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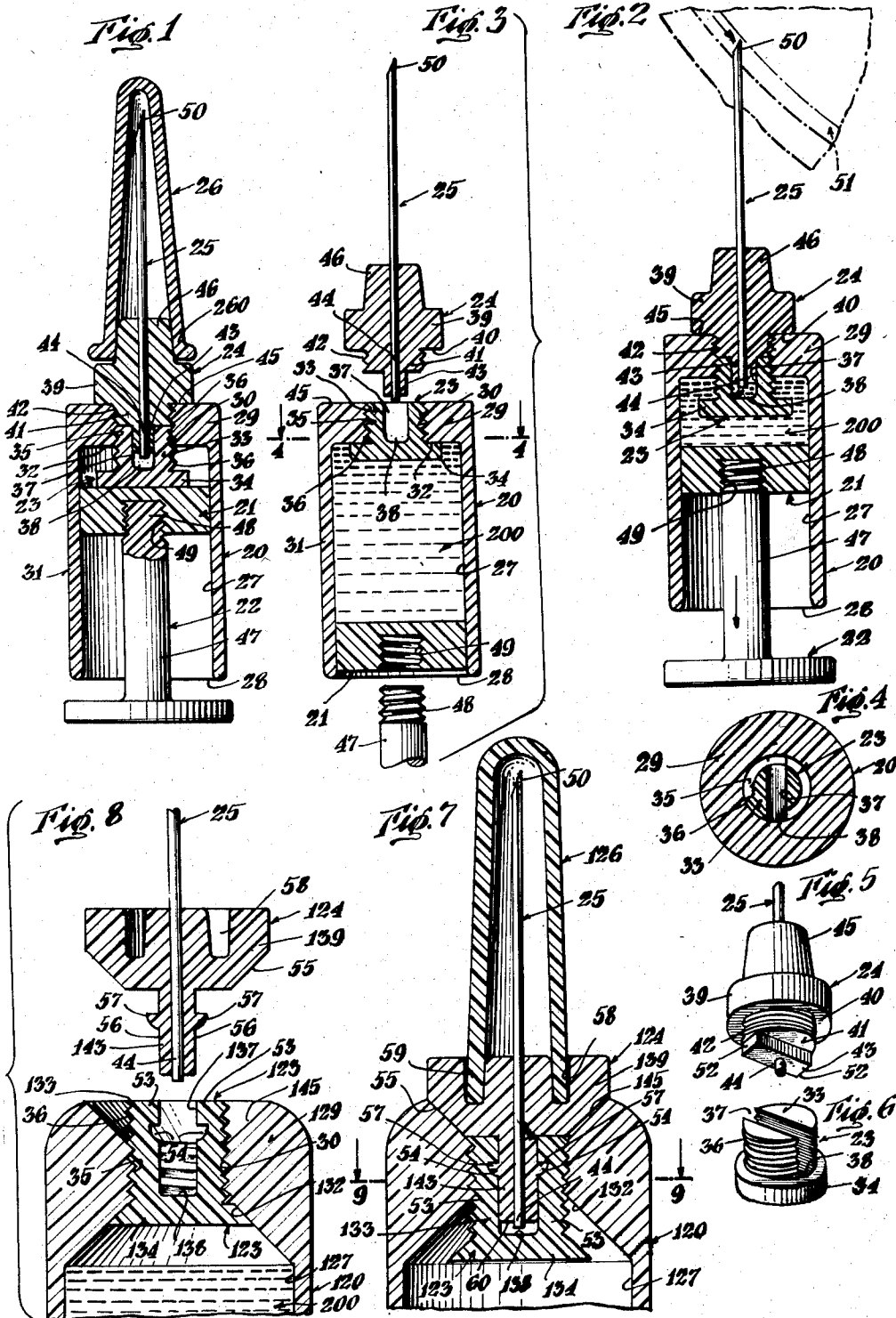
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HYPODERMIC AND BODY FLUIDS SAMPLING SYRINGES

Filed June 12, 1957

2 Sheets-Sheet 1



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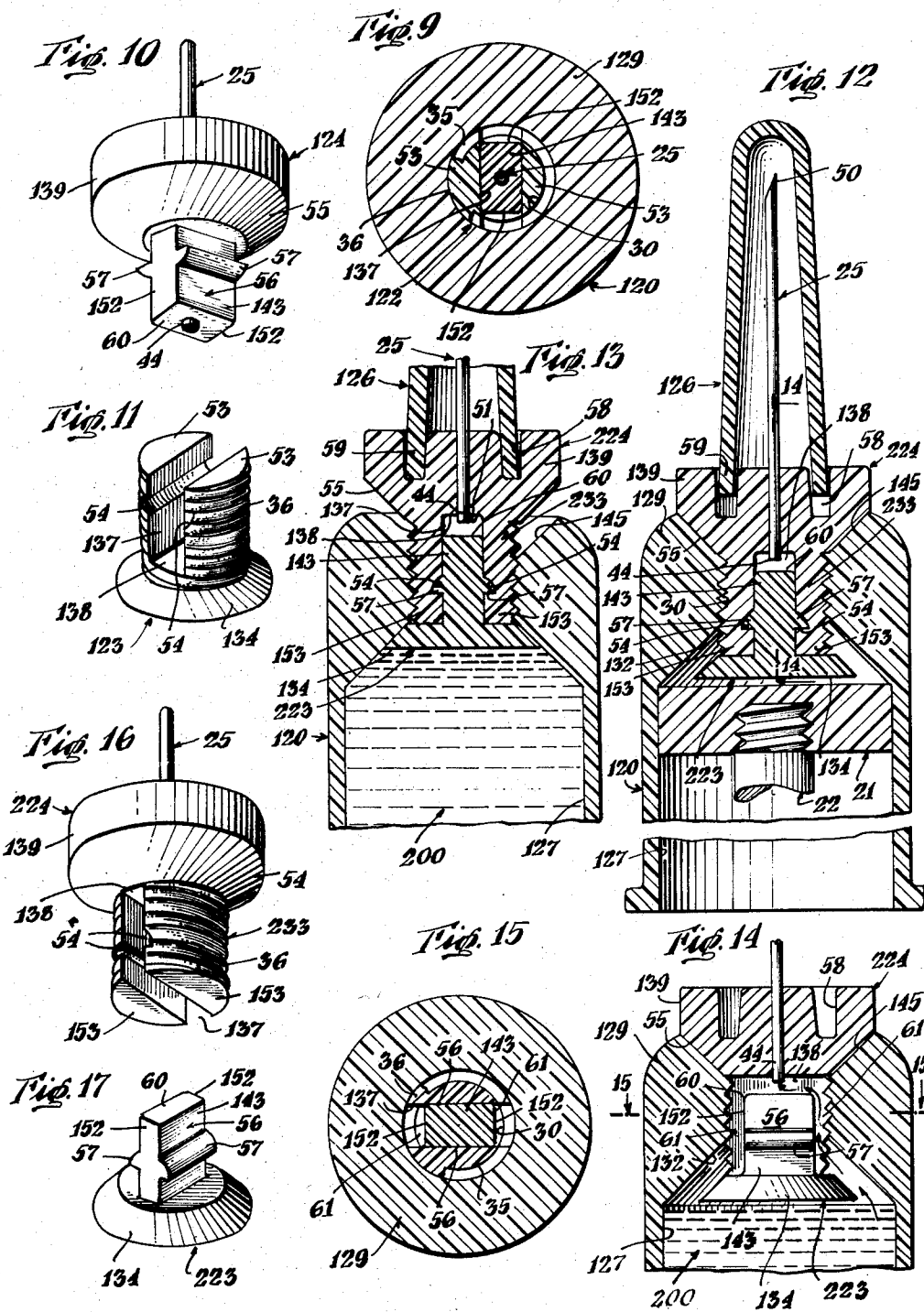
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HYPODERMIC AND BODY FLUIDS SAMPLING SYRINGES

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21 Claims. (Cl. 128—218)

The present invention relates to syringe structures designed both for expelling liquid contents and aspirating liquids and, more particularly, to such structures which may be employed for hypodermic administration of parenteral liquids or for taking specimens of body fluids and storing or transporting the latter.

A general object of the present invention is to provide such syringes which are of unusually simple construction while providing for efficient valving of the head passages leading to and from their liquid chambers, such as by way of cannula lumens, preferably the valving structure of useful embodiments being in the form of a unique sub-assembly longitudinally translatable with respect to the chamber structure both effectively to perform the valving and to permit ready assembling and disassembling of the parts thereof.

A more specific object of the invention is to provide such syringe construction in a form which after pre-sterilization will effectively maintain the sterile conditions of the interiors and needles thereof until use while permitting, if desired, removal of the needle and its mount from the chamber structure after valve closure of the latter, thereby allowing efficient use of the chamber structure as an effective storage or transporting container for a liquid specimen after aspiration therein with the use of the needle.

Another object of the invention is to provide the syringe in a single-use disposable, parenteral liquid administrative type wherein the chamber structure with attached needle when obtained may already be loaded with a charge of parenteral liquid ready for hypodermic administration by valving and expulsive manipulation of the syringe, or which is well adapted to loading by the operator just prior to such hypodermic administrative use.

A further object of the invention is to provide such syringe construction in such forms as to make unnecessary the use of relatively expensive double-ended needles and chamber-closing needle-puncturable diaphragms which may require measures to avoid needle lumens from being plugged by diaphragm material in the puncturing of the diaphragms or provision of means, such as stylets, to clear the plugging material therefrom, the single-ended needles hereof being firmly and rigidly held by the syringe head structure without tendency to yaw or wobble during insertion in body tissue.

Still another object of the invention is to provide structural embodiments of the syringe which are readily and economically constructed in mass production with the parts being easily and simply assembled, the construction thereof permitting assured sterilization of the syringes with the sterile condition thereof being readily and effectively maintained, such structural embodiments permitting 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, combinations of elements, and arrangement

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of parts, which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

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

Fig. 1 is a longitudinal or axial sectional of parts of an embodiment of the syringe of the present invention, showing the component parts connected together and ready for use to aspirate a specimen of body fluids;

Fig. 2 is an axial section of the structure shown in Fig. 1, showing the cannula or needle uncovered with its tip inserted in body tissue to communication with a vein, depicted in dot-dash lines, indicating loading of the barrel chamber with a liquid specimen by piston retraction;

Fig. 3 is an axial section of the structure shown in Fig. 2, with parts broken away, showing the chamber thereof fully loaded with the liquid specimen and barrel valve closed, the needle sub-assembly and the plunger being shown disconnected therefrom;

Fig. 4 is a transverse section taken substantially on line 4—4 of Fig. 3;

Figs. 5 and 6 are perspective views, respectively, of the hub part and the valve part together constituting a two-part cannula hub and valve structure of the embodiment illustrated in Figs. 1 to 4 inclusive;

Fig. 7 is an enlarged longitudinal or axial section, with parts broken away, of another embodiment of the syringe of the present invention which has its component parts preset, pre-sterilized and ready for use, parts thereof being illustrated in the relative positions shown in Fig. 1;

Fig. 8 is an axial section of the structure shown in Fig. 7, with parts broken away, illustrating parts thereof in the relative positions of Fig. 3 after loading with a liquid specimen;

Fig. 9 is a transverse section taken substantially on line 9—9 of Fig. 7;

Figs. 10 and 11 are perspective views respectively similar to Figs. 5 and 6, of the hub and valve parts of the embodiment illustrated in Figs. 7 to 9 inclusive;

Fig. 12 is a longitudinal or axial section of still another embodiment of the present invention, with parts broken away, showing the barrel valve open and the parts connected together substantially in the positions of equivalent parts in Figs. 1 and 7 but with the needle-protective cap loosened to facilitate flow through the needle sub-assembly of an appropriate sterilizing agent;

Fig. 13 is an axial section similar to Fig. 12 but with additional parts broken away, showing the cannula or needle tightly covered and the barrel valve closed to seal the medicament therein, with the piston plug in a bore-closing position in the proximal end of the barrel broken away in this view;

Fig. 14 is a sectional view similar to Fig. 12 taken on line 14—14 thereof in a plane substantially normal to the plane of sectioning of Fig. 12, with parts broken away, the barrel chamber being shown as charged with a quantity of parenteral liquid and the needle-protective cap removed for injective use of the syringe;

Fig. 15 is a sectional view taken substantially on line 15—15 of Fig. 14; and

Figs. 16 and 17 are perspective views, respectively, of the hub and valve parts of the embodiment of Figs. 12 to 15 inclusive, similar to the perspective views of Figs. 10 and 11.

In the drawings like numerals identify similar parts throughout. It will be seen therefrom that the cannula or hypodermic needles of the illustrated syringes are of conventional single-ended type, preferably made of steel, each having a longitudinally-extending lumen or bore and a sharpened distal tip. The various illustrated embodi-

ments of the syringe of the present invention are featured by a chamber structure for containing liquid, either of the parenteral or body fluids types, and with wall means or a portion thereof being moveable to vary the chamber capacity either for aspiration thereinto of such liquid or expulsion of liquid contents. By way of example, the illustrated embodiments have been shown as being of the barrel and plunger type wherein the moveable wall portion of the chamber is in the form of a piston head or plug of suitable elastic material, such as some conventional rubber-like composition. The other parts in the illustrated embodiments preferably are formed of suitable plastic materials. Elastic and relatively rigid synthetic resins or plastic materials which may be used to advantage from which to mold or otherwise form the barrel, plunger rod, cap, valve, and needle hub units or parts of the illustrated embodiments may be selected from those which are compatible with the intended parenteral liquid contents or body fluids specimens to be taken with the use thereof, and not contaminable of body tissue. These are, by way of example, ethyl cellulose, cellulose acetate, polyethylene, polystyrene, vinyl chloride-vinyl acetate copolymer, vinyl chloride resin, phenolic resin composition, ureaformaldehyde composition, butyl methacrylate, rubber compositions of both the natural and synthetic types, such as natural gum, rubber hydrochloride and neoprene, and other materials having similar properties. It is preferred to employ a polyethylene as the elastic plastic and a polystyrene as the relatively rigid plastic in view of the non-contaminable, compatible and physical properties thereof, as well as from an economy point of view since embodiments of the present invention are intended to be marketed as disposables. In some of the illustrated embodiments springiness of parts relative to others may be required for mutual assembly and if one such part is formed of relatively rigid material, an elastic plastic material is selected for formation of the other part. For example, in the embodiments where valve and needle hub parts are assembled together in interlocking fashion, that part which is receptive of the other part may be formed of suitable elastic plastic material with the latter formed of relatively rigid plastic material, and the barrel unit may be formed of either of such plastic materials. If desired, the barrel unit, the valve part and the needle hub part may all be formed from polyethylene or the barrel unit and the part of the two-part cannula hub and valve structure which is received in the other part of the latter may be formed of polystyrene.

As illustrated in Figs. 1 to 6 inclusive an embodiment of the present invention may comprise a barrel structure 20, a slidable piston plug or head 21, plunger means 22, a valve part 23, a cannula hub part 24 carrying a single-ended needle 25, and a needle-protective cap 26. Barrel 20 is provided with a cylindrical bore 27 having an open back or proximal end 28 with the distal end of the barrel defined by a cross head structure 29 having a through inlet and outlet opening 30 provided axially therein. As illustrated in Fig. 3, the cylindrical side wall 31 of the barrel 20, the piston head 21 and the cross head structure 29 together define therebetween the chamber, which may be filled with a quantity of liquid 200. The head structure opening 30 may be suitably closed off by the valve part 23, as shown in Fig. 3.

The opening 30 through the cross head structure 29 is surrounded by a valve seat 32 at the chamber end thereof. The valve part 23 has a shank or stem portion 33 engaged in the head structure opening 30 and an enlarged inner end 34 serving as a valve head which is seated in a fluid-tight manner against the valve seat 32 in the outward valve-closing position illustrated in Fig. 3. Since the valve part 23 is to be translated longitudinally or axially between the outward valve-closing position shown in Fig. 3 and the inward valve-open position shown in Figs. 1 and 2 complementary camming surfaces are provided to accomplish such translation upon relative ro-

tation. For this purpose, the complementary camming surfaces may be provided in the form of mutually engaged male and female helical threads with the wall of the opening 30 carrying female thread 35 and the valve stem 33 carrying male thread 36.

As a part of a fluid flow passage, the outer or distal end of valve stem 33 preferably is provided with a longitudinally-extending transverse or cross slot 37 outward of the valve head 34 having a lateral bottom portion 38 serving as a flow port. In the outward valve-closing position, illustrated in Fig. 3, the mouth or port of the fluid flow passage provided by either end of the slot bottom portion 38 is at a point where communication thereof with the barrel chamber or bore 27 is cut off both by the wall of opening 30 and contact between valve head 34 and its seat 32. However, in the inward valve-open position of the valve part 23, illustrated in Figs. 1 and 2, the port provided by bottom portion 38 of slot 37 is at a point accessible to the barrel chamber for flow of liquid therebetween.

The needle hub part 24 has an enlargement 39 which may serve as a manually-engageable element for rotating it relative to the barrel 20, and may, if desired, be knurled to facilitate grasp thereof by the operator's fingers. The finger-engageable enlargement 39 provides an annular transverse seating surface 40 about the root of a coaxially-extending stem 41, preferably provided with a male helical thread 42 threadably engageable with the female thread 35 of the head structure opening 30. The inner end of the stem 41 includes, as a part thereof, a longitudinally-extending cross rib or tongue 43 which, as will be seen from Figs. 1 and 2, may be slid or inserted longitudinally into the outer portion of cross slot 37 of the valve part 23, short of the port bottom portion 38, for interfitting engagement so that the valve part and the hub part will be mutually rotated upon manual rotation of the latter.

The inner or proximal end 44 of the single-ended needle 24 extends axially through the hub part 24 so that its lumen or bore is in communication with the port space 38, intervening the bottom of the cross slot 37 and the inner end of the tongue 43, so that the fluid flow passage from or to the barrel chamber includes successively the transverse port space 38 and the needle lumen. A fluid-tight joint between needle hub 39 and barrel head structure 29 is assured by the annular seat 40 of the former snugly contacting the outer end surface 45 of the head structure. Preferably, needle hub part 24 includes a tapered neck 46 over which may be telescopically jammed the conical open proximal end 260 of the needle-protective cap 26, as shown in Fig. 1.

The plunger means 24 may be in the form of a headed rod or stem 47 having external threads on its distal end 48 threadably engaged in an internally-threaded socket 49 in the back end of piston head 22, as illustrated in Fig. 1, for retracting the latter in barrel bore 27, as indicated in Fig. 2.

Let it be assumed that Fig. 1 is representative of a presterilized, single use, disposable type specimen collection device suitably packaged and ready for use with its component parts pre-assembled as shown. To use this device, it would be removed from the package, the needle-protective cap 26 would be loosened from the hub neck 46 over which it had been jammed and the cap would be withdrawn from about the needle 25. The sharpened distal end 50 of the needle 25 would next be thrust into body tissue to communicate its lumen with a vein, as illustrated in dot-dash lines at 51 in Fig. 2. Retraction of the plunger rod 47 in the direction of the arrow shown in Fig. 2, will draw the piston plug 21 back in the barrel bore 27, increasing the chamber capacity with aspirating effect to draw a quantity of blood thereinto. Then the needle hub part 24 may be unscrewed from the head structure opening 30 axially translating the valve part 23 outward from the valve-open position, shown in Figs. 1 to 2, to the valve-closing position, shown in Fig.

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3, so that the valve head 34 securely seats against the head structure seat 32 in a fluid-tight manner securely to store in the barrel chamber the blood specimen. Such action frees the needle hub and needle sub-assembly from the barrel structure as is indicated in Fig. 3. Also, at the end of the aspirating operation, the plunger structure may be detached from the piston plug 21 by unscrewing its threaded end 48 out of socket 49. Thus the barrel structure 20, sealed at its head or distal end by the valve part 23 and at its proximal end by the piston plug 21, serves as an effective storage and/or transporting container. Also, such barrel structure, serving as a closed container carrying a specimen of body fluid, may have the contour and outside dimensions of the conventional blood specimen tube so that it may be placed directly into a centrifuge apparatus if its contents are to be centrifuged prior to being analyzed. The specimen contents of the barrel chamber 27 of such container construction preferably are removed by withdrawing the piston plug 21 from the proximal end 28 of the barrel and then either decanting or pipetting the fluid from the barrel bore.

It is to be understood that, of course, the relative dimensions of the parts illustrated in Figs. 1 to 6 inclusive have been selected only by way of example and in order more clearly to show them in an understandable manner since it will be desired that, when the piston plug or head 21 is adjacent the valve head 34 as in Fig. 1 preparatory to aspirating retraction, the remaining space in the barrel will be a minimum. For example, the valve head 34 may be of a diameter only slightly less than the diameter of the barrel bore 27 and the head structure opening 30 and valve stem 33 may be appreciably larger in diameter.

It will be understood from Figs. 5 and 6 that the tongue 43 is narrower or of appreciably less width than the cross slot 37 so that its end edges 52, 52 will be free of contact with the female thread 35 in the head structure opening 30. This permits ready insertion of the tongue 43 in the cross slot 37, when the valve and needle hub parts 23 and 24 are in their relative positions of Fig. 3 in the initial assembly of the syringe parts, after the valve part has been inserted in the barrel bore 27 and screwed up into the internally threaded opening 30. Such relative dimensions of these parts, or their equivalents, may serve an additional purpose of providing a portion of the fluid flow passage in other embodiments of the present syringe, as will be understood from the following description of the additional embodiments illustrated in the drawings.

In the embodiment illustrated in Figs. 7 to 11 inclusive barrel structure 120 is provided with a slightly modified form of cross head structure 129. In this embodiment, the inner face on the chamber side of head structure 129 is frusto-conical to form a tapered valve seat 132. The valve part 123 is provided with a frusto-conical valve head 134 which seats snugly in a fluid-tight manner into the conical seat 132. Also the outer or distal end face of the head structure 129 preferably is concaved to provide a frusto-conical seat 145 for a dual purpose to be explained later.

The valve part 123 has an externally-threaded stem 133 carrying male thread 36 threadably engaged with female thread 35 of head structure opening 30 and, as will be seen from Figs. 7 and 8, is appreciably longer than the latter. The valve part 123 has a longitudinally-extending cross slot 137 extended into the valve stem appreciably so as to position its bottom end portion 138 closely to the valve head 134 substantially in the position of port portion 38 of cross slot 37 of the first embodiment, and this slot subdivides the stem 133 into a pair of laterally-spaced legs 53, 53. Preferably the valve part 123 is made of elastic plastic, such as polyethylene, so that the legs 53, 53 are springy or flexible to be relatively spreadable for increasing the width of the slot 137 be-

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yond the point of confinement of the stem 133 in the head structure opening 30, i. e., in the area of the conical seat 145. The stem legs 53, 53 are provided with means for interlocking them with the needle hub tongue and in the areas of their flexibility where they can be spread apart readily by virtue of being free of confinement in the head structure opening 30 when the valve part 123 is in its outward valve-closing position, illustrated in Fig. 8. Such means for interlocking the hub part to the valve part may include transverse grooves 54, 54 in opposed faces of the cross slot 137.

In the Figs. 7 to 11 inclusive embodiment, the needle hub part 124 may have its manually-engageable enlargement 139 provided with a proximal frusto-conical face 55 adapted to seat into the conical recess 145 of the head structure 129 when the two-part cannula hub and valve structure is translated axially inward to move the valve part 123 to its inward valve-open position, as will be best seen from Fig. 7. The stem of the hub part 124 preferably is in the form of a relatively wide flat tongue 143 through which the needle inner end 44 extends. Opposite faces 56, 56 of the tongue 143 are provided with transverse ribs 57, 57 shaped complementary to the grooves 54, 54 in the opposed faces of the spring legs 53, 53. Preferably, the enlargement 139 of the hub part 123 is provided with an annular groove 58 into which the flared inner end 59 of the needle-protective cap 126 may be jammed.

Let it be assumed that the valve part 123 of the Figs. 7 to 11 inclusive embodiment is in the outward valve-closing position depicted in Fig. 8. The needle hub and needle sub-assembly may then be connected thereto by inserting the hub tongue 143 into the outer end of the valve part slot 137. Further inward thrust of the needle hub 124 will cause the interlocking side ribs 57, 57 to cam the outer free ends of the valve part legs 53, 53 laterally out away from each other to permit insertions of these ribs into the cross slot 137 until they are received in the transverse grooves 54, 54, thereby permitting the valve legs to snap back to their original parallel positions with the tongue ribs interlocked in the valve part grooves and with tongue 143 interdigitally interfitted with these legs. Thereafter, when the hub enlargement 139 is manually rotated, the valve part 123 is threadably retracted in the head structure opening 30 to the inward valve-open position depicted in Fig. 7, carrying with it the valve hub 124 to secure seating of its conical face 55 against the conical head structure seat 145 to assure a fluid-tight joint and dust seal.

Such threaded retraction or inward axial translation of the two-part cannula hub and valve structure of the Figs. 7 to 11 inclusive embodiment frees the valve head 134 from its conical seat 132 and moves the bottom portion 138 of the cross slot 137 into the chamber 127 to a point accessible to the chamber space or any fluid contents therein. It will be seen from Fig. 7 that the hub stem in the form of tongue 143 is appreciably shorter than the depth of the valve part groove 137, as in the embodiment of Figs. 1 to 6 inclusive, so that there is provided between the tip 60 of the tongue and the bottom of the slot 137 intervening space 138 to which the inner end 44 of the needle 24 and its lumen reach.

It will be seen from Fig. 9 that the relatively flat hub tongue 143, which snugly fits in the cross slot 137 of the valve part 123 between the laterally spaced legs 53, 53 thereof, is narrower or of appreciably less width than the cross slot, and in fact is of less width than the internal diameter of the internally-threaded head structure opening 30 so that the female thread 35 will not interfere with the interdigital insertion of the tongue into the slot. The lateral spacing between side edges 152, 152 of the tongue 143 and the female thread 35 of the head structure opening 30, which permits the ready interdigital engagement of the tongue with the valve part legs 53, 53, will be seen in Fig. 9.

The embodiment of the syringe illustrated in Figs. 7 to 11 inclusive is particularly useful for the type of service that the syringe of my United States Patent No. 2,742,041 of April 17, 1956 is well adapted, i. e., the taking, storing, transporting and processing of body fluids specimens. Let it be assumed that the needle-hub and cap sub-assembly of this embodiment is mounted or connected to the barrel structure 120 with the two-part cannula hub and valve structure in the inward-valve-open position of Fig. 7 and the needle-protective cap 126 telescoped securely over the needle 25. The parts thereof will have been suitably sterilized and such sterile conditions will be maintained in the Fig. 7 relative positions both by the needle-protective cap 126 and the secure seating of the hub enlargement seat 55 in the conical head structure seat 145. In order to obtain a body fluid specimen, such as a blood specimen, with the Figs. 7 to 11 inclusive syringe construction, with the valve in the open position of Fig. 7 or manipulated thereto, the needle-protective cap 126 will be withdrawn off of the needle 25. With a piston plug, which will be similar to that shown at 21 in Figs. 1 to 3 inclusive, adjacent the valve part head 134 in barrel bore 127, thereby minimizing the capacity of the barrel chamber, and the tip 50 of the needle inserted into body tissue to communication of the needle lumen with a vein, as illustrated in Fig. 2, retraction of the piston plug by its plunger rod or stem will cause blood to be drawn through the needle lumen to the intervening space 138 and thence from the ends thereof, serving as communicating mouths or ports into the barrel chamber 127. After a suitable quantity of body fluid or blood has been aspirated into the barrel chamber 127, the two-part cannula hub and valve structure may be translated axially outward, to move the valve part 123 to the valve-closing position illustrated in Fig. 8, by suitable manual rotation of the hub part enlargement 139. The needle and its hub then may be disengaged from the barrel structure 120 by leveraging the hub part 124 laterally to spring the valve legs 53, 53 apart sufficiently to withdraw the tongue 143 and its transverse interlocking ribs 57, 57. The resulting closed container housing a quantity or specimen of body fluid or blood may then be employed and handled in the manner described above in connection with the embodiment of Figs. 1 to 6 inclusive.

A variation of the syringe construction illustrated in Figs. 7 to 11 inclusive may be provided as a disposable plunger-type syringe either initially to house an injectable single dosage stored therein or, if empty, to be filled with a charge of parenteral liquid immediately prior to hypodermic administration. Such a syringe construction is illustrated in Figs. 12 to 17 inclusive and it will be seen that this differs chiefly in a reversal of parts or features of the two-part cannula hub and valve structure. In this syringe construction, the needle hub part 224 is provided with the externally threaded stem 233 having the longitudinally-extending slot 137 to define thereon the laterally-spaced legs 53, 53, in the faces of which are formed the interlocking transverse grooves 54, 54. The valve part 223 is provided with a stem in the form of tongue 143, having the transverse interlocking ribs 57, 57 on opposite faces thereof.

In this embodiment the inner end 44 of the single-ended needle 25 reaches through only the hub body 139 to the distal end of the reversed cross slot 137 and the tip 60 of the tongue is spaced from this cross slot bottom end to provide intervening space 138 to which the needle lumen communicates. As in the Figs. 7 to 11 inclusive embodiment, the tongue 143 is narrower than the cross slot and of a width appreciably less than the diameter of the internally-threaded opening 30. As indicated in Fig. 15, the side edges 152, 152 of tongue 143 define with side walls of cross slot 137 and portions of the internally-threaded head structure opening 30 at least one and preferably a pair of longitudinally-extending flow spaces or

side grooves 61, 61 which extend from the distal side of the valve head 134 to the intervening space 138, so as to provide with the latter and the needle lumen a fluid flow passage communicating with the chamber 127 at a point below or inward of the conical valve seat 132 when the valve head 134 is backed up or retracted to the inward-valve-open position illustrated in Fig. 12. Fig. 14 well illustrates the function of the side grooves or flow spaces 61, 61 in effecting such communication.

In order to assemble the parts of the embodiment illustrated in the Figs. 12 to 17 inclusive, the externally-threaded stem 233 of the hub part 224 will be threaded into the internally-threaded opening 30 extending through the head structure 129 of the barrel 120 until its conical seat 55 is securely seated into the conical recess 145, as illustrated in Fig. 12. As a result, the tips of the hub stem legs 53, 53 project appreciably into the area of the conical valve seat 132 to be free of lateral confinement inside the chamber for lateral spreading. Then the valve part 223 will be inserted through the open back end of the barrel 120 and its tongue 143 interfitted with the hub stem by interdigital insertion with respect to the legs 53, 53, until the transverse ribs 57, 57 snap into the transverse grooves 54, 54, to provide the assembly of parts illustrated in Fig. 12.

With communication to the interior of the barrel chamber 127 established through the needle lumen, the intervening space 138 and the side grooves 61, 61, via the annular conical space between the valve head 134 and the conical valve seat 132, as illustrated in Fig. 12, a piston plug and a plunger rod structure similar to and in the same relative positions as those indicated at 21 and 22 respectively in Fig. 1, and the edge 59 of needle-protective cap 126 loosely seated only partly into hub groove 58 as indicated in Fig. 12, the syringe construction so arranged, may be sterilized. The cap 126 will be telescoped inward to jam its edge 59 securely into hub groove 58 to effect a fluid-tight seal and the sterilized syringe construction will then be packaged under sterile conditions for use at a subsequent time.

When such syringe construction is to be used, the syringe is taken from its sterile package, the protective needle cap 126 is dislodged from the annular groove 58 of the hub part 224 and withdrawn from about the needle 25. Then, under aseptic technique, the distal end 50 of the needle 25 is thrust through the closure of a medicament container to submergence in the parenteral liquid therein and by retraction of the plunger structure 22, a measured load of the medicament is drawn into the barrel chamber 127 of the syringe. At this point, the loaded syringe may be used to administer a parenteral injection immediately. However, if desired, the protective needle cap 126 may be replaced over the needle 25, snugly seating its end edge 59 into the annular hub groove 58, and the needle hub part 224 may be manually rotated so as axially to translate the valve part 223 to the closing position illustrated in Fig. 13. The resulting loaded syringe construction, shown in Fig. 13, with the needle 25 protectively recapped and the barrel chamber 127 sealed at its head end by the valve head 134 and at its proximal end by the piston plug 21, to which the plunger rod structure is left attached, may be stored in a clean, covered receptacle for use at a subsequent time. To use such a loaded syringe construction the operator need only manually rotate the needle hub part 224 so as to open the valve, withdraw the protective needle cap 126 from about the needle 25, as illustrated in Fig. 14, and then use the syringe in the normal fashion to administer a parenteral injection.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the scope of the invention, it is intended that

all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

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

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

1. A hypodermic and body fluid sampling syringe comprising, in combination, means defining a liquid chamber with wall means thereof being movable to vary the chamber capacity, one portion of the wall of said chamber being provided as a head structure having a through inlet and outlet opening, and a two-part cannula hub and valve structure movably mounted in said opening for longitudinal translation between an outward valve-closing position and an inward valve-open position, the valve and hub parts of said structure having dismountable engagement for movement together between said positions, said two-part valve and hub structure having defined therethrough longitudinally thereof a fluid passage terminating in a chamber communicating mouth at a point which is accessible to the chamber with the structure in its inward valve-open position and with communication between the chamber and passage mouth cut off when the structure is in its outward valve-closing position.

2. The syringe as defined in claim 1 characterized by juxtaposed surfaces of the chamber opening and two-part valve and hub structure having complementary camming surfaces which translate the latter upon rotation relative to the former between the outward valve-closing position and inward valve-open position.

3. The syringe as defined in claim 2 characterized by said complementary camming surfaces being in the form of engaged female and male helical threads.

4. The syringe as defined in claim 3 characterized by one of the valve and hub parts being provided with all of said male threads engaged with said female threads when said two-part structure is in its outward valve-closing position.

5. The syringe as defined in claim 4 characterized by said valve and hub parts having interfitting engaging means causing said valve part to be rotated with said hub part upon manual rotation of the latter.

6. The syringe as defined in claim 2 characterized by means on said valve and hub parts having interfitting engagement for rotation of the former by the latter.

7. The syringe as defined in claim 1 characterized by the head structure opening being surrounded on the chamber side by a valve seat, said valve part having a head seating against said seat in a fluid-tight manner when said two-part structure is in the outward valve-closing position.

8. The syringe as defined in claim 7 characterized by said chamber head and two-part valve and hub structures having complementary camming surfaces which translate said two-part structure longitudinally with respect to said head structure between the valve-closing and valve-open positions upon relative rotation.

9. The syringe as defined in claim 8 characterized by said complementary camming surfaces being in the form of male helical threads on the two-part structure and female helical threads in the head structure opening.

10. The syringe as defined in claim 9 characterized by the valve and hub parts of said two-part structure having interfitting engagement for rotation of the former by the latter, one of said parts having all such male threads with the other being unthreaded.

11. The syringe as defined in claim 10 characterized by the interfitting engagement being provided by a longitudinally-extending cross slot in one of said parts with the other part having a longitudinally-extending

tongue received in the cross slot in relatively non-rotatable manner.

12. The syringe as defined in claim 11 characterized by the tongue being narrower than and of a length appreciably less than the depth of the cross slot providing as portions of the fluid passage at least one longitudinally-extending groove along one side of the tongue and a cross opening between the tip of the latter and the bottom of the cross slot.

13. The syringe as defined in claim 12 characterized by a side wall of the slot and a side face of the tongue being juxtaposed and having interlocking means preventing longitudinal separation when located in the head structure opening.

14. The syringe as defined in claim 13 characterized by the slotted part being formed of elastic material permitting lateral spreading of the opposed sides defining the cross slot when unconfined in the head structure opening to permit disengagement of said interlocking means.

15. The syringe as defined in claim 12 characterized by a cannula fixed in and extending through the hub part with its lumen forming a portion of the fluid passage and extending to communication with the cross opening between the tip of the tongue and the bottom of the cross slot.

16. A hypodermic and body fluid sampling syringe comprising, in combination, a barrel having a cylindrical bore closed at one end by a cross head structure with a piston plug slidably mounted in said bore defining therewith a liquid chamber, said cross head structure having an internally-threaded inlet and outlet opening extending therethrough coaxially of the barrel bore, a valve seat surrounding the opening at the chamber proximal end thereof, and a two-part cannula hub and valve structure mounted together through the opening and comprising a headed valve part having its head seatable against said seat in an outward valve-closing position of said two-part structure and a hub part beyond the distal end of the opening carrying a single-ended hypodermic needle extending axially therethrough, one of said parts having an externally-threaded stem threadably engaged in a rotatable manner in the internally-threaded opening for axial translation therein and provided with a cross slot extending longitudinally thereof, the other part having a stem in the form of a relatively flat tongue interdigitally engaged in the cross slot for rotation of the valve part by the hub part, the tip of the tongue being spaced from the bottom of the slot thereby providing intervening space in communication with the chamber when said valve part is in an inward valve-open position, the needle lumen being in communication with said intervening space.

17. A hypodermic and body fluid sampling syringe comprising, in combination, a barrel having a cylindrical bore closed at one end by a cross head structure with a piston plug slidably mounted in said bore defining therewith a liquid chamber, said cross head structure having an internally-threaded inlet and outlet opening extending therethrough coaxially of the barrel bore, a valve seat surrounding the opening at the chamber proximal end thereof, and a two-part cannula hub and valve structure mounted together through the opening and comprising a headed valve part having its head seatable against said seat in an outward valve-closing position of said two-part structure and a hub part beyond the distal end of the opening carrying a single-ended hypodermic needle extending axially therethrough, one of said parts having an externally-threaded stem threadably engaged in a rotatable manner in the internally-threaded opening for axial translation therein and provided with a cross slot extending longitudinally thereof, the other part having a stem in the form of a relatively flat tongue interdigitally engaged in the cross slot for rotation of the valve part by the hub part, the tip of the tongue being

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spaced from the bottom of the slot thereby providing intervening space with said tongue being narrower than the diameter of the internally-threaded opening, the lumen of the needle being in communication with said intervening space with the latter in turn in communication with the chamber when the head of said valve part is spaced inwardly from said valve seat.

18. A hypodermic and body fluid sampling syringe comprising, in combination, a barrel having a cylindrical bore closed at one end by a cross head structure with a piston plug slidably mounted in said bore defining therewith a liquid chamber, said cross head structure having an internally-threaded inlet and outlet opening extending therethrough coaxially of the barrel bore, a valve seat surrounding the opening at the chamber proximal end thereof, and a two-part cannula hub and valve structure mounted together through the opening and comprising a headed valve part having its head seatable against said seat in an outward valve-closing position of said two-part structure and a hub part beyond the distal end of the opening carrying a single-ended hypodermic needle extending axially therethrough, one of said parts having an externally-threaded stem threadably engaged in a rotatable manner in the internally-threaded opening for axial translation therein and provided with a cross slot extending longitudinally thereof, the other part having a stem in the form of a relatively flat tongue interdigitally engaged in the cross slot for rotation of the valve part by the hub part, the tip of the tongue being spaced from the bottom of the slot thereby providing intervening space with said tongue being narrower than the diameter of the internally-threaded opening, and laterally-projecting interlocking means on said slotted stem and tongue preventing

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longitudinal separation when said interlocking means is located between the proximal and distal ends of the internally-threaded opening, said two-part structure being axially translatable between an outward valve-closing position and an inward valve-open position by manual rotation of said hub part, the cross slot in the threaded stem defining a pair of laterally-spaced legs with the latter being spreadable at points where they are unconfined in the internally-threaded opening and with the threaded stem interlocking means being located at a point where said spaced legs are spreadable in one axial position of the threaded stem for longitudinal mounting and dismounting from therebetween of said tongue and its interlocking means, said two-part hub structure providing a fluid passage communicating the lumen of the needle with the chamber in the inward valve-open position, the fluid passage being closed off in the outward valve-closing position with said valve head seated against its seat.

19. The syringe as defined in claim 18 characterized by said slotted threaded stem being formed of elastic plastic to permit the spreading of the legs thereof.

20. The syringe as defined in claim 18 characterized by said part having the slotted threaded stem being the valve part.

21. The syringe as defined in claim 18 characterized by said part having the slotted threaded stem being the needle hub part.

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