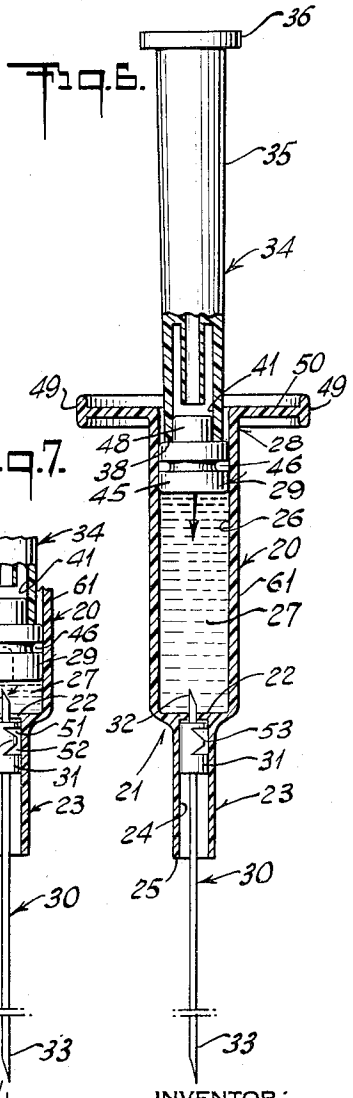

Fig. 7.

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Fig. 8.

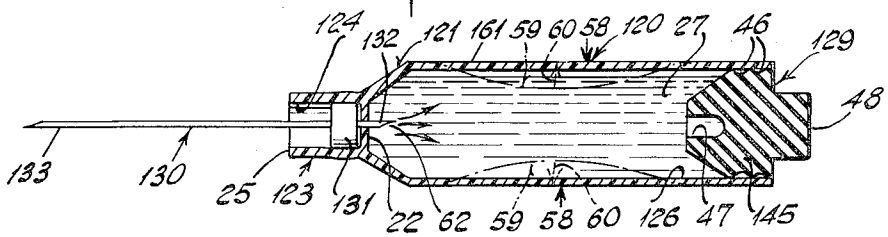


Fig. 9.

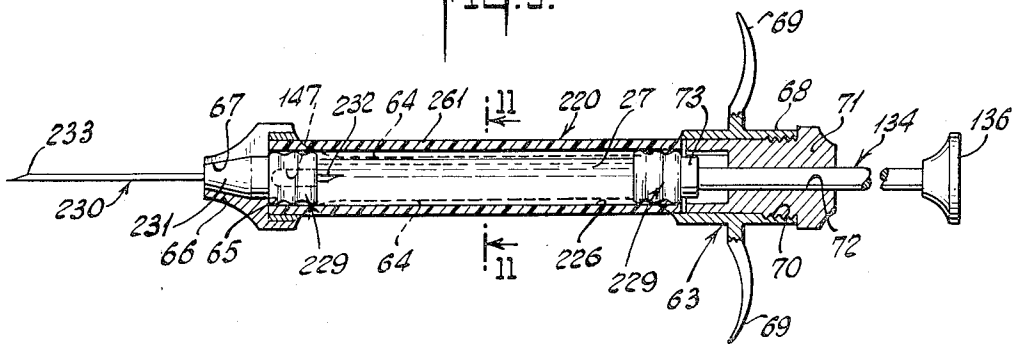


Fig. 10.

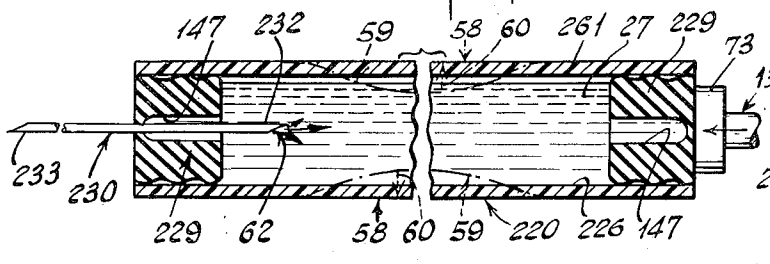


Fig. 11.

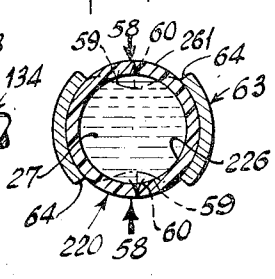
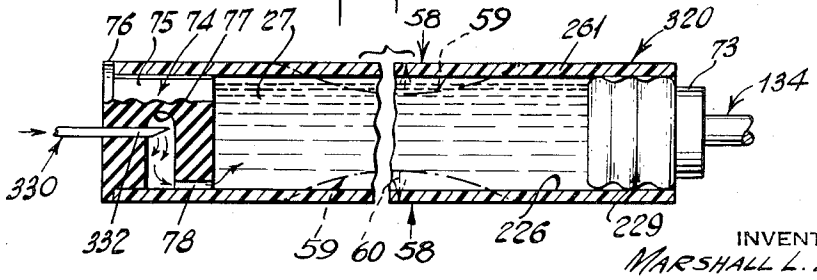


Fig. 12.



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ASPIRATING HYPODERMIC SYRINGE STRUCTURES OF THE PISTON TYPE FEATURING MEANS FACILITATING BLOOD SHOWINGS

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Application November 23, 1951, Serial No. 257,838

4 Claims. (Cl. 128—218)

The present invention relates to hypodermic syringes of the piston type for subcutaneous injection of barrel or ampule contents and, more particularly, to such devices equipped with means readily to provide showings of blood for ready guidance of proper subcutaneous insertion such as that referred to in my copending application Serial No. 250,703, filed October 10, 1951, now Patent No. 2,693,183 of November 2, 1954.

A general object of the present invention is to provide such hypodermic syringe structures and parts thereof which are of simple construction readily producible on an economical basis, and are easily assembled and efficiently employable; and which feature elastic wall barrel or ampule means permitting ready aspiration by wall depression and release and equipped with piston means to expel the liquid contents thereof in the hypodermic administration of the latter.

A more specific object of the present invention is to provide in such hypodermic syringe device barrel, cartridge or ampule means readily formed of substantially cylindrical, light-transmitting, elastic tubing so as to permit simple aspiration and blood showings by squeezing or pinching the side walls thereof inward and releasing, with one end of such tubing closed by liquid contents-expelling piston means to be pushed forward or axially for hypodermic injection of the contained medicinal liquid.

Another object of the present invention is to adapt such elastic wall aspirating cylindrical barrel, cartridge or ampule to single dosage disposable hypodermic syringe devices of types illustrated in my copending aplications Serial No. 202,333, filed December 22, 1950, now Patent No. 2,625,157 of January 13, 1953; and Serial No. 250,703, filed October 10, 1951 now Patent No. 2,693,183 of November 2, 1954, the protective cover cap for the injecting end of the needle being employable upon removal and reversal as plunger means to push forward piston means to expel the liquid contents of the tubular barrel, cartridge or ampule structure; such tubular structure having at least a windowed transparency and preferably being formed of substantially transparent material to permit efficient observation of blood showings therein.

A still further object of the present invention is to provide structural embodiments of such elastic wall aspirating hypodermic syringe barrel, cartridge or ampule means and hypodermic syringe devices featuring the employment thereof which are readily and economically constructed on a commercial scale and which permit efficient use, operation and functioning thereof, as will be more fully apparent from the following descriptions of the embodiments illustrated by way of example in the accompanying drawings.

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

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts, which will be exemplified in the construction 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 perspective view to a scale slightly larger than natural size of an embodiment of the hypodermic syringe device of the present invention showing the parts thereof in their relative positions as the device is preferably conditioned for commercial distribution;

Fig. 2 is an enlarged axial section taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a side elevation, with parts broken away and in section, of the structure shown in Figs. 1 and 2 to substantially the scale of Fig. 2, indicating manipulation of the needle-protective cover cap to bring the bore of the hollow needle assembly into communication with the interior of the medicinal liquid storage chamber;

Fig. 4 is a view similar to Fig. 1 showing the conditioned hypodermic syringe resulting from the manipulation illustrated in Fig. 3 and subsequent removal of the cover cap, illustrating exploratory subcutaneous insertion of the injecting end of the needle;

Fig. 5 is an enlarged side elevation, with parts broken away and in axial section, illustrating aspirating action of the hypodermic syringe barrel or ampule walls after the exploratory insertion illustrated in Fig. 4 and diagrammatically indicating the development of a showing of blood by such aspiration when the bore of the hypodermic needle or injecting cannula has been brought to communication with a blood vein by the Fig. 4 subcutaneous insertion;

Fig. 6 is a side elevational view, with parts broken away and in axial section, illustrating the beginning of hypodermic expulsion of the medicinal liquid contents of the chamber with piston action following the aspiration illustrated in Fig. 5, the needle-protective cover being employed as a plunger stem for the piston means;

Fig. 7 is a view similar to Fig. 6 but with more parts broken away and illustrating final stages of piston expulsion of chamber contents;

Fig. 8 is an enlarged axial section of a modified form of the needle assembly, ampule or barrel, and piston or plunger means of the embodiment shown in Figs. 1 to 7 incl., illustrating the aspirating action thereof for a showing of blood;

Fig. 9 is an axial section of another embodiment of the hypodermic syringe device of the present invention showing a loaded ampule or cartridge unit loaded in syringe casing structure ready for use;

Fig. 10 is an enlarged axial section, with parts broken away, of the cartridge of the Fig. 9 structure, showing parts of the associated double-ended needle at one end and plunger means at the other end illustrated in Fig. 9, with Fig. 10 diagrammatically depicting aspirating action of the elastic side walls of the cartridge.

Fig. 11 is a transverse section of the cartridge structure shown in Fig. 10 taken substantially intermediate the ends thereof in the vicinity of line 11—11 of Fig. 9; and

Fig. 12 is a view similar to Fig. 10, but with some parts in elevation rather than in section, showing a modified form of plug mounted in the leading end of the cartridge tube.

Referring to the drawings, like numerals therein identify similar parts throughout. It will be seen therefrom that embodiments of the present invention and parts thereof are adapted to hypodermic syringe devices of the types disclosed in my above-identified copending applications Serial No. 202,333, now Patent No. 2,625,157 of January 13, 1953; and Serial No. 250,703, now Patent No. 2,693,183 of November 2, 1954. Those various embodiments shown in the present drawings illustrate different ways in which there may be incorporated in a variety of

differing types of hypodermic syringe devices and barrels, cartridges or ampules thereof, simple means for ready aspiration of the medicinal-containing chambers to facilitate a showing of blood while being equipped with piston means for injection expulsion of chamber contents.

Accordingly, an embodiment of that device, as illustrated in Figs. 1 to 7 inclusive, may take the form of a flexible, elastic wall container **20** having at least a portion formed of light-transmitting material to permit observation opposite that portion and interiorly of the chamber of a showing of blood aspirated into the chamber by inward or lateral depression or squeezing of side wall portions and elastic rebound. For this purpose, container **20** preferably is made of an elastic plastic composition, such as a suitable light-transmitting or substantially transparent polyethylene composition, since, in accordance with the present invention, at least a window or a portion of the wall of the neck or side wall of the chamber must permit observation therethrough of a showing or flow of blood with aspirating manipulation or flexing of the chamber side wall. Thus, the entire container structure **20** preferably is molded from substantially transparent polyethylene.

As best seen in Fig. 2, one end **21** of the elastic plastic tubular ampule **20** is closed by a needle-pierceable diaphragm **22** made as an integral part of the container. A hollow neck **23** is mounted coaxially upon end **21** of container **20**, and preferably is integral therewith. Hollow neck **23** has an axial socket, preferably in the form of a cylindrical bore **24**, extending longitudinally thereof and closed at its inner end or bottom by diaphragm **22**. The outer end **25** of the hollow neck **23** constitutes an abutment for cooperative association with certain stop means, as hereinafter explained. Container ampule **20** preferably is molded integral with its diaphragm-closed end **21** and the neck **23**, and preferably is in the form of a tubular section **61** providing therein a substantially cylindrical chamber **26** in which a body **27** of medicinal liquid or injective medicament intended for hypodermic administration is protectively housed or stored. For this purpose, the back or rear end **28** of cylindrical section **61** is closed off by suitable piston means, preferably in the form of a piston plug **29**.

The hollow ampule neck **23** carries therein a double-ended hypodermic needle or cannula assembly **30**, preferably slidably supported in the neck bore **24** by means of a body or generally cylindrical hub **31**. Hub **31** preferably is of slightly larger diameter than the neck bore to be frictionally held securely in the expandable neck at any adjusted axial position. As shown in Figs. 1 to 7 inclusive, inner cannula stub end **32** of the needle or cannula assembly **30** projects a short distance inwardly of the inner end of the hub **31**. The major portion or outer end **33** of the needle element projects coaxially outwardly of the outer end of the hub **31**, as shown. As indicated in Figs. 1 and 2, normally the needle hub **31** is mounted at a certain outer position in the neck bore **24**, so that the cannula stub end **32** extends toward but short of or is spaced outwardly of the diaphragm **22** to avoid puncture of the latter, and is temporarily held in such position by friction. By employing elastic plastic composition from which to form the ampule or container **20** and its neck **23**, the walls of the hollow neck will have some give or elasticity so as to permit the desired sliding action therein of the slightly oversize hub **31** while assuring the frictional temporary retention in an adjusted position, especially when the hub is made of substantially rigid material, such as rigid plastic or metal as is preferred.

Needle-protective cover or cap **34** is preferably provided in the form of an elongated cup-shaped capsule, preferably molded from a suitable, substantially rigid, plastic composition, such as polystyrene. Preferably cap **34** has a slightly tapered, elongated shank **35** made integral with an enlarged, manually-engageable, transversely-extending thrust head **36**, with an axial bore or elongated socket **37** extending substantially the length of the shank **35** to the vicinity of the head **36** to provide a receptive protective socket for the outer needle end **33**. The inner end **38** of the cap **34** is provided with a pair of concentric, axially-extending, annular flanges, with the inner flange **39** extending axially short of the end of the outer flange **40** together to define a socket **41**, as best seen in Figs. 6 and 7, for a piston means-engaging purpose hereinafter explained.

By providing the inner and outer concentric flanges **39** and **40** of different lengths an appreciable portion of the outer flange **40** is permitted to overlap the outer cylindrical wall of the container neck **23** to assure secure temporary telescopic seating of the cover on the ampule neck, as shown in Fig. 2, while the inner end **42** of the shorter inner flange **39** will be permitted to engage the outer end of needle hub **31** without causing the hub and cannula inner end **32** to be pushed forward to puncture of the diaphragm **22**. The inner and outer flanges **39** and **40** are defined by an intervening annular groove **43** slidably receptive of the container neck **23** when cap **34** is telescoped down over the container neck. If desired, the end edge **25** of the neck **23** may be brought to engagement of the bottom **44** of the annular groove **43** to limit inward travel of the needle hub **31** and cannula inner end **32**. Thus, by forming annular groove **43** of definite depth, its bottom **44** may cooperate with the end edge **25** of the neck **23** to limit the telescopic action to that which permits the inner end of the needle hub **31** to stop at least slightly short of the diaphragm **22** while permitting the cannula inner end **32** to puncture completely through the diaphragm to the relative positions indicated in Fig. 3.

Piston plug **29** may have a main body section **45** similar in many respects to common types of piston plugs for hypodermic syringe cartridges or ampules now on the market, and thus may be formed as a substantially cylindrical section of suitable elastic rubber or other elastic material, preferably having one or more annular grooves **46** in the cylindrical surface thereof, as shown in Figs. 2, 6 and 7. Likewise, its inner end is preferably provided with an axial socket or recess **47**, indicated in dotted lines in Fig. 7, with its mouth being shown in Figs. 1 and 4. The axial socket **47**, of course, is provided for the usual purpose of receiving the cannula inner stub end **32** as the piston plug approaches the forward end of the chamber in expelling its contents so as to avoid bore-plugging thrust into the piston plug body and to assure expulsion of almost all of the medicinal liquid. The rear end of piston plug **29** preferably is provided with an axially-extending, relatively short post **48** to facilitate engagement of the piston plug by plunger stem means. When the needle protective cap **34** is employed as the piston or plunger stem, as is intended, its end socket **41** receives and preferably snugly engages about the stem **48** of piston plug **29** securely to hold the latter to the stem temporarily.

Since piston plug **29** is to be pushed forward into barrel chamber **26** for expulsion of liquid contents, means are preferably provided to assure ready engagement of the barrel by the operator's fingers to limit its forward motion while the piston means is being depressed or thrust forward. Such barrel engaging means may be provided in the form of a pair of diametrically-opposed, laterally-extending wings **49**, **49**, preferably provided as integral parts of the molded barrel or container structure **20**, such as by being formed as protruding portions of a circumambient oblong rim attached to the barrel by a lateral web **50**, and that wing-forming structure is preferably generally diamond-shaped, not only to provide the desired structural features, but also to enhance the appearance thereof. Further, since the side walls of the tubular portion of the barrel structure **20** are molded from flexible material so as to assure the required elasticity for purposes of the present invention, the shape of the wing-forming structure, including the diamond-shaped rim and its support-

ing web 50, assures that the rim will give sufficient rigidity to that structure and the diametrically-opposed wing portions 49, 49 thereof as to avoid any undue tendency for the rear end of the barrel structure to collapse or unduly distort under leverage forces developed during forward thrust of the piston plug.

As is well known, some medicinal or therapeutic compositions are intended for intravenous injection and others for intramuscular injection. To assure proper insertion of the hypodermic injecting needle in a vein for the first type of injection, or to be certain that it is not located in a vein for the second type of injection, aspiration for a show of blood is commonly employed. By forming the side walls of the ampule 20 of elastic material, such aspiration may be readily performed, since if relatively slight squeezing pressure on or pinching in of the side walls of the collapsible tube container is momentarily relieved or they are released they will elastically rebound to create suction in the chamber 26 to aspirate a small amount of blood thereinto.

When the liquid to be injected is clear and transparent such aspirated blood may be readily observed at the inner cannula stub end 32. However, many medicinal liquid preparations are translucent or have a degree of opacity which may mask from view a show of blood at the inner end of the cannula stub 32, such as is the case with certain penicillin preparations having a milky appearance. Blood telltale means which are described and claimed in my above-identified copending application Serial No. 250,703 may be readily added to or employed in syringe structure of the type illustrated in Figs. 1 to 7 so as to overcome such difficulties of ready observation of a showing of blood. For this purpose, the needle hub 31 may be provided with a pair of transversely-extending, longitudinally-spaced notches 51 and 52 defining therebetween a transversely-extending dam, weir or transverse partition 53, with inner notch 51 in communication with bore 54 of inner cannula stub end 32 and with outer notch 52 in communication with bore 55 of the outer injecting needle end 33. As a result, when blood is aspirated through injecting needle end bore 55 into notch 52, it must travel up over weir 53 to reach notch 51 and bore 54 as suction is applied to the latter by aspiration of chamber 26. As pointed out more fuly in that copending application, blood is thus caused to flow directly against the inner face of that portion of the transparent ampule neck 23 opposed to the top edge of weir 53 there to be readily observable.

In operation of the embodiment shown in Figs. 1 to 7 inclusive, the operator will select an assembly such as that illustrated in Fig. 1 wherein ampule chamber 26 is loaded with a body 27 of medicinal liquid intended to be hypodermicaly administered and with the injecting end 33 of the needle protectively housed under sterile conditions by the cap 34 telescoped over ampule neck 23. The operator slips off the cap 34 and exploratorily thrusts needle outer end 33 into a patient's flesh, as diagrammatically illustrated at 56 in Fig. 4.

The operator then determines whether or not the cannula bore 55 is in communication with a vein, such as that diagrammatically illustrated at 57 in Fig. 5. This he determines by aspiration for a show of blood, either in the notches 51 and 52 and over weir 53 of the hub 31, or at the cannula inner end 32. Such aspiration is readily attained by pinching or squeezing laterally inward or depressing the flexible elastic side walls of the ampule chamber 26 in the direction of the arrows 58, 58 to the dotted line positions 59, 59, as shown in Fig. 5. This manipulation, of course, reduces the volumetric capacity of chamber 26 somewhat with expulsion of an inconsequential amount of contained liquid so that when the ampule side walls are then released from their inward depressed positions 59, 59, they will rebound in the direction of the dotted arrows 60, 60 to the full line positions shown in Fig. 5, so as to increase or restore the capacity of chamber 26 and thereby aspirate. As a result of the suction created, a showing of blood will be attained if the needle bore 55 is in communication with a vein, such as is illustrated at 57, and if the medicinal contents of the barrel 20 is intended for intravenous injection, the operator may then proceed with the hypodermic administration thereof. If, however, the medicinal contents are intended for intramuscular injection, the operator repeats the exploratory subcutaneous insertion of the needle for aspiration until he is assured by absence of a showing of blood that the needle bore is no longer in communication with a vein.

In accordance with another feature of the present invention, the medicament liquid housed in the hypodermic syringe barrel or ampule 20 is to be expelled during hypodermic administration thereof by piston or plunger action. Thus, the needle-protective cap 34 will be reversed end-for-end and also reversed in position with respect to the barrel or ampule 20. Piston plug post 48 is snugly received in socket 41 of the inner end of cap 34 as shown in Fig. 6. Inward thrust is then applied to piston plug 29 by means of cap 34 which now serves as a piston or plunger stem with application of manual pressure on the thrust head 36 as indicated by the arrow at the top thereof. Piston plug 29 is thus pushed forward in chamber 26 toward the leading end 21 so as to expel liquid 27 through the needle bore. Fig. 6 illustrates the beginning of such piston expulsion of liquid contents in the ampule chamber, and Fig. 7 illustrates substantial completion of such expulsion with, of course, piston plug socket 47 being receivable of the inner cannula stub end 32 so that the leading end of the piston plug may be brought substantially to contact with the head end 21 of the chamber for discharge of a maximum amount of the chamber contents.

It will thus be seen that the embodiment of Figs. 1 to 7 inclusive permits simple aspiration for a show of blood by alternate pinching or squeezing inward of the elastic side walls of the barrel or ampule and release for elastic rebound; while allowing piston expulsion of chamber contents in hypodermic administration of the contained medicinal liquid, which may be preferred to other methods of expulsion as avoiding undue wastage and assuring certainty of injection of a maximum amount in predetermined and accurate quantity of the contents. Further, that particular embodiment features a minimum of parts economically producible on a mass basis which are readily assembled and assure ready observation of aspirated blood even though the liquid medicament may be of a high degree of opacity, with the needle-protective cap economically serving three purposes. The cover cap serves as means insuring sterility of the needle assembly prior to injective use. It also serves as means to push the needle assembly forward to puncture of the diaphragm. Likewise, it serves as piston or plunger stem means during hypodermic administration of liquid contents.

If the medicinal liquid to be injected is of a high degree of clarity so that a showing of blood can readily be observed at the inner end of the cannula stub which pierces through the diaphragm to communication with the chamber, a needle assembly of less cost may be substituted for the blood telltale needle assembly illustrated in Figs. 1 to 7 inclusive. Such simplified needle assembly is illustrated in Fig. 8 at 130 and, as there indicated, may comprise a double-ended, unitary, hollow needle or cannula element extending through a cylindrical hub 131 slidably receivable in an ampule neck, such as 23 of ampule 20.

Fig. 8 further illustrates that the ampule container may also be provided in simpler and more economical form. Ampule 120 may comprise a cylindrical or tubular section 161 merged with a frusto-conical section 121, in turn merged with cylindrical neck 123, the latter two being defined from each other by needle-pierceable transverse diaphram 22, and with the rear end of the tubular section plugged by piston plug 129. Piston plug 129 has a body

145 comprising a substantially cylindrical section merged into a frusto-conical nose to fit into the front end of chamber 126. Ampule container 120, of course, preferably is molded from elastic plastic material similar to that employed in the production of the ampule container 20 of Figs. 1 to 7 inclusive. Thus, the side walls of cylindrical section 161 are flexible and elastic, permitting them to be pinched or squeezed inwardly in the direction of the arrows 58, 58 to the dotted line positions 59, 59 and then to be released, so that they will return in the directions of the dotted arrows 60, 60 to the full line positions shown. Such flexing manipulation, of course, alters the capacity of chamber 126 for aspirating it to develop a showing of blood at 62 in the vicinity of the end of the inner cannula stub 132. The employment of such elastic material also permits the needle hub 131 to be provided in a size having an O. D. slightly larger than the I. D. of the neck bore 124 to assure snug frictional sliding fit of the former in the latter. Of course, with the structure shown in Fig. 8 will be employed a form of the needle-protective cap shown in the Figs. 1 to 7 inclusive embodiment, which may serve the triple function outlined above, and may be of a form similar to that illustrated in the drawings of my above-identified copending application Serial No. 202,333, now Patent No. 2,625,157 of January 13, 1953. Although piston post 48 is preferably of an O. D. slightly greater than the I. D. of the open end of the protective cap so as to assure a snug fit therebetween when the cap is employed as a piston stem, the cap may be used for such purpose even though the piston post be of appreciably less diameter or entirely omitted.

The operation of the embodiment illustrated in Fig. 8 is generally similar to that of the embodiment illustrated in Figs. 1 to 7 inclusive. After removal of the needles protective cap for exploratory insertion of the injection needle end 133 the side walls of ampule section 161 are flexed or manipulated to aspirate chamber 126. The operator then fits the neck 123 between two of his fingers of one hand so that they bear against the frusto-conical section 121 and thrusts piston plug 129 forward, preferably with the thumb of the same hand. Due to its shape, section 121 has a fair amount of rigidity so as to oppose any appreciable distortion under application of axial forces applied to slide piston plug 129 forward in chamber 126. The shown shape of the nose of piston plug body 145 assures expulsion of a maximum amount of contained liquid.

Features of the present invention may be incorporated in syringe devices of the Cook type as illustrated in Patent No. 1,661,818 of March 6, 1928, by formation of the barrel or cylindrical tubing serving as the side walls of the cartridge or replaceable ampule of elastic material, such as that proposed above in connection with the production of the containers or ampules 20 and 120. As illustrated in Figs. 9 to 11 inclusive, cartridge or ampule 220 may include a cylindrical section 261 of elastic light-transmitting or substantially transparent material, such as a length of elastic plastic tubing, through which blood color may be observed. Tubular section 261 is closed off at opposite ends by piston plugs 229, 229, each a substantial duplicate of the other and similar to the cylindrical section 45 of piston plug 29 with the post 48 thereof omitted. Body 27 of injectable medicinal liquid is housed in cartridge or ampule chamber 226. By employing similar piston plugs 229, 229 in opposite ends of the cylindrical section 261 of elastic tubing, a problem of proper orientation of the cartridge or ampule as it is loaded into the hypodermic syringe casing is eliminated.

That loaded cartridge or ampule 220 is removably mounted in a suitable tubular syringe casing 63. The tubular casing 63 is cut away on opposite sides at 64, 64 to provide opposed, elongated sight slots, and to permit application of depressing force to or pinching toward each other of the elastic side walls of the ampule tubular section 261. One end of loaded ampule 220 is received in an axial socket 65 in the back end of casing head 66, with the bottom of the socket providing an abutment against which the outer end of the adjacent piston plug 229 may be rested. As is usual in such a type of syringe, head 66 also has another seat or socket 67 therein which receives an enlargement or hub 231 mounted on a double-ended needle 230 intermediate its inner cannula plug-piercing stub end 232 and its outer injecting end 233.

Each piston plug 229 of the Figs. 9 to 11 inclusive structure has a relatively deep axial socket 147 in its inner end closely approaching the outer end to leave a relatively thin intervening sealing layer readily pierceable by the cannula inner end 232 to communicate the bore of the latter with the ampule chamber 126 when that particular plug is guided into the cartridge 63 as the leading end, as illustrated in Fig. 10. Also, the socket 147 in the other rear piston plug 229 which is to be given liquid-expelling piston action provides clearance for the projecting sharp inner cannula end 232 which preferably extends inward of the back end of leading plug 229 to facilitate observation of blood showings, as will be apparent from Fig. 10.

The back end 68 of the tubular casing 63 carries finger-engaging wings 69, 69 and is internally-threaded at 70 threadably to receive an externally-threaded closure plug or rear head 71. Casing closure rear head 71 has an axial bore 72 reciprocatively receiving piston or plunger stem 134. Plunger stem 134 preferably threadably carries on its outer end a thumb-engaging thrust knob 136 and its inner end 73 is preferably enlarged to provide a head, as shown, securely to seat against the outer end of the rear piston plug 229. Features of the present invention make any tedious connection between plunger stem 134 and rear piston plug 229 unnecessary, since aspirating action is obtained not by any reciprocative action of rear piston plug 229, but by flexure of the elastic tubular section 261.

In operation of the embodiment shown in Figs. 9 to 11 inclusive, the operator loads a loaded cartridge or ampule 220 into the hypodermic syringe casing 63 to form the assembly illustrated in Fig. 9. He inserts the outer injecting end 233 of the hollow needle or cannula 230 subcutaneously into the patient in the exploratory manner described above, and aspirates for a show of blood by applying with his fingers inward pressure to opposite sides of the ampule tube 261 through sight windows 64, 64 in the direction of arrows 58, 58 shown in Fig. 10. This inward depression of the opposite sides of the ampule tube 261, or resultant squeezing or pinching of the latter, causes the sides to flex inwardly to the dotted line positions 59, 59 shown in Fig. 10 to reduce the capacity of chamber 226. Upon release of the opposed sides of the elastic tube 261 they elastically rebound or return in the direction of the dotted arrows 60, 60 to the full line positions indicated in Fig. 10, thereby restoring or increasing the capacity of chamber 226 and aspirating for a show of blood at 62 in the vicinity of the needle inner end 232. Thereafter the contained injectable liquid 27 is expelled through the needle 230 by piston action of the rear piston plug 229, pushed forward into the tube 261 by stem 134 with manual application of pressure to thrust knob 136. Thus, as in the other embodiments, aspiration for a show of blood is attained by flexure of the elastic side walls of the cartridge or ampule and expulsion of liquid contents is attained by piston action of the piston plug closing the rear end of the ampule tube.

In the event that the medicinal liquid 27 with which the cartridge or ampule 220 is loaded is of a high degree of opacity making observation of a showing of blood at 62 difficult, the leading end of the ampule tube 261 may be closed by a blood telltale plug, as proposed in Fig. 12, which may be of the type illustrated and claimed in my above-identified copending application Ser. No. 250,703. The blood telltale plug 74 closes off the leading end of ampule tube 261 to provide with the remaining piston

plug 229 in the rear end of the ampule tube the intervening chamber 226 loaded with liquid body 27 to form cartridge or ampule 320. Plug 74 may, as shown in Fig. 12, comprise a substantially cylindrical section 75 snugly received in the leading end of ampule tube 261 and having an end flange 76 not only to limit insertion, but also to aid in identifying the opposite ends of the tube to dictate proper orientation of the cartridge or ampule when it is to be loaded into the syringe casing 63. Preferably such blood telltale plug 74 is formed of elastic material, as are the piston plugs 229, such as by being molded from synthetic or natural rubber, for example, pure gum, with its cylindrical section 75 of an O. D. slightly larger than the I. D. of the tube 261.

Blood telltale plug 74 is provided in one side intermediate its outer and inner ends with a laterally extending notch 77 to which the cannula inner end 332 of the double-ended needle 330 is readily pierceable when the cartridge or ampule 320 is loaded into the syringe casing 63. Needle 330 is similar to needle 230 except the inner end 332 is shorter than the inner end 232. The resulting pocket provided by notch 77 is communicated with chamber 126 by means of a channel formed by a longitudinally extending groove 78. Flow between chamber 226 and the inner cannula end 332 is diverted to adjacent the inner face of the portion of the transparent tube 261 which closes the side of the longitudinal groove 78 so that flow of blood in that channel will be readily observable despite a high degree of opacity of injectable liquid 27.

Thus, it will be seen that in all of the illustrated embodiments aspiration for a show of blood is obtained by manipulation or flexure of the elastic side walls of the ampule or syringe barrel, i. e. momentary chamber capacity reduction upon inward wall depression and aspirating capacity restoration upon release. Also, in each embodiment expulsion of liquid contents of the elastic wall chamber in hypodermic administration thereof is effectively obtained by piston action.

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 construction and different embodiments of the invention could be made without departing from the scope thereof, 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, means providing an injectable-liquid chamber including a substantially cylindrical barrel with the chamber defined at one end by fixed closing means having an elongated hollow neck extending therefrom closed off at its inner end by a needle-pierceable chamber wall portion; a double-ended injecting needle structure having an outer injecting end, an inner piercing end for piercing said needle-pierceable chamber wall portion, an outlet passage for said chamber extending from the piercing end to the injecting end, and an enlarged hub slidably mounted in said neck with the injecting end extending out of said neck; piston plug means defining and closing off the other end of said chamber slidable axially into said barrel to expel liquid contents thereof through the needle structure passage, a protective elongated cap removably covering said needle injecting end, and a pair of inner and outer axially-extending concentric annular flanges on said cap with the inner flange slidably mounted inside said neck to push said needle hub forward therein to puncture of said chamber wall portion by said needle inner piercing end, said outer flange being spaced radially from said inner flange a distance sufficient slidably to receive said neck therebetween with said outer flange lapping and being slidable over the outside of said neck, said outer flange and said piston plug means having interfitting engaging means to connect and securely hold them together temporarily when said cap is removed from the neck end of said barrel and employed at the other end of the latter as a piston to thrust said piston plug means forward in said barrel.

2. A hypodermic syringe comprising, in combination, means providing an injectable-liquid chamber including a substantially cylindrical barrel with the chamber defined at one end by fixed closing means having an elongated hollow neck extending therefrom closed off at its inner end by a needle-pierceable chamber wall portion; a double-ended injecting needle structure having an outer injecting end, an inner piercing end for piercing said needle-pierceable chamber wall portion, an outlet passage for said chamber extending from the piercing end to the injecting end, and an enlarged hub slidably mounted in said neck with the injecting end extending out of said neck; piston plug means defining and closing off the other end of said chamber slidable axially into said barrel to expel liquid contents thereof through the needle structure passage; and a protective elongated piston-cap having a closed manually-engageable end and an open end removably covering said needle injecting end, said open end of said piston-cap being provided with a pair of inner and outer radially-spaced axially-extending annular flanges with the inner flange slidably mounted inside said neck to push said needle hub forward therein to puncture of said neck-closing chamber wall portion by said needle inner piercing end, said outer flange lapping over and being slidably mounted about the outside of said neck, said outer flange and said piston plug means having interfitting socket and projection engaging means to connect and securely hold them together temporarily when said piston-cap is removed from said neck and engaged to said piston plug means at the other end of said barrel.

3. The hypodermic syringe structure as defined in claim 2 characterized by the projection of said engaging means being withdrawable from the socket of the latter to effect disengagement of said piston plug means when said piston-cap is withdrawn back out of said barrel.

4. A hypodermic syringe comprising, in combination, means providing an injectable-liquid chamber including a substantially cylindrical barrel of elastic material, a piston plug slidably received in one end of said barrel defining one end of said chamber and for expelling liquid contents thereof, said piston plug having an axially-extending post projecting rearwardly therefrom, said chamber being defined at the other end of said barrel by means supportable of a hollow needle communicable with said chamber and comprising a cylindrical hollow neck closed by a chamber wall portion; a double-ended hollow needle having an outer injecting end, an inner chamber wall-piercing end, and a circular needle hub slidably received in said neck to move said needle inner end inward therein to puncture of said wall portion to communicate the needle bore with said chamber; and a protective cap having an inner open end removably covering said needle outer end and a pair of axially-extending concentric annular flanges on its inner open end with the inner flange slidably received in said neck to push said needle hub forward in the latter and move said needle inner end inward to puncturing position with respect to said wall portion, the outer of said flanges being spaced radially from said inner flange a distance sufficient slidably to receive said neck therebetween and longer than the inner flange appreciably to increase the overlap on said neck and to provide a socket defined at its inner end by the edge of said inner flange with said socket snugly receivable of said piston plug post when said cap is removed from said neck

and reversed to push said piston plug inward into said barrel.

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