Dec. 20, 1955 M. L. LOCKHART 2,727,516

MEDICAL SAMPLING DEVICES AND SPECIMEN CONTAINERS

Filed March 19, 1953

Fig. 1.

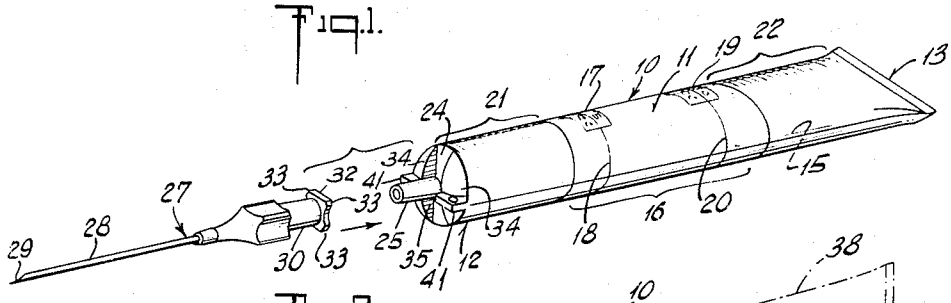


Fig. 2.

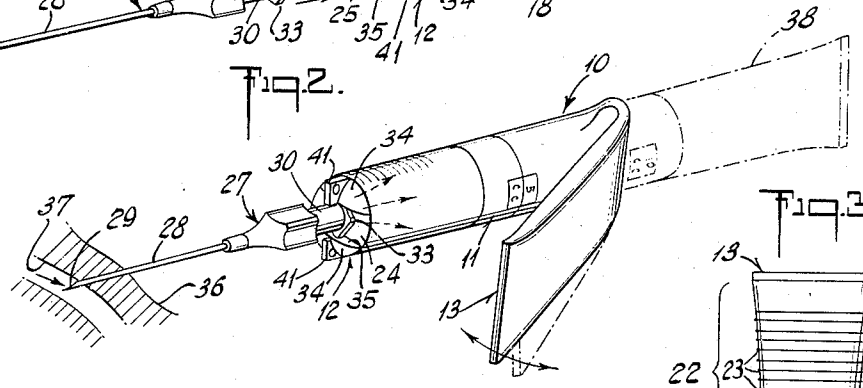


Fig. 3.

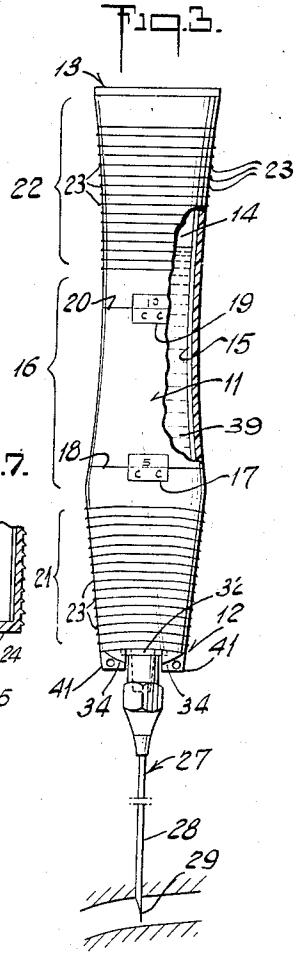


Fig. 6.

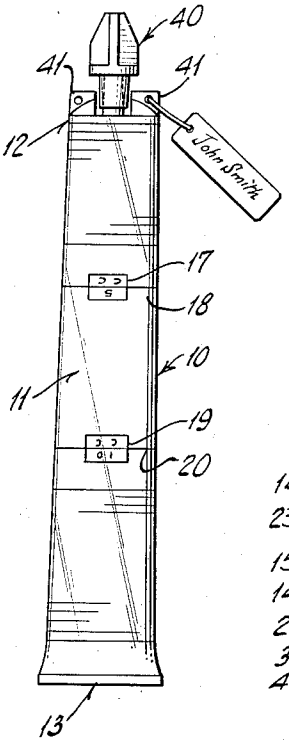


Fig. 5.

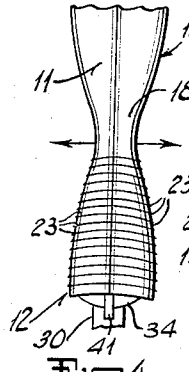


Fig. 7.

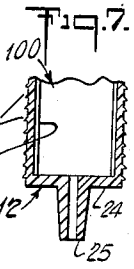
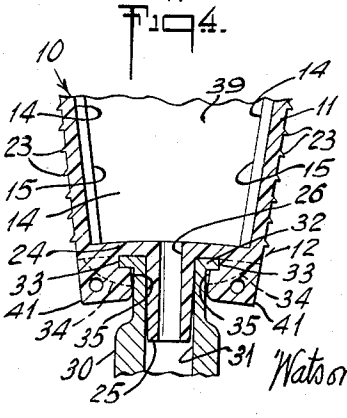


Fig. 4.



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MEDICAL SAMPLING DEVICES AND SPECIMEN CONTAINERS

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14 Claims. (Cl. 128—276)

The present invention relates to body fluids sampling devices and specimen containers useful to the medical profession, which may be employed to advantage with cannulas and hypodermic syringe needles for withdrawing blood samples and are useful thereafter in processing the same. More particularly, it relates to improvements of the devices of this type which are illustrated in my copending patent applications Serial Nos. 309,421 and 336,467, respectively filed September 13, 1952, and February 12, 1953.

A general object of the present invention is to provide such suction devices and parts thereof which are of simple construction readily producible on an economical basis, and are easily assembled and efficiently employable; and that feature elastic, collapsible tubular containers or tubes of unique construction which may be provided with novel means readily to receive and temporarily to anchor thereto in an unusually secure manner hub structure of a "Luer-lok" or similar type of cannula or hollow needle, which assures secure handling, and which may be securely attached to a patient's clothing.

A more specific object of the present invention is to provide in such suction devices collapsible tubes readily formed or molded from elastic plastic material, preferably light-transmitting, so as to permit ready filling with blood or other body fluids by pinching and folding the side walls thereof and releasing, with one end of such tubular structure closed by head means having a duct element or hollow neck adapted readily to be telescopically received in a needle hub socket and anchoring means distortably to engage hub flange elements for secure temporary anchorage of the needle, the pinching and folding operations being dictated by certain tube structure in a manner to enhance the anchorage.

Another object of the invention is to provide such collapsible tubes with grip-assuring means effectively to minimize or eliminate any tendency of the device to spring free and escape during the pinching, folding and/or release thereof.

A further object of the invention is to provide such collapsible tubes of a construction wherein may be readily formed with the molding of needle-anchoring lugs or projections pierced ears for pin attachment to patient's garments and/or identifying tags.

A still further object of the present invention is to provide uniquely simple structural embodiments of such elastic plastic collapsible tubes 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 elementts 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 drawing, in which:

Fig. 1 is an exploded perspective view of an embodiment of the elastic collapsible tube of the present invention and a Luer-lok type hypodermic syringe needle, illustrating the mounting of the latter to the head end of the tube container;

Fig. 2 is a perspective view of the assembly resulting from manipulative mounting of the needle on the tube container of Fig. 10, and illustrating insertion of the piercing end of the needle subcutaneously to a vein after volume-reducing manual collapse of the tube and suction-creating release thereof to draw a sample of blood into the tube;

Fig. 3 is a side elevational view, with parts broken away and in section, of the device illustrated in Fig. 2, after the elastic collapsible tube container thereof has been partially released to draw blood thereinto by suction;

Fig. 4 is an enlarged detailed axial section of the head end portion of the collapsible tube and mounted needle hub illustrated in Fig. 3;

Fig. 5 is a side elevtaional view, with parts broken away, of the structure shown in Fig. 3, illustrating the final step of release of the elastic collapsible tube container to complete the suction loading thereof with a blood sample;

Fig. 6 is a side elevational view of the collapsible tube container of the Figs. 1 and 2 device after a fluid sample has been drawn thereinto and it has been capped and tagged for identification; and

Fig. 7 is an axial section, with parts broken away, of the head end of a modified form of the elastic collapsible tube container of the present invention.

Referring to the drawings, in which like numerals identify similar parts throughout, it will be seen that embodiments of the present invention are adapted to use as body fluids sampling devices and specimen containers of the types illustrated in my above identified copending patent applications and useful to the medical profession in the taking of such samples, such as samples of blood, and/or processing thereof including centrifuging. Accordingly, an embodiment of the present invention, as illustrated in Figs. 1 to 6 incl., may take the form of a flexible, elastic collapsible tube or tubular container **10**, preferably formed of light-transmitting material to permit one readily to see into the chamber thereof, such as a polyethylene composition. The elastic plastic collapsible tube **10** of the present invention preferably is molded from substantially transparent polythene. The elastic plastic collapsible tube **10** preferably is provided with a substantially cylindrical, flexible, elastic side wall section **11**, closed at one end by head means **12**, preferably molded integral therewith, and at the other end **13** by pinching of and sealing the opposite sides together to form a closed collapsible tube type of container structure having an internal chamber **14**.

Since head means **12** is preferably molded integral with the side walls section **11**, prior to closure at the opposite end **13** the tubular container is in the form of a deep cup. The molding thereof produces a pair of diametrically-opposed, longitudinally-extending, internal, stiffening seam beads **15**, **15** which are utilized in the incorporation of an advantageous feature of the collapsible tube of the present invention, as will be explained later.

In the molding of the elastic plastic collapsible tube **10**, a medial zone or circumferentially-extending band **16** thereof preferably is provided with a substantially smooth external surface so as to facilitate visual identification

thereon of volume markings formed in the molding, such as the "5 cc." panel **17** and associated circumferential rib line **18**, and the "10 cc." panel **19** and its associated circumferential rib line **20**. With the collapsible tube **10** inverted with its head means **12** extending downwardly, fluid drawn into the tube by suction will be of a quantity of about 5 ccs. when the surface thereof is substantially aligned with the volume line **18**, and about 10 ccs. when the surface thereof is substantially aligned with the volume line **20**.

In accordance with another feature of the present invention, external surfaces of the tube side walls **11** are provided with means to enhance or assure secure manual grip. Molded plastic composition, particularly elastic plastic, of the type preferred for construction of the present tubes, frequently has a slippery surface that may be rendered more slippery if the tube or hands are damp; and collapse of the elastic plastic tubes of the present invention and release thereof to create suction requires considerable manipulation of their side walls. At least the external surfaces of end zones **21** and **22** of the side walls **11** are suitably roughened or provided with grip-enhancing means or projections, preferably in the form of a plurality of circumferentially-extending, axially-spaced, external ribs **23—23**, as is best seen from Figs. 3 and 4; although, if desired, substantially the entire external side wall surfaces may be provided therewith.

As indicated in Fig. 4, the head means or portion **12** of the elastic plastic collapsible tube **10** comprises a transversely-extending head wall **24** having a hollow, coaxially-extending tubular neck **25** molded integral therewith, and provided with a passage or bore **26** in communication with the chamber **14**. In the form of the invention illustrated in Figs. 1 to 6 incl., the elastic plastic collapsible tube **10** is preferably provided with means for anchoring to the head end **12** a Luer-lok hypodermic needle **27**. As is well known, such a needle unit **27** comprises a hollow cannula or needle **28** having a sharp piercing end **29** for subcutaneous insertion and coaxially mounted upon a socketed metal hub **30**. As is best seen in Fig. 4, the hub **30** is provided with an axially-extending socket **31** adapted telescopically to receive the collapsible tube neck **25** for communicating the needle bore with the container chamber **14**. Adjacent the mouth of the socket **31**, hub **30** is preferably provided with a circumambient flange **32** having arcs or portions thereof omitted or removed substantially at quarter points so that the base end of the hub is substantially rectangular in shape, as shown in Fig. 1, and to provide two pairs of diametrically-opposed engaging projections or wings **33—33**.

In accordance with one feature of the present invention, as embodied in the structure of Figs. 1 to 6 incl., the head end **12** of the collapsible tube **10** is provided with means for anchoring such a needle unit **27**, preferably in the form of substantially longitudinally-extending, laterally-spaced, integral projections or lugs **34, 34** in the form of thickened arcuate portions of said head end, and having opposed faces **35, 35** arranged in laterally-spaced relation on opposite sides of the base of the neck **25**. Being of elastic material, the faces **35, 35** of the anchoring projections or lugs **34, 34** will permit projections or wings of harder material, such as metal, to dig therein for temporary anchorage. Accordingly, the tips of a diametrically-opposed pair of metallic wings or projections **33, 33** on the needle hub **30** are spaced apart a distance appreciably greater than the lateral spacing of the opposed faces **35, 35** of the anchoring lugs **34, 34** while the external diameter of the needle hub **30** preferably is somewhat less than the spacing between those lug faces. As a result, an operator may readily mount the needle unit **27** upon the head end **12** of collapsible tube **10** by telescoping the socketed hub **30** over the tube neck **25** with the shaped flange **32** oriented relative to the space between the opposed pair of anchoring lugs **34, 34**, as illustrated in Fig. 1, to be receptive therein. Then, the operator rotates the needle hub **30** on the collapsible tube neck **25** approximately through an angle of about forty-five degrees in either direction so as to turn a pair of opposed, engaging, needle hub projections **33, 33** into the faces **35, 35** of the anchoring lugs, as illustrated in Figs. 2 and 4. The elasticity of the anchoring lugs **34, 34** permits the engaging projections or hub wings **33, 33** to dig into the lug faces **35, 35** and the elastic material thereof to flow around those hub wings, as illustrated in Fig. 4, securely to anchor the needle hub **30** to the collapsible tube container **10**.

It has been found that when a needle unit **27** of that type is so mounted on such a collapsible tube **10**, if the opposite tube side walls are pinched toward each other, particularly in the vicinity of the head end **12**, in a plane substantially parallel to the planes of the lug faces **35, 35**, the resultant attendant spreading of the diametrically-opposed, longitudinal folds in the tube side walls at the locality of pinch and accompanying convergence of the intermediate side wall portions will cause the opposed faces **35, 35** of the anchoring lugs **34, 34** to be levered outwardly to relative oblique diverging positions. This may be enhanced if diametrically-opposed portions of the tube side walls are stiffened, such as by internal ribs or beads **15, 15**, when they are arranged in a plane substantially parallel to the opposed lug faces **35, 35**. Thus, when pinch is applied to opposite side walls of the tube **10**, in the vicinity of the mid-portions of the bases of the anchoring lugs **34, 34**, they will be levered outwardly so that the opposed anchoring faces **35, 35** thereof will diverge and spread. This spreading action decreases the effectiveness of the clamping action of the anchoring lugs **34, 34** relative to the needle hub wings **33, 33**. As a result, the effectiveness of the secure anchorage of the needle unit **27** to the collapsible tube **10** may be reduced sufficiently to permit the needle hub to be disengaged from the tube head **12** when the operator, after taking a blood sample, attempts to withdraw the needle **28** from a patient's flesh with pull upon the collapsible tube **10**. It is desirable that any psychological effect, which may result from the needle remaining in a patient's flesh when he had expected its withdrawal with pull away of the tube, is to be avoided.

In accordance with one feature of the present invention characterizing the structure of Figs. 1 to 6 incl., the anchoring lugs **34, 34** are oriented relative to the tube side wall structure in such manner as to cause such collapse pinching of the tube to tend to lever the anchoring lugs **34, 34** convergingly inward, rather than divergingly outward, so as to strengthen rather than weaken the anchorage of the needle unit thereto. This is accomplished by molding the anchoring lugs **34, 34** on the tube head **21** in such positions as to arrange the lug faces **35, 35** in planes substantially normal to the plane of the seam beads **15, 15**. It is natural for an operator to collapse the side walls of the tube **10** by pinching in localities which at least visually appear to be and actually are more flexible. This, of course, is in localities intermediate the beads **15, 15**. As will be best noted from Figs. 3 and 4, the pinching in such localities tends to spread or flare the beads **15, 15** and to pull inwardly and/or bend the weaker or more flexible portions of the head wall **24** in the space between the lugs **34, 34**. As a result, the anchoring lugs **34, 34** are levered convergingly inward rather than divergingly outward, so that their opposed engaging faces **35, 35** approach rather than recede from each other. Consequently, the anchoring lugs **34, 34** become more securely engaged about the needle hub wings **33, 33** instead of gripping them less securely. As a result, the structure of the collapsible tube **10** of Figs. 1 to 6 incl. makes certain that the operator naturally will so manipulate the tube in the taking of blood samples as to assure that, after a desired quantity of the blood has been sucked into the tube, pull upon the latter will remove the needle from the patient's flesh. Freeing of the needle from the tube may be facilitated by pinch in the plane of the seam beads **15, 15**.

In operation of the embodiment illustrated in Figs. 1 to

6 incl., particularly for the purpose of taking a sample of a patient's blood, the operator will mount needle unit **27** upon the elastic collapsible tube **10** in the manner indicated above and as illustrated in Figs. 1 and 2. The operator then collapses the side walls **11** of the tube by pinching toward each other opposed portions thereof which are of relatively high flexibility, i. e., squeezes in localities intervening the seam beads **15, 15** which constitute visual delineating means identifying those intervening portions of higher flexibility, and thus reduces the internal capacity of the chamber **14** with expulsion of air through the needle. The operator may further reduce the internal capacity of the tube chamber **14** with further expulsion of air by then folding over the closed end **13** toward the head end **12** so as to lap together the opposite ends of the tube. He then thrusts the needle tip **29** into a patient's flesh, such as that illustrated at **36** in Fig. 2, to communicate with a vein, such as that illustrated at **37** in Fig. 2. Thereafter, the operator releases the end **13** of the tube **10** while retaining a firm grip upon the roughened head end portion **21**, so that the released end will automatically swing back, due to the elasticity of the tube, to the full line position illustrated in Fig. 2 and finally to the dot-dash position at **38**. This action increases the internal capacity of the chamber **14**, thereby creating suction to draw a quantity of blood up into the tube, such as is illustrated at **39** in Fig. 3. Finally the tube walls will substantially recover to their full line positions shown in Fig. 1 with opposed portions of the tube walls intervening the seam beads **15, 15** moving outwardly in opposite directions, as indicated by the arrows in Fig. 5.

The operator controls the amount of the fluid sample drawn into the tube chamber **14** by using the volume lines **18** and **20** and information indicia at **17** and **19**. Of course, he may not with accuracy withdraw the precise quantity of blood desired in the tube in the initial instance while attempting to employ such volume markings. However, with proper instruction, he should learn readily that the surface of the quantity of blood in the tube chamber **14** should be collected to a point somewhat beyond the selected volume marking to accommodate a volume differential inherent in any such distortion of the tube walls in the creating of the suction. Then, upon removal of the needle **28** from the patient's flesh, he may reduce the volume of the sample taken to a precise amount as dictated by the selected volume marking by discharging a small amount of the sample through the withdrawn needle by slight flexing of the tube walls **11**.

Thereafter, the operator removes the needle unit **27** from the tube **10** by again rotating the needle hub **30** through approximately forty-five degrees, so as to free the hub wings **33, 33** from engagement with the anchoring lugs **34, 34**, and withdrawing the needle hub from off of the tube neck **25**. The operator then closes the loaded tube **10** by mounting any suitable cap structure on the neck **25**, such as that illustrated at **40** in Fig. 6 which constitutes the subject matter of my above identified patent application Serial No. 336,467. The loaded and closed tube is then ready for processing in accordance with established procedure, such as by centrifuging discussed in that copending application.

It is desirable practice physically to associate a sample with the patient for ready identification. Thus, in accordance with one embodiment of the present invention and as illustrated in Figs. 1 to 6 incl., apertured ears **41, 41** preferably are provided on the elastic collapsible tube **10**. Such ears **41, 41** are preferably molded integral with the anchoring lugs **34, 34**; and in the preferred form constitute substantially axially-extending fins substantially aligned with the seam beads **15, 15**, whereby they may serve to stiffen the lugs and aid in the levering action of the latter. In such positions, the apertured ears **41, 41** form strengthening or stiffening fins for the anchoring lugs **34, 34** in the plane of the seam beads, **15, 15**, so as to enhance the levering action previously described. One

of the apertured ears **41** may be employed for reception of a safety pin to attach the container to a patient's garment, and, as illustrated in Fig. 6, the other apertured ear may be employed for connecting thereto an identifying tag to facilitate identification of the contained sample and also, if desired, the patient.

As illustrated in Fig. 7, the elastic plastic collapsible tube of the present invention may be provided in a form in which the needle anchoring lugs **34, 34** are omitted. Such a simplified form of tube **100** is particularly useful in connection with the taking of samples of body fluids where the needle is not or need not be employed as an adjunct to the taking of the sample. However, needles having socketed hubs, such as of the Luer-lok type, may be mounted upon the neck **25** of the elastic plastic collapsible tube **100** of the Fig. 7 embodiment with reliance upon frictional grip between the external surface of the tube neck **25** and the internal surface of the needle hub socket **31**. Such frictional engagement may be considerable, particularly since the tube neck **25** preferably is molded integral with the body of the tube and thus from elastic material, preferably polythene. As a consequence, when the tube neck **25** is jammed with considerable force into a needle hub socket which, due to relative dimensions, causes appreciable contraction of the tube neck, a secure frictional grip is attained. Preferably, the elastic plastic collapsible tube of the Fig. 7 embodiment is provided with the other features of the embodiment of Figs. 1 to 6 incl. and, more particularly, the grip-enhancing means such as the ribs **23—23**.

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 medical sampling and specimen container comprising, in combination; an elongated, elastic plastic, collapsible tube closed at one end and having another head end extending transversely of and integral with the side walls of said tube to define an internal liquid chamber, the side walls of said tube being provided with longitudinally-extending, diametrically-opposed, stiffening seam beads, extending to the vicinity of said head end; an integral hollow neck coaxially extending from said head end with its bore in communication with said chamber; and a pair of external, longitudinally-extending, laterally-spaced, needle-anchoring projections on said head end disposed on opposite sides of the base of said neck at points in the vicinity of said beads, whereby pinching together opposite portions of the tube side walls intermediate said beads levers said needle-anchoring projections inwardly toward each other in converging relation.

2. A medical sampling and specimen container comprising, in combination; an elongated, elastic plastic, collapsible tube closed at one end and having another head end extending transversely of and integral with the side walls of said tube to define an internal liquid chamber; an integral hollow neck coaxially extending from said head end with its bore in communication with said chamber; visual delineating means identifying opposed relatively highly flexible portions of said side walls in the vicinity of said head end to be pinched toward each other for chamber-capacity reduction; and a pair of external, longitudinally-extending, laterally-spaced, needle-anchoring projections on said head end disposed on opposite sides

of the base of said neck at points intermediate said defined opposed portions whereby pinching together the latter levers said needle-anchoring projections inwardly toward each other in converging relation.

3. A medical sampling and specimen container comprising, in combination; an elongated, elastic plastic, collapsible and foldable tube having a transverse head; a hollow neck extending coaxially from said head; visual delineating means identifying opposed relatively highly flexible side wall portions of said tube in the vicinity of said head to be pinched toward each other for chamber-capacity reduction; and a pair of longitudinally-extending, laterally-spaced, needle-anchoring projections fixed to said head and disposed on opposite sides of said neck at points intermediate said opposed defined side wall portions.

4. A medical sampling and specimen container comprising, in combination; an elongated, elastic plastic, collapsible and foldable tube having an integral head; a hollow integral neck extending coaxially from said head; visual delineating identifying opposed relatively highly flexible side wall portions of said tube in the vicinity of said head to be pinched toward each other for chamber-capacity reduction; and a pair of longitudinally-extending, laterally-spaced, needle-anchoring lugs integral with said head and disposed on opposite sides of said neck at points intermediate said opposed defined side wall portions.

5. A medical sampling and specimen container comprising, in combination; an elongated, elastic plastic, collapsible tube closed at one end and having another head end extending transversely of and integral with the side walls of said tube to define an internal liquid chamber; an integral hollow neck coaxially extending from said head end with its bore in communication with said chamber; a pair of diametrically-opposed, longitudinally-extending, internal side wall-stiffening seam beads extending to and merged with said head end; and a pair of external, longitudinally-extending, laterally-spaced, needle-anchoring lugs integral with said head end and having opposed faces disposed in planes substantially equidistantly spaced on opposite sides of the base of said neck, said lugs being located on said head end at points of mergence of said seam beads with said head end and in positions which dispose said faces in planes substantially normal to the plane of said seam beads, whereby pinching together opposite portions of the tube side walls intermediate said beads levers said opposed lug faces inwardly toward each other in converging relation.

6. The container as defined in claim 5 characterized by said lugs constituting thickened arcuate portions of said head end each substantially medially merged with one of said integral seam beads, the intervening thinner portion of said head end centrally carrying said integral neck and being relatively flexible on diametrically opposite sides of said neck base.

7. The container as defined in claim 6 characterized by said lug faces being disposed in substantially parallel planes whereby pinch together of side walls of the tube intermediate said seam beads swing said lug faces convergingly inward toward each other and similar pinch in a normal direction swing said lug faces divergingly outward away from each other.

8. The container as defined in claim 5 characterized by the provision of grip-assuring projections on the external side wall surfaces of said tube at least adjacent its opposite ends.

9. The container as defined in claim 8 characterized by the provision of said projections in the form of longitudinally-spaced, circumferentially-extending ribs.

10. The container as defined in claim 9 characterized by substantial confinement of said ribs to end zones with an intermediate zone carrying volume markings.

11. The container as defined in claim 5 characterized by the provision of each lug with a pierced ear.

12. The container as defined in claim 5 characterized by the provision of each lug with a pierced ear constituting a substantially axially-extending fin in the vicinity of the seam bead which is merged with that lug.

13. The container as defined in claim 6 characterized by a pair of longitudinally-extending fins each integral with the outer end of one of said lugs to stiffen the same and being substantially aligned with the seam bead which is merged with that lug, each of said fins being pierced.

14. A blood sampling container comprising an elongated, elastic plastic, collapsible and foldable tube closed at one end and having an integral transverse head at the other end; an elongated, outwardly-tapered, integral neck coaxially extending from said head communicable with the interior of said tube; a series of circumferentially-extending, axially-spaced, small raised ribs on the exterior surface of said tube adjacent said head, and a similar series of said ribs adjacent said closed end; a medial zone defined between said two series of ribs and having volume markings therein, the side walls of said tube being provided with longitudinally-extending, diametrically-opposed, stiffening seam beads, extending to the vicinity of said head; and a pair of external, longitudinally-extending, laterally-spaced, needle-anchoring projections integral with said head disposed on opposite sides of the base of said neck at points in the vicinity of said beads, whereby pinching together opposite portions of the tube side walls intermediate said beads levers said needle-anchoring projections inwardly toward each other in converging relation.

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