

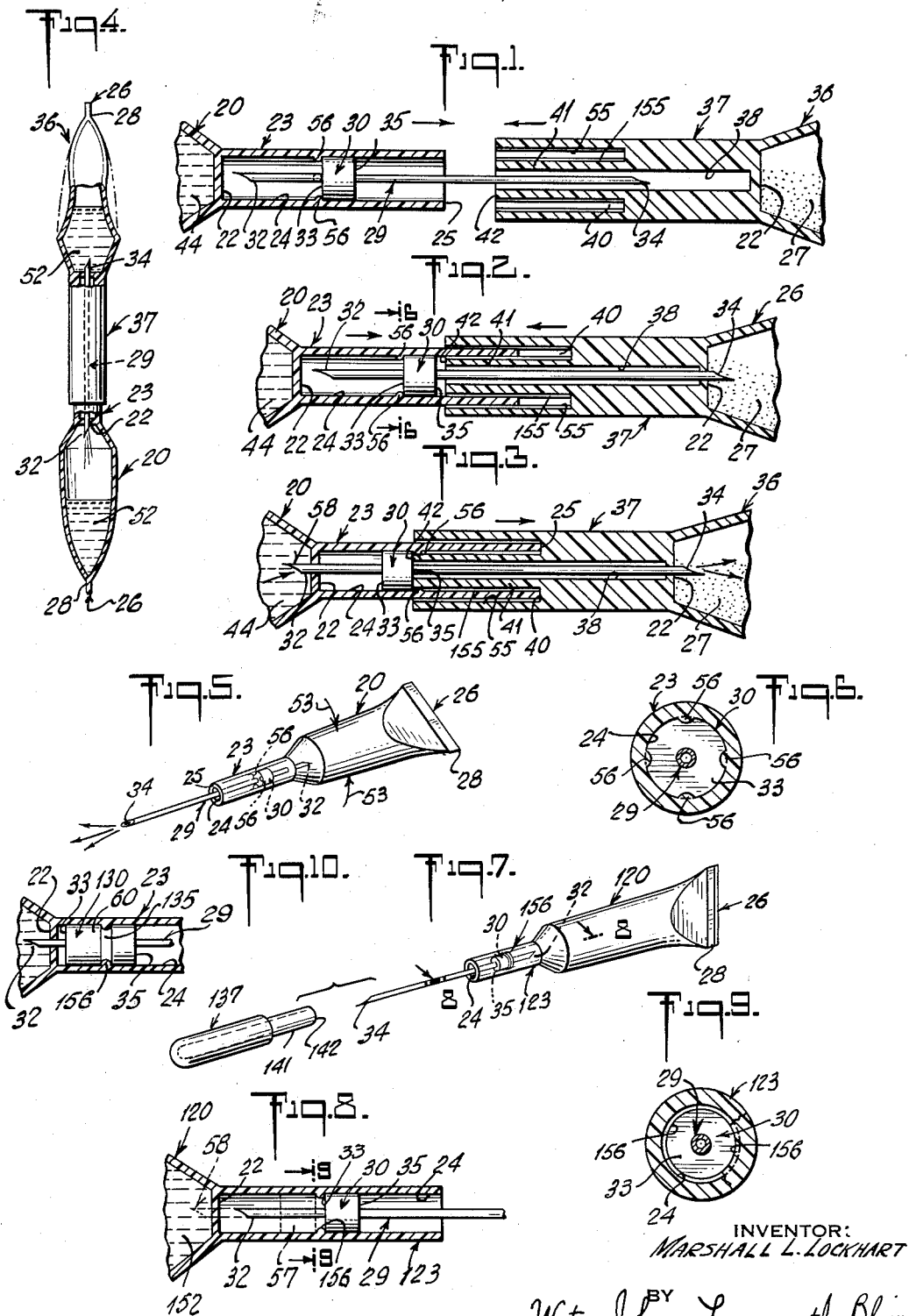
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HYPODERMIC SYRINGE STRUCTURE

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HYPODERMIC SYRINGE STRUCTURE

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The present invention relates to disposable hypodermic syringes of the types illustrated in my copending applications Serial No. 202,333, filed December 22, 1950, now Patent No. 2,625,157 of January 13, 1953, and Serial No. 234,106, filed June 28, 1951; and the present application is a continuation-in-part of Serial No. 234,106.

A general object of the present invention is to provide in such hypodermic syringes unique means temporarily to resist sliding movement of the double-ended cannula support, which may be in the form of a hub, in the elongated hollow neck of the ampule, either effectively to dictate piercing sequence of diaphragms or to avoid complete withdrawal of the cannula or needle from the ampule neck when, after an injection, the operator attempts to withdraw the needle from a patient's flesh.

A more specific object of the present invention is to provide a temporary stop means in such an ampule neck whereby, when either the neck or the needle support slidable therein is capable of being changed in lateral dimension, such as by elastic expansion or contraction, they are permitted to slide relative to each with application of suitable force, while resisting relative sliding motion with application of less force, efficiently to allow selective operation and/or to facilitate needle withdrawal after an injection.

Another object is to provide structural embodiments of the invention which may be readily and economically constructed on a mass production basis and which permit efficient 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, 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 drawing, in which:

Fig. 1 is an enlarged exploded axial section, with parts broken away, of an embodiment of paired mixing containers for storage of segregated ingredients of injectable medicinal preparations to be manipulated for admixture of the ingredients with a part then being employable as a syringe for subcutaneous administration of the resulting preparation, characterized by a form of stop means of the present invention;

Fig. 2 is a sectional view similar to Fig. 1 showing parts of the containers being telescoped together preparatory to bringing the housed ingredients together;

Fig. 3 is a sectional view similar to Fig. 2 showing intercommunication between the chambers in which the ingredients had been separately housed to permit liquid transfer and attain admixture;

Fig. 4 is an elevational view to a smaller scale, with parts broken away and in section, illustrating a transfer-

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of-liquid manipulation following admixture of the ingredients;

Fig. 5 is a perspective view of one of the two containers illustrated in Figs. 1 to 4 incl., equipped with the intercommunicating double-ended cannula, which together may now serve as a disposable single-dosage hypodermic syringe for subcutaneous administration of admixture contents;

Fig. 6 is an enlarged cross sectional view taken substantially on line 6—6 of Fig. 2;

Fig. 7 is an exploded perspective view of another type of single-dosage, disposable, hypodermic syringe construction in which is embodied a modified form of the stop means employed in the construction illustrated in Figs. 1 to 6 incl.;

Fig. 8 is an enlarged axial section, with parts broken away, taken substantially on line 8—8 of Fig. 7;

Fig. 9 is a transverse section to a larger scale taken substantially on line 9—9 of Fig. 8, and with a part broken away to show a section of stop means therein; and

Fig. 10 is a sectional detail of a further modification.

Referring to the drawing, in which like numerals identify similar parts throughout, it will be seen from Figs. 1 to 6 incl. that a construction in which an embodiment of the present stop means invention is included to advantage may comprise a collapsible wall container or ampule 20, preferably in the form of a collapsible tube, having relatively thin, highly flexible, elastic side walls and, for this purpose, preferably is made of an elastic plastic material, such as a polyethylene composition. One end of the elastic plastic tube 20, is closed by a needle-pierceable portion or diaphragm 22, preferably in the form of an integral flexible membrane. A head 23 is mounted upon container 20, preferably in the form of a hollow neck having a socket, desirably in the form of a cylindrical bore 24, extending longitudinally or axially 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 explained hereinafter, and the neck bore 24 is of substantially uniform cross section or diameter from end to end thereof.

The container 20 preferably is molded integrally with the neck 23 and diaphragm 22 and has its bottom end 26 initially open to receive therein a charge of an ingredient of a therapeutic preparation or composition, such as a dosage of medicinal liquid to be hypodermically administered. Such ingredient preferably may comprise a body 44 of liquid to serve as a vehicle for another ingredient which may be solids in particulate or pill form with which the liquid ingredient is to be admixed. After the body of liquid 44 is loaded into the chamber or compartment provided by the interior of collapsible tube 20, the bottom end 26 of the latter may be securely closed by pinching opposite edges together and heat sealing, as at 28 in Fig. 5.

The hollow neck 23 is adapted to receive therein and, if desired, carry a cannula unit 29 preferably supportable in the bore 24 by means of a hub proper in the form of a support body or hub 30. The cannula-supporting hub or body 30 may comprise a hub proper in the form of a cylindrical metallic slug of such diameter as to be slidable in the bore 24 with some frictional resistance to tend to hold it in any position of adjustment. As shown, the cannula 29 preferably is in the form of a double-ended hypodermic needle with its inner or diaphragm-piercing end 32 projecting a relatively short distance inwardly of the inner end 33 of the needle-supporting hub 30, and with its major portion or outer injective end 34 extending outwardly of the outer end 35 of its hub proper.

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As indicated in Fig. 2, normally the support body 30 is to be mounted at a certain point in the bore 24 so that the cannula inner end 32 extends toward but short of or is spaced outwardly of the diaphragm 22 to avoid puncture of the latter. It is temporarily held in such position preferably by making the hub 30 slightly oversize, or i. e., of a diameter slightly larger than the diameter of the bore 24 of elastic neck 23, so that it will be slidable therein but can be frictionally held in any desired position, particularly with the aid of additional stop means of the present invention.

The feature of relative elasticity may be incorporated either in the container neck 23 or in the needle hub 30. For example, similar frictional sliding and temporary holding of the hub 30 in a position of adjustment in the container neck 23 may be attained with either one formed of elastic material and the other formed of more rigid material. If, by way of illustration, neck 23 be molded from a substantially rigid plastic composition, such as polystyrene, hub 30 may be formed of a silicone-containing synthetic rubber composition, so as to be contractible into the neck bore 24 and passable through any constriction therein. The present invention is particularly concerned with the provision of such constriction or equivalent means to serve as temporary stop means to control a limited degree relative sliding action of the needle hub in the container neck.

In the embodiment of Figs. 1 to 6 incl., a second or complementary container 36 is provided for housing the other ingredient of the therapeutic preparation and may, as therein shown, be in the form of another elastic plastic collapsible tube somewhat similar to tube 20 except for certain head or neck structure thereof. Accordingly, its head end is also closed by a needle-pierceable diaphragm 22 preferably made as an integral part of the body of that container. Since head or neck 37 of tube 36 is intended to constitute certain sleeve means for connecting the containers together, preferably it is in the form of an elongated cylindrical member having an axial bore 38 terminating at its closing diaphragm 22 and freely receivable of the outward injective needle end 34. The outer end of neck 37 is provided with a relatively deep, cylindrical, coaxial recess 40 to form about an outer portion of the axial bore 38 piston means 41 in the form of a hollow post having an outer abutment end 42.

In accordance with the present invention a tendency for the needle hub 30 to resist being slid in neck 24 of container 20 may be magnified by providing in the latter suitable inwardly projecting stop means. Such stop means may be provided in the nature of a plurality of small nibs or teats 56—56 against which the inner end 33 of the needle hub 30 may abut, as indicated in full lines in Fig. 1, temporarily to resist inward sliding of the hub. The nib structure 56—56, illustrated by way of example in Figs. 1 to 3 incl., may be more readily understood by reference to Fig. 6. This may be particularly useful in the device of the type illustrated in Figs. 1 to 6 incl., so as to dictate the order in which the closing diaphragms 22 and 22 of the containers 36 and 20 are pierced respectively by the needle outer end 34 and the needle inner end 32.

In use of the device illustrated in Figs. 1 to 6 incl. the cannula sub-assembly 29 may be mounted in the neck bore 24 in the full line position there illustrated with the inner end 33 of the needle hub 30 resting against the nibs 56—56 so as to tend to limit further the inward sliding of that cannula unit. The hollow neck 37 of the other container 36 is positioned over the needle outer end 34 and the container necks are moved toward each other in the direction of the arrows indicated in Fig. 1. As a result, the container necks 23 and 37 are telescoped together, the outer end 25 of the neck 23 sliding into recess 40 of neck 37 until the outer injective needle end 34 pierces through diaphragm 22 of solids container 36, as illustrated in Fig. 2. This is assured by virtue of a fair amount of frictional

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resistance of the hub 30 to slide forward further into neck bore 24 and by the temporary stop action of the nibs 56—56 with respect to the needle hub. Thus, the bore of needle 29 is first brought into communication with the chamber in container 36 in which the solids 27 are housed, and with the outer abutment end 42 of the piston post 41 approaching to contact of the outer end 35 of the needle hub 30.

Thereafter, with further telescope of the container necks 23 and 37, piston post 41 pushes the needle hub 30 forward or down into neck bore 24 to puncture of the diaphragm 22 of container 20 by the inner needle end 32, as illustrated in Fig. 3. By virtue of the elasticity of the material from which the walls of neck 23 are formed, the latter eventually will swell sufficiently and the nibs or teats 56—56 may distort to a degree which will permit needle-supporting body or hub 30 to be slid inward or down into neck bore 24 by the piston means or post 41, substantially to the position indicated in full lines in Fig. 3, with the inner needle end 32 pierced through diaphragm 22 of container 20. This is the "communicative" condition of the device illustrated in Figs. 1 to 6 incl. Further telescope of the necks 23 and 37 relative to each other is prevented by abutment of the outer end 25 of neck 23 against the bottom of the cylindrical recess 40, as illustrated in Fig. 3.

The operator then transfers the liquid vehicle 44 from container 20 through the bore of needle 29 into the container 36 there to be admixed with the solids 27. This transfer action may be accomplished by holding the device in a somewhat upright position, as illustrated in Fig. 4 but with the liquid-containing collapsible tube 20 uppermost, and by lateral application of inward pressure to the side walls of that container, such as by squeezing. Thereafter, the assembly, in which a major portion or almost all of the liquid vehicle has been transferred into the solids container 36, may be shaken longitudinally to assure thorough admixture of the ingredients within the chamber of that latter container.

The operator may then reverse the assembly, as illustrated in Fig. 4, so as to permit transfer of the admixture or injectable medicament 52 from the container 36 back through the bore of needle 29 into the container 20. Such transfer, of course, is attained in a manner similar to transfer of the liquid vehicle 44 from the container 20 to the container 36, accompanied by squeezing of the side walls of the container 36 to move them inward from the dot-dash line positions to the full line positions illustrated in Fig. 4.

The device of Figs. 1 to 6 incl. is then brought to the "administering" condition by withdrawal of the new substantially empty tube 36, with the neck 23 being slid out of the connecting neck structure 37. This will produce the hypodermic syringe structure shown in Fig. 5, with the needle 29 and its hub 30 remaining in bore 24 of neck 23 substantially at the position indicated in Fig. 3, and with the outer injectable needle end 34 exposed and extending beyond the outer neck end 25 an appreciable distance for hypodermic administration of admixture contents of the collapsible tube 20. By virtue of the fact that the inner needle end 32 remains pierced through the diaphragm 22 of container 20, with the needle bore in communication with the compartment or chamber provided by that container and the liquid admixture 52 therein, the hypodermic syringe of Fig. 5 may then be used (after subcutaneous insertion of the outer needle end 34) by applying lateral pressure to the side walls of the collapsible tube 20 in the direction of the arrows 53, 53 so as to eject therefrom the contained liquid therapeutic preparation.

Of course, other known means may be employed to expel the contained liquid therapeutic preparation after the admixing of the ingredients thereof in the subcutaneous administration of such preparation. For example, the capacity-reducible chamber of the syringe may be

equipped with piston expelling means such as is taught in my copending application Serial No. 257,838 filed November 23, 1951. Whatever the specific form of the syringe chamber or barrel may be is of no moment with respect to the present invention. Incidentally, in order to avoid telescope-arresting entrapment of air in the cylindrical recess 40 by the neck 23, one or more walls of that recess may be provided with longitudinally extending ribs 55—55 and 155—155 so that air venting ways are provided between such ribs.

The inwardly projecting stop means formed by the plurality of nibs 56—56 not only serve to delay sliding of the needle hub 30 forward into the neck bore 44 but also has additional advantages. After the syringe device of Fig. 5 has been used for subcutaneous administration of contents, the operator must withdraw the needle injecting end 34 from the patient's flesh. If the needle hub 30 is easily slidable in the neck 23, pull on the container 20 by the operator accidentally may fail to withdraw the needle from the patient's flesh, the needle hub 30 sliding out of the neck bore 24 to leave the needle in the body tissues. The unsightly results and the need for the operator then to grasp the needle assembly 29 and again apply pull to withdraw it, readily can develop in the patient a deleterious psychological reaction. This is effectively avoided by the stop means of the present invention, since when the syringe device of Fig. 5 has been prepared for injective use, the needle hub 30 is forward in the neck bore 24 beyond the nibs 56—56, such as in the full line position indicated in Fig. 3. The nibs 56—56 prevent the needle hub 30 from sliding out of the neck bore 24 when pull is applied upon the container 20 sufficient to withdraw the injectable end 34 of the needle from the patient's flesh. The outer end 35 of hub 30, or the circumferential edge thereof, defines a locking point on the hub when abutted against nibs 56—56.

The stop means inside the hollow neck of the container to retard sliding motion of the needle hub in the neck bore, and preferably located at a point outward of the chamber-closing diaphragm a distance greater than the length of the inner end of the needle but less than the combined length of the needle inner end and the hub, may be incorporated in a syringe structure of the general type illustrated in Fig. 5, and in a modified form as illustrated in Figs. 7, 8 and 9. A container 120, similar to container 20 and preferably formed of elastic plastic material, preferably is provided with a coaxially-extending elongated cylindrical neck 123 having its bore 24 closed off at the bottom by diaphragm 22, as illustrated in Figs. 7 and 8. The neck bore 24 slidably carries the hub 30 of the needle assembly 29 and is adapted telescopically to receive a reduced cylindrical section 141 of an elongated protective cap 137 to be fitted over the outer injective end 34 of the needle. The inner end 142 of the cap 137 is, of course, adapted to engage the outer end 35 of the needle hub 30 to push the latter forward in the neck bore 24 to puncture of the diaphragm 22, such as is illustrated in dotted lines at 58 in Fig. 8, so that when the cap is removed the syringe device shown in the left hand side of Fig. 7 may be used for subcutaneous administration of the contained medicinal liquid 152. Again the locking point on hub 30 is defined by its outer end 35 or the circumferential edge of the latter.

In the embodiment illustrated in Figs. 7, 8 and 9 the stop means there retarding sliding motion of the needle hub 30 is in the form of an inwardly extending or radially inwardly projecting circular rib 156 of elastic material to permit swelling, and preferably made integral with the elastic plastic neck 123. Thus, if the needle hub 30 is pushed forward in the neck bore 24 by the cap end 142, the elastic rib 156 and that portion of the elastic neck 123 adjacent thereto are swelled sufficiently to permit the needle hub to pass to the dotted line position 57 indicated in Fig. 8.

After the outer end 34 of the needle of the Figs. 7, 8 and 9 embodiment has been thrust into a patient's flesh and the contents of the container 120 subcutaneously administered, pull applied to the container will with assurance withdraw the needle from the body tissues, since the stop rib 156, like nibs 56—56, resists outward sliding of the needle hub in the neck bore by abutment of the outer end 35 of hub 30 constituting its locking point. Accordingly, withdrawal of the needle from a patient's flesh by pull upon the syringe container is efficiently assured without danger of the needle assembly separating from the container and remaining in the body tissues, which would then require an additional pull upon the needle assembly to withdraw it.

Thus, the stop means of the present invention efficiently controls the sliding action of the support body of a cannula in a syringe structure neck which may be used to advantage for a variety of purposes including dictating the sequence of diaphragm piercing in dual container structures wherein ingredients of injectable medicaments are separately housed and, in any event, to assure that the needle assembly temporarily remains mounted to the syringe container so that the needle will be withdrawn from a patient's flesh when pull is applied to the container. If desired, the needle unit 29 may be separated for reuse from the emptied container 20 or 120 by applying thereto separating pull of greater force.

As proposed in Fig. 10 the cylindrical hub, such as that shown at 130, may be provided with a circumferential groove 135 located at any desired locking point between its inner and outer ends. There is thus defined between the inner end 33 and groove 135 a hub proper or an inner end hub portion 60 which may be considered the equivalent of hub 130. When hub 130 is forcibly slid inward to the full line position shown in Fig. 10, the rib 156 stretches and the portion of the neck 23 there adjacent swells to permit the hub proper or portion 60 to slide through the hole or constriction defined by the circular rib until the groove 135 is brought to substantial alignment with the rib. The rib 156 then snaps into the groove 135 to effect temporary locking engagement thereof temporarily holding the hub 130 in the neck 23, so that the needle shall be withdrawn from a patient's flesh by application of pull to the exhausted syringe container. Thus, in the Figs. 1 to 6 incl., and Figs. 7, 8 and 9 forms, there is temporary locking engagement between the hub and the stop means when either end of the entire hub 30 constituting the hub proper is abutted against the stop means; and in the Fig. 10 forms such temporary locking engagement is attained when either the inner end of the inner hub portion 60 constituting the hub proper, or the sides of the groove 135 are abutted against the stop means. Of course, if the inner end of neck 23 of the Fig. 10 structure is made longer the hub 130 might be pushed inward completely through the hole or constriction defined by rib 156, so that the inner side of the latter is abutted by the outer hub end 35 temporarily to resist withdrawal of the hub from the neck bore 24. Incidentally, when rib 156 snaps into groove 135 there is such locking engagement as to resist temporarily either outward or inward sliding of the hub in neck. This feature may be relied upon to assure both withdrawal of the needle from a patient's flesh and limiting of inward motion of the hub to a position outward of the diaphragm 22 to avoid any possibility of undesirable rupture of the latter.

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 departure from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing 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 structure comprising, in combination, means providing a capacity-reducible chamber for injectable liquid, a hollow neck of elastic material projecting therefrom and having a bore of substantially uniform cross section from end to end thereof, a needle-pierceable diaphragm forming a portion of the chamber walls and sealing off said neck bore, a needle hub proper of certain length slidably mounted in said neck bore and having an inner end opposed to said diaphragm, a diaphragm-piercing hollow needle inner end carried by the inner end of certain length of said hub proper and projecting inward toward said diaphragm, and means projecting radially inward from the side walls of said neck bore at a point outward of said diaphragm a distance greater than the length of said needle inner end but less than the combined lengths of said needle inner end and said hub proper, whereby said radially projecting means forms a temporary hub stop with the elasticity of said neck permitting said hub proper to be forced inward past said stop means to puncture of said diaphragm by said needle inner end.

2. The syringe structure as defined in claim 1 characterized by said stop means being in the form of a plurality of circumamiantly-distributed inwardly-projecting nibs.

3. The syringe structure as defined in claim 1 characterized by said stop means being in the form of an internal, laterally-extending rib of elastic material.

4. A hypodermic syringe structure comprising, in combination, means providing a capacity-reducible chamber for injectable liquid, a hollow neck element projecting therefrom and providing a continuous neck passage of substantially uniform cross-section from end to end thereof, a needle-pierceable diaphragm forming a portion of the walls of said chamber and closing off the inner end of said hollow neck element and its passage, a needle support body element slidably mounted in said hollow neck element and having an inner side opposed in spaced relation to said diaphragm, a double-ended hollow needle supported by said body element with an inner end projecting inwardly from the inner side of said body element toward but short of said diaphragm, said needle having an outer end projecting outwardly from said body element an appreciable distance out of said neck element for injective use, and stop means in said hollow neck element passage projecting radially inward at a point outward of said diaphragm which dictates spacing of said needle inner end outward from said diaphragm when said body element is juxtaposed to said stop means on the outer side of the latter, the length of at least a portion of said body element from its inner end to a locking point thereon being shorter than the spacing of said stop means from said diaphragm to accommodate that portion of said body ele-

ment therebetween, one of said neck and body elements being formed of elastic material to permit relative contraction and expansion so that at least that portion of said body element may be slid forward forcibly in said neck past said stop means to said locking point with said stop means resisting slide of said body element therepast in either direction.

5. The syringe structure as defined in claim 4 characterized by said neck element being formed of elastic material, and said support body element being formed of relatively rigid material.

6. The syringe structure as defined in claim 5 characterized by said internal stop means being formed integral with said elastic neck element.

7. The syringe structure as defined in claim 6 characterized by said stop means and neck element being formed of elastic plastic material with the latter having a substantially cylindrical bore and said support body being provided as a substantially cylindrical metallic hub of a diameter slightly larger than that of said bore.

8. The syringe structure as defined in claim 7 characterized by said stop means being in the form of a plurality of inwardly projecting nibs.

9. The syringe structure as defined in claim 7 characterized by said stop means being in the form of a circular rib.

10. In a hypodermic syringe structure a capacity-reducible tubular ampule of plastic material having an integral, elongated, hollow, substantially cylindrical neck of elastic material with its bore being of substantially uniform diameter, said neck having in its bore intermediate its inner and outer ends an internal, laterally-extending, circumferential rib integral with said neck; and a needle assembly including a substantially cylindrical hub of substantially rigid material slidably receivable in the said neck bore and forcible at least partly past said rib to temporary locking engagement with the latter with stretching of said rib and swelling of said neck thereat.

11. The syringe structure as defined in claim 10 characterized by location of said rib at a point farther from the inner end of said neck than the length of said hub with the diameter of the latter being appreciably greater than the diameter of the constriction defined by said rib, whereby said hub may be forced completely past said rib to temporary locking engagement therewith either in an inward position with the outer end of said hub juxtaposed to the inner side of said rib or in an outward position with the inner end of said hub juxtaposed to the outer side of said rib.

12. The syringe structure as defined in claim 9 characterized by the provision of a circumferential groove in said hub between its ends into which said rib may snap when brought to alignment therewith.

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