Dec. 31, 1963 E. H. WILBURN 3,115,875

CARTRIDGE SYRINGES

Filed Nov. 14, 1960 5 Sheets-Sheet 1

FIG. 2

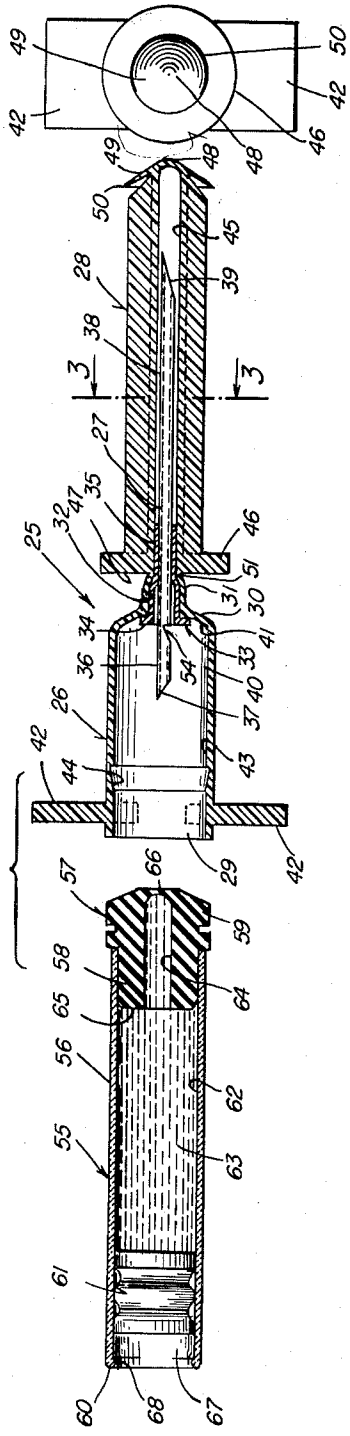


FIG. 1

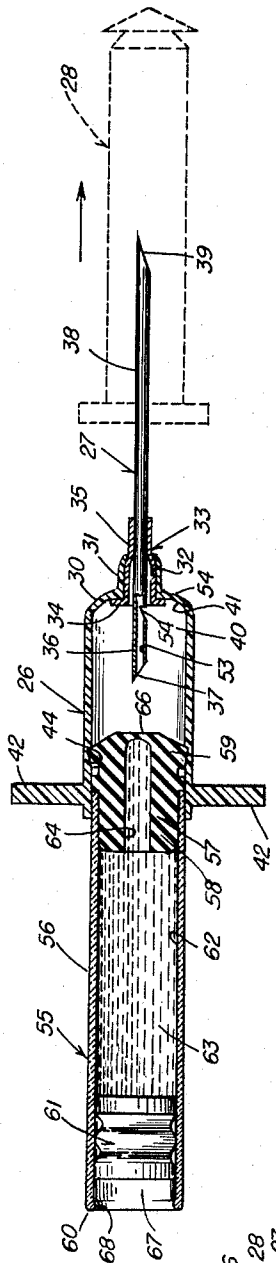


FIG. 4

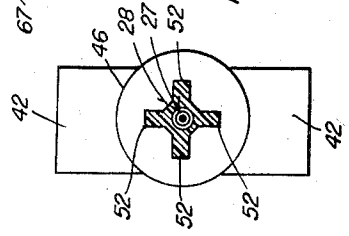


FIG. 3

Dec. 31, 1963 E. H. WILBURN 3,115,875

CARTRIDGE SYRINGES

Filed Nov. 14, 1960 5 Sheets-Sheet 2

FIG. 5

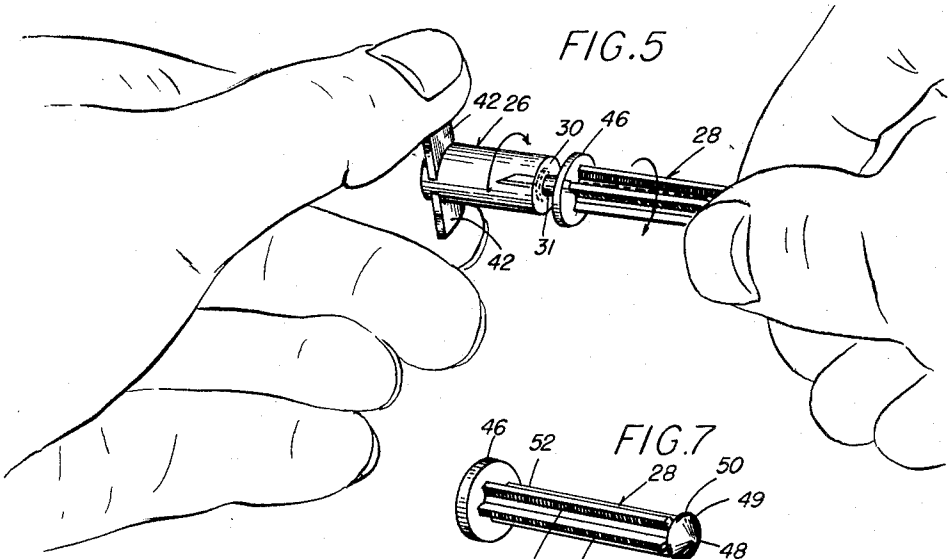


FIG. 7

FIG. 6

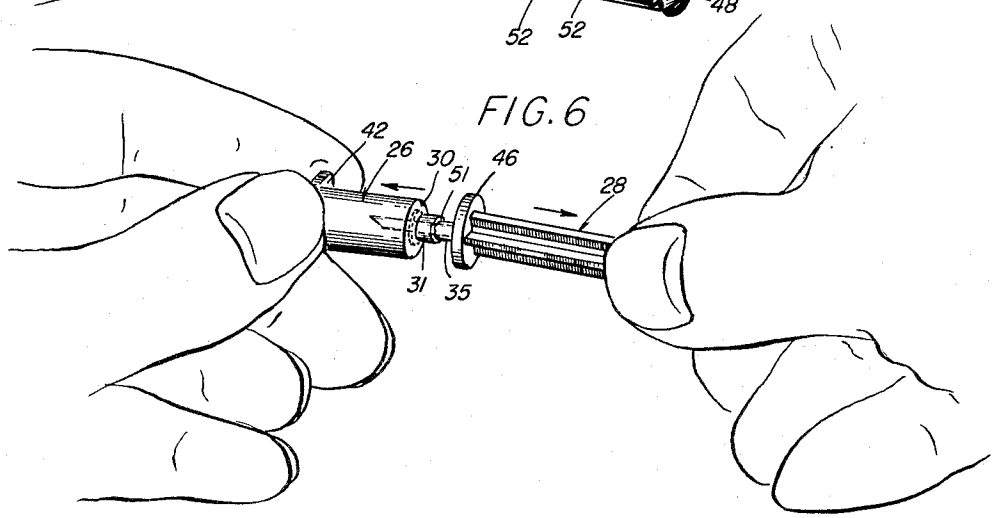
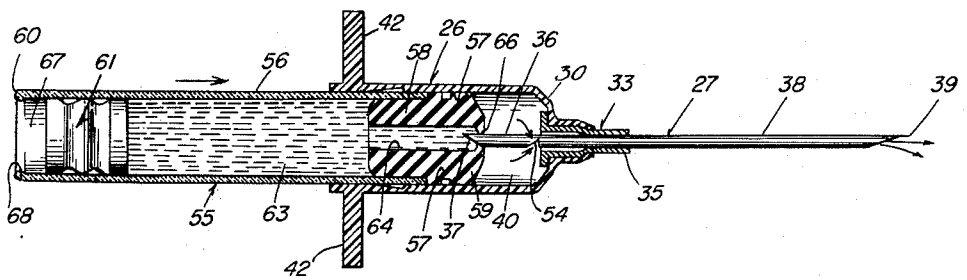


FIG. 8



Dec. 31, 1963 E. H. WILBURN 3,115,875

CARTRIDGE SYRINGES

Filed Nov. 14, 1960 5 Sheets-Sheet 3

FIG. 10

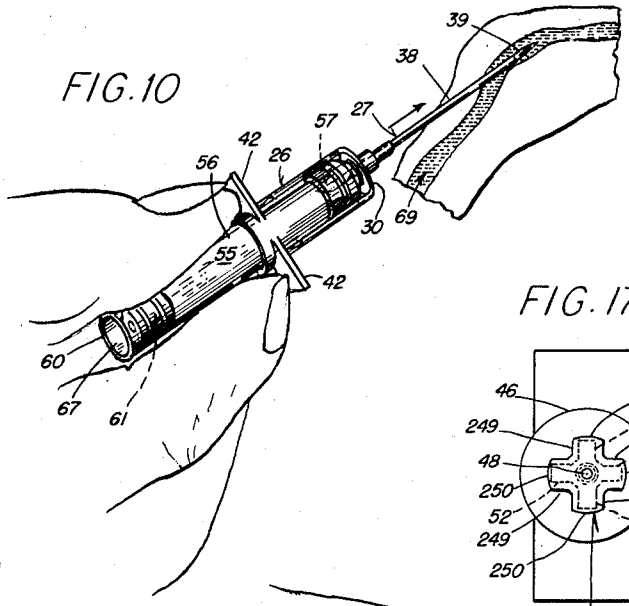


FIG. 17

FIG. 9

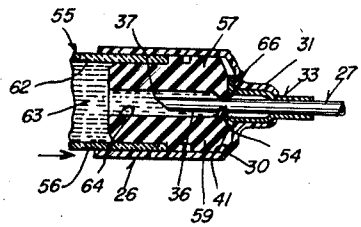
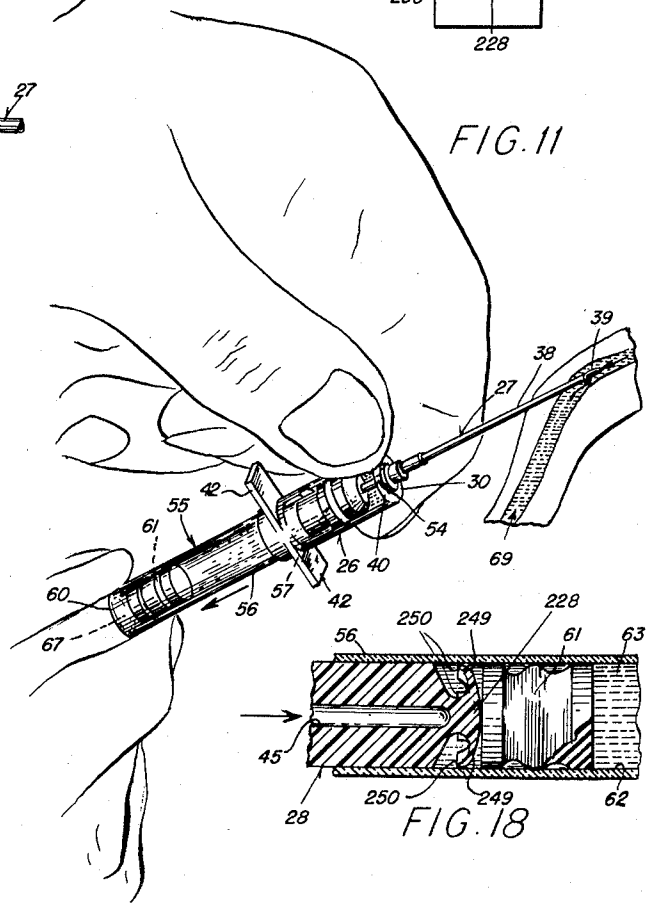


FIG. 11



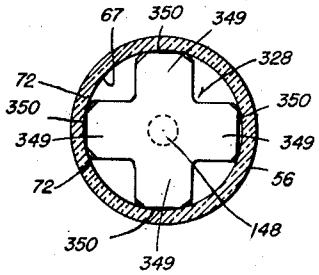


FIG. 19

FIG. 18

Dec. 31, 1963 E. H. WILBURN 3,115,875

CARTRIDGE SYRINGES

Filed Nov. 14, 1960 5 Sheets-Sheet 4

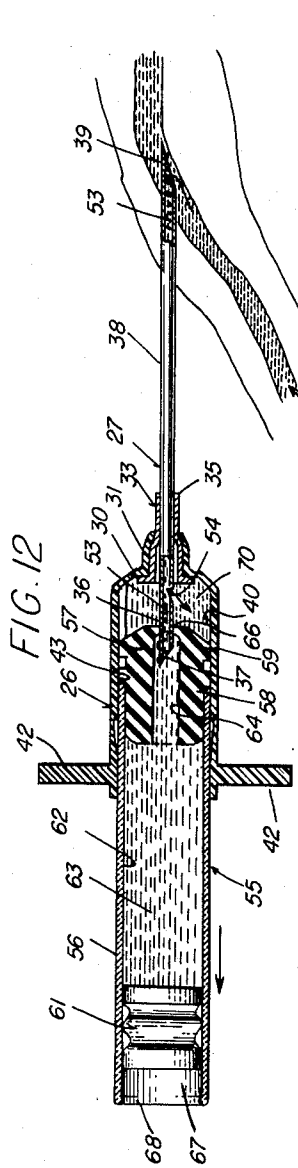


FIG. 12

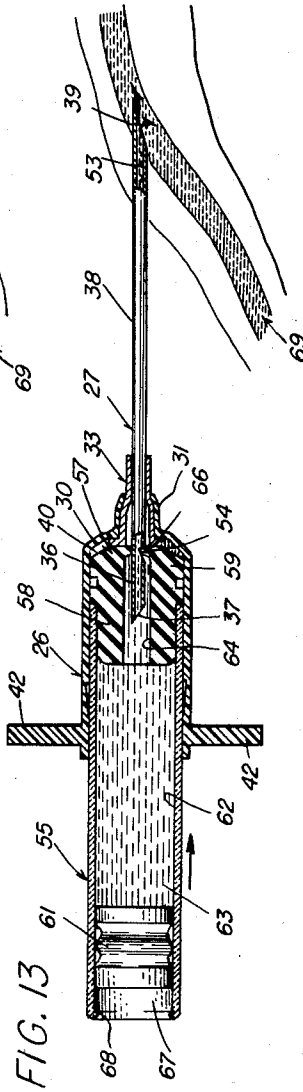


FIG. 13

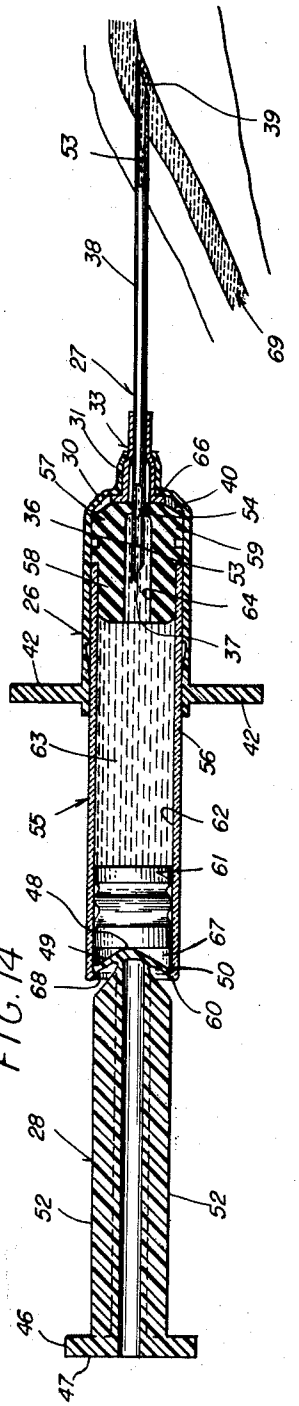


FIG. 14

Dec. 31, 1963 E. H. WILBURN 3,115,875

CARTRIDGE SYRINGES

Filed Nov. 14, 1960 5 Sheets-Sheet 5

FIG. 15

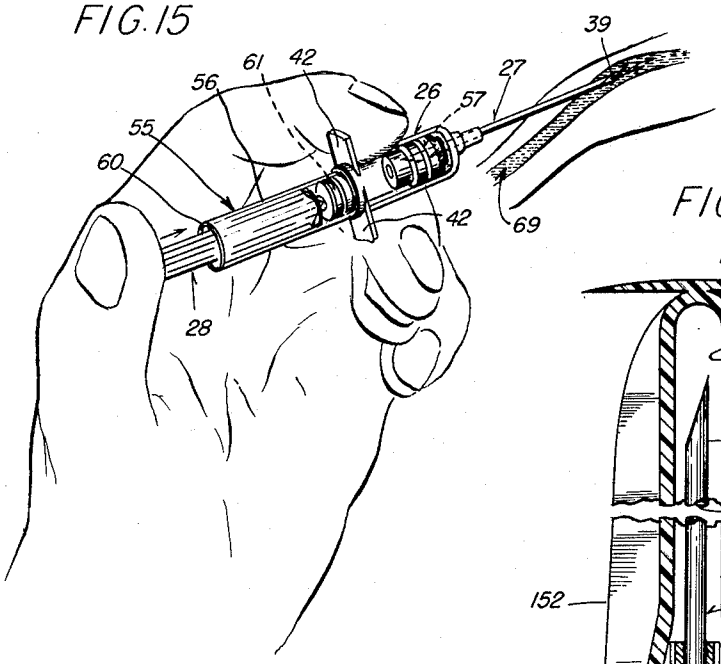


FIG. 16

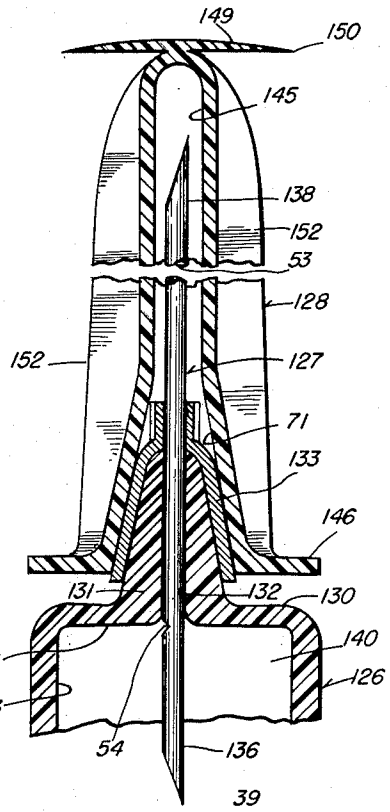


FIG. 20

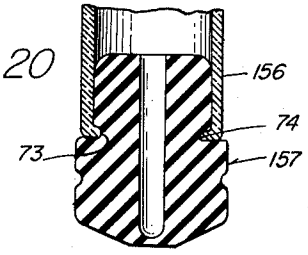


FIG. 21

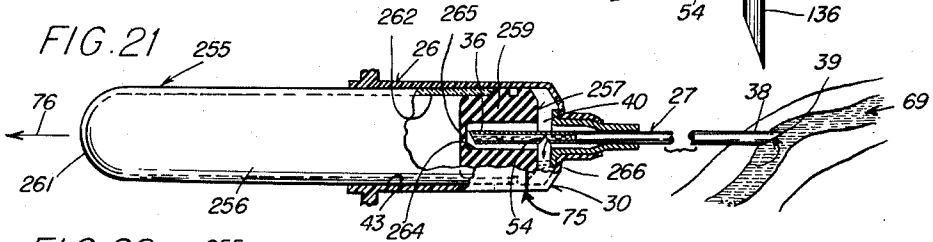
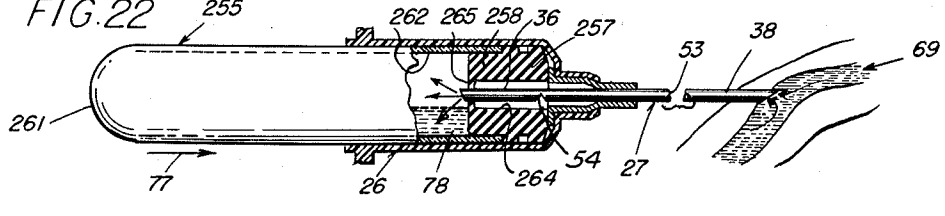


FIG. 22



United States Patent Office 3,115,875 Patented Dec. 31, 1963

3,115,875

CARTRIDGE SYRINGES

Edgar H. Wilburn, 21 The Terrace, Rutherford, N.J.

Filed Nov. 14, 1960, Ser. No. 68,956
14 Claims. (Cl. 128—218)

The present invention relates to cartridge syringes of the type in which a casing is equipped with a cannula needle and adapted to receive an ampule for connection to the latter.

A general object of the present invention is to provide such a cartridge syringe which effectively may be employed with one type of cartridge or ampule for hypodermic injection of liquid medicament and with another type for blood sampling, both services being performable in an efficient manner which avoids injection of dangerous quantities of air.

Another object of the invention is to provide such a syringe device in an aspirating form and of unique construction which in different services will assure blood showings advising of the proper communication of the cannula needle with a vein.

A further object is to provide structural embodiments of the invention which may be readily and economically constructed and assembled in mass production and which allow efficient use and operation.

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

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

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

FIG. 1 is an exploded axial section of an embodiment of the cartridge syringe of the present invention which, as shown, includes an ampule-receptive casing and an axially-sectioned loaded ampule to be mounted therein for injecting liquid medicament;

FIG. 2 is an elevational view of the proximal end of the ampule-receiving casing structure illustrated in FIG. 1;

FIG. 3 is a transverse sectional view taken substantially on line 3—3 of FIG. 1;

FIG. 4 is an axial section of the casing structure shown in FIG. 1, but indicating in dotted lines the needle-protective cap after being separated from the casing barrel and in a position of removal from over the cannula needle, the loaded ampule being shown in assembled position with respect to the casing barrel;

FIG. 5 is a perspective and pictorial view illustrating a step in the removal of the needle-protective cap of FIG. 1;

FIG. 6 is another perspective and pictorial view illustrating a further step in the removal of the needle-protective cap;

FIG. 7 is a perspective view of the needle-protective cap after it has been removed so that it may then serve as piston post means for expelling the liquid contents of the ampule;

FIG. 8 is an axial section of the assembly illustrated in FIG. 4 showing manipulation of the loaded ampule in the casing barrel to expel to atmosphere air in the head space of the latter so as to avoid in subsequent use injection of dangerous quantities of air;

FIG. 9 is an axial section, with parts broken away and omitted, of the structure shown in FIG. 8 with the parts in their final relative positions to effect the maximum expulsion of air in the head space;

FIG. 10 is a perspective and pictorial view illustrating the step following the elimination of at least most of the air in the head space by the manipulations depicted in FIGS. 8 and 9, showing subcutaneous insertion of the outer end of the cannula needle to communication of its bore with a vein;

FIG. 11 is a perspective and pictorial view illustrating the step following that depicted in FIG. 10, involving pumping manipulation of the loaded ampule relative to the casing barrel for a show of blood to inform the operator of proper communication of the cannula needle with a vein;

FIG. 12 is an axial section of the assembly illustrated in FIGS. 4 and 8 to 11 incl., with parts broken away, showing the same manipulation depicted in FIG. 11 for attaining the blood showing;

FIG. 13 is an axial section similar to FIG. 12, illustrating the next step of manipulation of the loaded ampule relative to the casing barrel preparatory to injecting the liquid medicament in the ampule chamber into the blood stream;

FIG. 14 is an axial section of the assembly illustrated in FIG. 13, with the addition thereto of the separated needle protective cap now positioned for use as piston post means to eject the liquid contents of the ampule;

FIG. 15 is a perspective and pictorial view illustrating the final manipulative step of ejecting the liquid contents of the ampule into the blood stream;

FIG. 16 is an enlarged axial section, with parts broken away, of another embodiment of the casing barrel and cap subassembly, illustrating a modified anchorage of the needle and needle-protective cap on the casing barrel;

FIG. 17 is a proximal end elevation, similar to FIG. 2, showing a modified form of the needle-protective cap structure;

FIG. 18 is an enlarged axial section, with parts broken away, of the rear portion of the ampule and the front portion of the piston post means in the form of the needle-protective cap shown in FIG. 17 showing the latter being employed for forward thrust of the piston plug to expel ampule liquid contents;

FIG. 19 is an enlarged cross-sectional view of a tubular ampule in which a modified form of the piston post means has been inserted for propelling the piston plug;

FIG. 20 is an enlarged sectional view, with parts broken away, showing the nose or head end of an ampule and illustrating a modified form of anchorage in the tubular side wall thereof of an aspirating head plug;

FIG. 21 is a side elevational view, with parts broken away and in section, illustrating an embodiment of the present syringe using with the casing barrel a type of evacuated cartridge designed to take a blood sample, the parts being in relative positions illustrating aspirating manipulation of the ampule for effecting a showing of blood to inform the operator of proper communication of the cannula needle with a vein; and

FIG. 22 is a view similar to FIG. 21, illustrating final manipulation of the evacuated ampule relative to the receptive casing barrel to draw into the evacuated ampule a blood sample.

Referring to the drawings, in which like numerals identify similar parts throughout, it will be seen that in the embodiment illustrated by way of example in FIGS. 1 to 15 incl. the aspirating cartridge syringe includes a subassembly 25 consisting of a casing structure or barrel 26, a double-ended cannula needle 27 and a needle protective cap 28. The casing barrel 26 is in the form of a tubular sleeve which is open at its distal or back end 29 and closed at its proximal or front end by a crosshead 30. Preferably the crosshead 30 is also provided with a tubular neck 31 extending coaxially outward therefrom.

The tubular neck 31 has securely anchored in a fluid-

tight manner in its neck bore 32 a suitable needle anchoring or hub structure 33, which may be in the form of a sleeve or ferrule flanged on its inner or back end 34 and with its front end 35 snugly crimped about the cannula needle 27. A section of the cannula needle 27 extends inwardly or back from the hub sleeve 33 to provide an inner end or stub 36 having its tip 37 sharpened to facilitate piercing of an ampule plug. Beyond the hub sleeve 33 a section of the needle 27 extends outwardly to provide an outer subcutaneously insertable end 38 having a sharpened tip 39 for thrust into a patient's flesh.

The casing barrel 26 thus defines a barrel socket or pumping chamber which is designed telescopically to receive a suitable cartridge or ampule, this socket including a head space 40 adjacent the inner face 41 of the crosshead 30 into which the needle inner end 36 extends.

The casing barrel 26 preferably is provided with a pair of laterally-extending, finger-engaging wings 42, and its inside cylindrical surface 43 may be provided with an internal annular recess 44 for a purpose to be explained later.

The needle-protective, elongated, tubular cover cap 28 has a base end and a tip end and is provided with a longitudinally-extending socket or recess 45 into which the needle outer end 38 is telescopically housed. The elongated, needle-receptive recess 45 has an open mouth at the cap base when cap 28 is a separated unit and a closed end at a point short of the cap tip. Preferably the cap 28 is provided at its base about the mouth of recess 45 with an annular flange 46 providing a thrust head having a transverse rear surface 47 for manual engagement by an operator's digit or thumb when this cap is removed and then employed as a piston post means, as is hereinafter explained. Closed tip end 48 of the cap 28 is provided with a transverse flange structure 49 having flexible thin edges 50 to serve as means for anchorage to cartridge or ampule structure, as is later explained.

The cap 28 may be advantageously made integral with the neck 31 of the casing barrel 26. This may be accomplished by molding the casing barrel structure and the cap structure together from suitable plastic material having appreciable rigidity in relatively thick section and flexibility in relatively thin section. Such plastic material should also be of a type which is not contaminable of body fluids, such as blood, and liquid medicament which is to be injected into the circulatory system of a patient. Certain polypropylenes and polyethylenes having the desired characteristics, as well as other known moldable plastics are suitable for this purpose. At the juncture of the base of the cap 28 where its rear annular face 47 is connected to the tip of the barrel neck 31 an annular line of weakening 51 is defined to permit the cap to be twisted free from the neck thereat for removal or uncovering of the needle outer end 38. Thus the needle-protective, elongated, tubular cover cap 28 and the tubular neck 31 together form a tubular structure having its side wall at the connection of the base of the cap to the neck annularly weakened to permit the cap to be manually twisted free readily from the neck for cap removal. When the barrel casing 26 and the cap 28 are molded as integral parts of a unitary structure the finger wings 42 likewise may be advantageously molded integral with the casing barrel.

Although the side wall of the tubular cap 28 may have a cylindrical outside surface it is desirable, for the purpose of conserving material and to lighten the weight of the structure, to make the tubular side wall of the cap relatively thin and provide on the outer surface thereof a plurality of longitudinal ribs spaced circumferentially thereabout. Such ribs should be more than two in number since they are to serve as guides for maintaining the cap structure substantialy coaxial with the tubular side wall of an ampule when the cap is employed as piston means to thrust forward in the ampule tube the piston plug. Thus, there may be three ribs arranged at about 120° apart, or more, such as the four ribs 52 shown in FIG. 3 as being arranged at about 90° apart. The structure of this cap 28 is clearly illustrated in FIG. 7.

It will be noted from FIGS. 1 and 4 that a hole is provided in the side wall of the needle inner end 36 to communicate the head space 40 directly with through bore 53 of the cannula needle 27, and that this hole may be in the form of a notch 54 provided in the vicinity of the inner face 41 of crosshead 30, i.e., at the base of the needle inner end. The by-pass passage provided by the hole 54 performs a number of important functions both in the use of the cartridge syringe for injecting liquid medicament and also in the use of a modified form thereof in taking blood samples. These functions will be pointed out in connection with the following descriptions of the operations of the various embodiments of the device.

Let it be assumed that an embodiment of the device is to be employed for injecting liquid medicament. For this purpose, the structure illustrated in FIGS. 1 to 15 may be employed, with a suitable loaded cartridge or ampule 55 being provided for such service. The cartridge or ampule 55 has a tubular side wall which may be in the form of a tube or section of glass tubing 56 of certain internal diameter and of an external diameter to be freely telescoped or slidably received in the barrel socket, defined by the cylindrical side wall surface 43 of casing barrel 26 and the crosshead 30, through the open back end 29 thereof. The proximal or front end of the ampule tube 56 is closed by an elastic aspirating head plug 57 which may have a back end shank portion 58 of an outer diameter somewhat larger than the inner diameter of the tube for snug seating in the front end of the latter. The aspirating head plug 57 may be molded from rubber, or other suitable elastic material, if desired. The head plug 57 has an enlarged leading nose 59 which provides an annular flange at its front end of an outer diameter somewhat larger than the internal diameter of the inner cylindrical wall 43 of receptive casing barrel 26. Thus, the enlarged leading nose 59 of the aspirating head plug 57 is snugly receivable in the barrel socket and is slidable therein for pumping action to aspirate the head space 40. The back or distal end of the ampule tube 56 is closed off forward of its back edge 60 by a suitable piston plug 61, which may also be molded from rubber or other suitable elastic material, slidably mounted with a snug fit in the bore of the tube. Thus, the aspirating head plug 57 and the piston plug 61 define with the side wall tube 56 a closed chamber 62 preloaded with a body 63 of suitable liquid medicament.

It will be noted from FIG. 1, and other views, that the aspirating head plug 57 has a closed, elongated, longitudinal recess 64 extending from its back end 65 forward close to but short of its tip end at 66, with this elongated recess being in communication with the chamber 63 and filled with the liquid medicament therein. The elongated recess 64 is preferably coaxially located so as to be aligned with the needle inner end 36 in the socket defined by casing barrel 26 for ultimate reception of the latter. The material of the aspirating head plug 57 between the closed front end of recess 64 and the surface of the tip at 66 provides a relatively thin diaphragm which is readily puncturable by the sharp tip 37 of needle inner end 36, to communicate the needle bore 53 with the ampule or cartridge chamber 62 and the liquid contents 63.

It will be noted from FIG. 1 and other views that with the location of the rear piston plug 61 appreciably forward of the distal end edge 60 of the ampule tube 56, a shallow recess 67 is defined in the back end of the ampule. Conventional manufacturing procedure in the production of cartridges or ampules from sections of glass tubing fitted with expelling piston and closing head plugs may include a heat treatment to remove sharp edges at the split off ends of the sections of tubing. This may produce in each tubular side wall 56 an internal bead, such as that illustrated at 68 in FIG. 1, so that the entrance

to the recess 67 is slightly constricted. The internal diameter of the recess 67 is somewhat less than the outer diameter of the flexible edges 50 of the transverse flange structure 49 on the nose or tip of the needle-protective cap 28. Also, the outer diameter of the tubular side wall of the cap 28 is slightly less than the internal diameter of the ampule tube 56. In other words, the outer edges of the longitudinal ribs 52 are arranged on a circle of a diameter slightly less than the internal diameter of the ampule side wall tube 56. Thus, when the cap 28 is employed as piston means it may be pushed forward in the bore of the ampule tube 56 with the ribs 52 serving as guides to keep it substantially coaxially arranged therein to avoid undue tilting thereof as it thrusts the piston plug 61 forward.

In operation of the injective embodiment of the cartridge syringe of the present invention illustrated in FIGS. 1 to 15 incl., consisting of the parts illustrated in FIG. 1, the operator may prepare the device for subcutaneous injection of the contents of the ampule 55 in the following manner. As is illustrated in FIG. 5 the operator may hold the casing barrel 26 in one hand, in any suitable manner, such as that illustrated therein, and grasp with the other hand the cap 28. By twisting the cap 28 relative to the casing barrel 26 the cap will be broken free from the barrel neck 31 at the line of weakening 51 (FIG. 1). The cap 28 is then separated from the barrel 26 by pulling it axially off of the needle outer end 38, as is illustrated in FIG. 6, to form the separate piston post means illustrated in FIG. 7.

The operator may then insert the enlarged nose 59 of the aspirating head plug 57 in the proximal end of the cartridge or ampule tube 56 through the open distal or back end 29 of the barrel casing 26 to the position illustrated in FIG. 4. In such position swelling of the constricted enlarged nose 59 of the aspirating head plug 57 into the annular internal recess 44 will securely hold the cartridge in the back end of the casing barrel 26.

The operator may thereafter manipulate the assembly of FIG. 4 to expel the air from the head space 40. As is illustrated in FIG. 8, this may be accomplished by thrusting the cartridge 55 farther forward with the aspirating head plug 57 expelling the air through the hole 54 to the needle bore 53 and then via the latter to atmosphere at the tip 39 of the needle outer end 38. When the front end of the aspirating head plug 57 is thus moved forward until it is juxtaposed to the inner face 41 of the crosshead 30, as is illustrated in FIG. 9, by such forward thrust of the cartridge 55, the needle inner end is pierced through the diaphragm of the head plug 57, at 66, to be housed in the rear recess 64 of the plug. In this position, the material of the head plug at the edges of the pierced hole in its diaphragm 66 may swell to close the by-pass hole 54, but this is not necessary. If the by-pass hole 54 is not completely closed by the material of the head plug 57 to shut off communication of the needle bore 53 with an immediate adjacent very small space defined between juxtaposed surfaces of the needle assembly, the casing barrel crosshead structure and the tip surfaces of the aspirating head plug, the action of the device and manipulation of its parts do not tend to cause injection of air into a patient's circulatory system when subsequent injection of the cartridge contents is performed. Any minute quantity of air which may be entrapped can be completely eliminated by carefully designing the inner faces of the casing barrel at the crosshead and the tip end of the aspirating head plug so that they are substantially complementary in shape. It will be understood from FIG. 9 that with such forward thrust of the cartridge 55 in the socket of the casing barrel 26 the bore of the double-ended needle 27 is brought to communication with the liquid medicament 63 in the ampule chamber 62 and the needle-receptive recess 64 in the aspirating head plug 57.

The operator next will thrust the sharpened tip 39 of the needle outer end 38 into the patient's flesh, in an effort to bring the needle bore 53 to communication with a vein, such as that illustrated at 69 in FIG. 10. In order to assure such desired communication the operator will then manipulate the ampule 55 for a showing of blood which will inform him of such proper communication. This may be done in the manner illustrated in FIG. 11 such as by holding the casing barrel 26 with one hand and pulling back on the cartridge 55 with the other hand to retract the aspirating head plug 57 in the casing barrel socket. As a result, the cubic capacity of the head space 40 is increased by such pumping action so as to reduce the pressure therein causing blood to be drawn from the vein 69 through the needle bore 53 and into the head space via the by-pass passage or hole 54. Since the casing barrel 26 preferably is formed from transparent, or at least translucent, material the color of the blood drawn into the head space 40 is readily observable therethrough. Such pumping action is illustrated in FIG. 12 which shows the aspiration of an appreciable quantity of blood 70 in the head space 40, drawn thereinto via the needle bore 53 and the by-pass passage 54. There is no tendency for the liquid medicament 63 in the cartridge chamber 62 to be drawn through the bore of the needle inner end 36 and the by-pass passage 54 into the head space 40 since considerable force is required to slide the piston plug 61 forward in the cartridge tube 56. The suction created will draw the blood from the vein 69 through the bore of the needle outer end 38 to the head space 40 by way of the by-pass passage 54 without developing sufficient force to move the piston plug 61 forward that would allow liquid medicament to flow into the head space.

With the operator now assured by the blood showing that he has the needle bore 53 communicated with the patient's vein 69 he then again thrusts the cartridge 55 forward and connects the piston post means 28 thereto, as is illustrated in FIG. 14. He does this by forcing the transverse flange structure 49 on the tip 48 of the post 28 into the rear recess 67. This causes the flexible edges 50 of the transverse flange structure 49 to be turned and flexed rearwardly and then to snap forward beyond the internal bead 68. The springiness of the transverse flange structure thus holds the piston post means 28 securely in the back end of the cartridge tube 56 behind the piston plug 61.

Then the operator administers the liquid medicament 63 in the ampule chamber 62 through the needle bore 53 into the patient's vein 69 or his blood stream by thrusting the piston plug 61 forward with application of push upon the piston post means which the detached cap 28 now constitutes. Such injective action is illustrated in FIG. 15 and, as therein proposed, may be effected by holding the casing barrel 26 between two fingers positioned beyond the finger wings 42 and applying by the thumb forward thrust against the rear surface 47 of the cap base flange 46.

It will thus be seen that the ampule 55 has been effectively employed to provide pumping action for aspirating the head space 40 within the casing barrel 26 so as to draw thereinto a blood showing. The by-pass passage 54 in the side wall of the needle inner end 36 has served a number of advantageous purposes. This by-pass passage 54 first permitted the operator to expel practically all of the air in the head space 40 out to atmosphere through the needle bore 53 before the needle outer end was subcutaneously inserted into a patient's flesh in an effort to communicate his blood stream with the interior of the aspirating cartridge syringe. Also, in order to assure the operator that he had thereafter been successful in establishing such communication, the retraction of the cartridge 55 had reduced the pressure in the head space 40 so that blood was sucked back through the needle bore 53 and by way of the by-pass passage 54 into the head space for observation there. Further, this by-pass passage 54 then permitted the blood drawn into the head space 40 for a showing to be returned to the patient's

blood stream in further manipulation of the syringe device preparatory to injecting the cartridge contents.

It has been found that the casing barrel and needle-protective cap subassembly illustrated in FIG. 1 permits economical production, but it is to be understood that the cap need not be made integral with the casing barrel. For example, as is illustrated in FIG. 16, casing barrel 126 may be provided with a coaxially-extending tapered neck 131 having a through bore 132 through which is loosely received a double-ended needle 127 to position needle inner end 136 within the barrel socket 143 and head space 140 thereof adjacent the inner face 141 of the crosshead 130. The double-ended needle 127 may be provided with a tubular hub 133, fixed thereon and so shaped as to form a conical recess therein into which the tapered tip of the barrel neck 131 may be jammed for fluid-tight connection. In such relative positions or parts this locates by-pass passage hole 54 adjacent or in the vicinity of the inner face 141 of barrel crosshead 130. The needle-protective cap 128 may then be in the form of a separately manufactured or molded unit, having a longitudinal recess 145 telescopically receptive of the needle outer end 138. The elongated recess 145 is enlarged or flared at 71 to provide a tapered recess complementary to the tapered hub sleeve 133 for jamming on the latter to maintain a sterile condition of the needle. The needle protective cap 128 may in the form illustrated in FIG. 16 also have a thrust-applying base flange 146 and thrust-guiding longitudinal ribs 152, with the tip preferably provided with transverse flange structure 149 having flexible circumferential edges 150 for the purpose previously explained in connection with the embodiment illustrated in FIGS. 1 to 15 incl.

As is illustrated in FIG. 17 the transverse end flange on the tip of the needle protective cap, there referenced 228, may be laterally notched to define a plurality of radial arms 249 each of which has a terminal flexible thin edge 250 to be distorted into gripping contact with the inner side wall of the rear recess 67 of the loaded cartridge 55. Manufacture of the structure of the type illustrated in FIG. 17 may be facilitated by such radial arms 249 and the longitudinal guide ribs 52 being aligned, as there shown.

As is proposed in FIG. 19 the flexible terminal edges of such radial arms of the transverse flange structure on the tip of the needle-protective cap need not be laid out on arcs of a circle. The tip 148 of the needle protective cap structure 328 may be provided with the transverse flange structure in the form of radial arms 349, each having its terminal edge 350 arranged substantially normal thereto. Consequently, both right angular corners 72 of each radial arm edge 350 will provide localized contact with the inner side wall surface of the ampule tube recess 67, with the tips of the flexible corners being readily distortable backwards upon insertion and, due to their springiness, providing the necessary gripping action.

No difficulty has been experienced in maintaining the aspirating head plug 57 within the front end of the ampule tube 56 upon aspirating retraction of the cartridge when the dimensions of the parts are of proper relative proportions. However, if it is desired that a more secure connection therebetween be provided so as more fully to assure maintenance of the mount of the aspirating head plug within the proximal end of the ampule tube, this may be attained in the manner proposed in FIG. 20. The front end edge of ampule tube 156 may be turned inwardly to provide an internal constricted bead or flange 73 and aspirating head plug 157 may be provided with an annular external groove 74 into which this internal flange is snapped.

The embodiment of FIGS. 1 to 15 incl. has been proposed for the purpose of hypodermic administration of liquid medicament. However, embodiments of the present invention may be advantageously employed to take blood samples for analysis. For this purpose the same barrel casing and its double-ended needle may be used with an evacuated cartridge. This service does not require the use of the needle protective cap as a piston post means, since there is to be no expulsion of cartridge contents, but such cover cap is desirable in order to protect the outer end of the needle from physical damage and its sterile condition. Such protective cap may be in either the form proposed in FIG. 1 or that proposed in FIG. 16. Such a blood sampling embodiment is illustrated in FIGS. 21 and 22.

In the embodiment of FIGS. 21 and 22 the subassembly of the cartridge-receptive casing, its double-ended needle and the protective cover cap can be similar or like that proposed in any of FIGS. 1, 16 and 17. In fact, such a cartridge-receptive subassembly may be marketed to be employed either with preloaded cartridges for hypodermic injection or evacuted cartridges for blood sampling. However, when it is intended that such cartridge-receptive casing be employed for blood sampling, it is desirable that its barrel be equipped with suitable index means to dictate the limit of the forward thrust of the evacuated cartridge incident to aspiration for testing by a show of blood proper communication between a patient's circulatory system and the needle bore. Such an index mark may be an internal structural element but in simple form may be a line or mark applied to the external surface of the casing barrel 26, such as that indicated at 75 in FIG. 21, which permits use of the same casing barrel with preloaded injective cartridges.

The blood sampling cartridge 255 proposed in FIGS. 21 and 22 may consist of a tubular barrel 256, formed of any suitable transparent or translucent material, such as glass, for observation of blood contents drawn thereinto, closed off on its distal end 261 by an integral crowned wall like a test tube. Into the open mouth of the tubular ampule barrel 256 at the proximal end of the latter is inserted a suitable aspirating piston head 257, of rubber or the like, having an enlarged leading nose or flanged head 59 for pumping action in the casing barrel 26 and a shank 258 snugly fitted in the open front end of the tubular ampule barrel. The aspirating head plug 257 differs chiefly from that shown at 57 in FIG. 1 in that the elongated recess 264 for reception of the needle inner end 36 is reversed and extends from the tip 266 of its nose back to the vicinity of its closed back end 265 to provide at the latter a needle-pierceable diaphragm to be punctured by the tip 37 of the needle inner end 36 upon forward thrust of the evacuated cartridge 255.

In use of the blood sampling embodiment illustrated in FIGS. 21 and 22 let it be assumed that the needle-protective cap has been removed by the operator from over the needle outer end 38, and that the evacuated cartridge 255 has been partially inserted into the casing barrel 26 with the aspirating head plug 257 leading. The operator will then push the evacuated cartridge 255 forward until the forward margin of the zone of contact between the cylindrical surface of the flanged head or enlarged nose 59 of the head plug 257 and the inner wall 43 of the casing barrel 26 is brought to alignment with the index mark 75 on the latter. This forward thrust will drive air out of the head space 40 by way of the by-pass hole 54 through the bore of the needle outer end 38 to the atmosphere at the tip 39, thereby reducing the head space 40 to a size approximating that illustrated in FIG. 21 but which still permits observation of the by-pass passage through the transparent wall of the casing barrel. This readying action also moves the rear pierceable diaphragm at 265 of the aspirating head plug 257 forward to the vicinity of the sharpened tip 37 of the needle inner end 36. The index mark 75 facilitates this proper placement of the parts relative to each other so that, although the operator can no longer see the sharpened tip 37 of the needle inner end 36, he can make certain that the rear plug diaphragm 265, closing off the evacuated chamber 262, is not accidentally punctured before such time as he

may wish to take a blood sample. This placement of the aspirating head plug 257 at a point spaced back from the crosshead 30 of course retains a greater amount of air in the head space 40 than that which remains in this head space when the injecting cartridge 55 is placed in the casing barrel 26 for hypodermic injection, but this is of no concern since most of this air will not be injected into the circulatory system, but will be drawn back into the evacuated chamber 262 upon piercing of the diaphragm 265.

The operator then subcutaneously inserts the tip 39 of the needle outer end 38 into the patient's flesh for communication to vein 69. He thereafter draws back the cartridge 255 in the direction of the arrow 76 in FIG. 21 with grasp of the cartridge barrel tube 256 by one hand while holding the barrel 26 with the other. As a result, the head space 40 is aspirated by the head plug 257 and if the tip 39 of the needle outer end is in proper communication with the vein 69 a showing of blood will be developed at the by-pass passage 54. The operator then can with assurance take the blood sample.

The blood sample is taken by the device of FIG. 21 in the manner illustrated in FIG. 22. To do so, the operator now thrusts the evacuated cartridge 255 forward, in the direction indicated by arrow 77, toward a position in which the tip 266 of the aspirating head plug 257 is juxtaposed to the crosshead 30 with attendant piercing of the diaphragm 265 by the sharpened tip 37 of the needle inner end 36. As the diaphragm 265 is first punctured, air in the recess 264 and the head space begins to be drawn immediately into the evacuated chamber 262 of the cartridge barrel 256. The attendant rapid reduction in pressure in the head space 40 will supplement the manual forward thrust of the blood-collecting cartridge 255 and cause it to be snapped fully forward for complete puncture of the diaphragm 265 by the sharpened tip 37 of the needle inner end for completely effective communication of the blood in the patient's vein 69 with the evacuated chamber 262 by way of the through needle bore 53. As a result, blood will be drawn through the cannula needle 27 into the evacuated chamber 262, as depicted in FIG. 22, to collect in the latter a quantity of blood 78 as a sample to be analyzed. Thereafter, the needle outer end will be withdrawn from the patient's flesh and the cartridge 255 withdrawn from the casing barrel 26, with the cartridge barrel 256 suitably housing the blood sample 78 protectively closed off by the aspirating head plug 257. This protective closure by the head plug 257 is assured by the fact that when the needle inner end 36 is withdrawn from the punctured diaphragm 265 the slit in the latter will automatically close.

It will thus be seen that when the subassembly, including the casing barrel 26, the double-ended needle 27 and the protective cover for the latter is employed with an evacuated cartridge of the type illustrated at 255 in FIGS. 21 and 22, the by-pass passage 54 performs a number of important functions. First, before the needle outer end 38 is thrust into a patient's flesh the by-pass passage 54 serves as a way for expulsion of excess air from the head space to the atmosphere via the needle bore. Secondly, it thereafter serves as a way for passage of blood from a patient's vein into the head space for observation upon aspirating retraction of the cartridge 255 to assure proper communication of the needle bore with the patient's circulatory system. And, finally, it cooperates with the bore of the needle inner end to provide a passage for sucking air out of the head space back into the cartridge evacuated chamber 262 as the diaphragm 265 is pierced by the needle inner end 37. Some air in the head space 40 and in the needle-receptive recess 264 possibly may be drawn back into the evacuated chamber 262 between the outer surface of the needle inner end and the edge of the pierced slit, but, of course, the by-pass passage and the bore of the needle inner end may alone perform this function of exhausting air in the head space and needle recess.

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. An aspirating cartridge syringe comprising, in combination; a casing barrel having a tubular sleeve and an integral crosshead together defining an ampule-receiving aspirating barrel socket, and a tubular neck extending outwardly from said crosshead; a cartridge having a tubular side wall of certain internal diameter telescopically received in said socket and closed at its proximal end by an elastic aspirating head closure means having an annular elastic enlargement snugly received in said socket and reciprocative therein by said cartridge side wall for pumping action, said cartridge being closed forward of its distal end by a piston plug slidable forward therein with a chamber defined within said side wall between said head closure means and plug and with said head closure means being needle-pierceable for communication of the bore of a cannula to the chamber, the distal end of said cartridge side wall and said piston plug defining together an open recess; a double-ended cannula needle having a through bore extending from end to end and mounted in fluid-tight manner through said crosshead and neck, said needle having an inner cartridge head closure means-piercing end extending back into said socket in opposed relation to said pierceable head closure means and an outer subcutaneously insertable end extending from said neck; and a needle-protective, elongated, tubular cover cap having an imperforate sidewall of an external transverse dimension less than the internal diameter of said cartridge sidewall removably mounted to said neck and housing therein the outer end of said needle, said cap being provided with a transverse closed tip carrying a transverse and laterally-extending flange structure having flexible thin edges spaced transversely a distance slightly greater than the internal diameter of said cartridge side wall, said cap being removable for use as piston post means and said transverse flange structure thereof then being insertable in the distal end recess of said cartridge with distortion of the flexible thin edges whereby the latter grippingly engage said cartridge side wall to hold said piston post means temporarily assembled thereto.

2. The aspirating cartridge syringe as defined in claim 1 characterized by said cap transverse flange structure being laterally notched to define a plurality of radial arms carrying said flexible thin edges.

3. The aspirating cartridge syringe as defined in claim 1 characterized by said casing barrel, tubular neck, cap and transverse flange structure of the latter being molded integral from plastic material having appreciable rigidity in relatively thick section and flexibility in relatively thin section; said cap having a base end connected to the tip end of said neck at an annular line of weakening of the tubular structure defined together by said neck and cap permitting said cap to be twisted free from said neck thereat.

4. The aspirating cartridge syringe as defined in claim 2 characterized by said cap and transverse flange structure being molded integral from plastic material having appreciable rigidity in relatively thick section and flexibility in relatively thin section.

5. The aspirating cartridge syringe as defined in claim 4 characterized by said cap having a main tubular body of

an outer diameter appreciably less than the internal diameter of said cartridge side wall and externally carrying a plurality of longitudinal guiding ribs spaced circumferentially about said tubular body at less than 180° apart with the outer edges of said ribs arranged on a circle of a diameter slightly less than the side wall internal diameter, said radial arms being equal in number to that of said ribs with each arm substantially aligned with only one of the latter.

6. An aspirating cartridge syringe comprising, in combination; a casing barrel having a tubular sleeve and an integral crosshead together defining an ampule-receiving aspirating barrel socket, and a tubular neck extending outwardly from said crosshead; a cartridge having a tubular side wall of certain internal diameter telescopically received in said socket and closed at its proximal end by an elastic aspirating head closure means having an annular elastic enlargement snugly received in said socket and reciprocative therein by said cartridge side wall for pumping action, said cartridge being closed forward of its distal end by a piston plug slidable forward therein with a chamber defined within said side wall between said head closure means and plug and with said head closure means being needle-pierceable for communication of the bore of a cannula to the chamber, the distal end of said cartridge side wall and said piston plug defining together an open recess; a double-ended cannula needle having a through bore extending from end to end and mounted in fluid-tight manner through said crosshead and neck, said needle having an inner cartridge head closure means-piercing end extending back into said socket and an outer subcutaneously insertable end extending from said neck; and a needle-protective, elongated, tubular cover cap having an imperforate sidewall of an external dimension less than the internal diameter of said cartridge sidewall removably mounted to said neck and housing therein the outer end of said needle, said cap being provided with a transverse closed tip carrying a transverse laterally-extending flange structure having flexible thin edges spaced transversely a distance slightly greater than the internal diameter of said cartridge sidewall, said cap being removable for use as piston post means and said transverse flange structure thereof then being insertable in the distal end recess of said cartridge with distortion of the flexible thin edges whereby the latter grippingly engage said cartridge sidewall to hold said piston post means temporarily assembled thereto, said needle inner end having a hole in the side thereof extending to the needle through bore in the vicinity of the base of said needle inner end at the inner face of said barrel crosshead providing a by-pass passage between the barrel socket head space and the needle bore.

7. In a cartridge syringe a unitary casing structure comprising a casing barrel molded from elastic plastic of appreciable rigidity in relatively thick section and having a tubular sleeve and an integral crosshead together defining an ampule-receiving aspirating barrel socket, an integral tubular neck extending outwardly axially of said crosshead, a needle-protective elongated tubular cover cap having a closed tip and an imperforate sidewall of certain external transverse dimension integrally connected to the outer end of said neck and extending coaxially therefrom to form therewith a tubular structure, said cap having a needle-receptive elongated closed space therein connected to the barrel socket by a neck bore, a double-ended needle snugly received through the neck bore and having an outer injective end housed in said cap space and an ampule-piercing inner end extending back into the barrel socket, said tubular structure at the connection of said cap to said neck having its side wall annularly weakened permitting said cap to be readily manually twisted free from said neck for cap removal, an ampule having a tubular side wall of certain internal diameter greater than the external transverse dimension of said tubular cap with said ampule telescoped into said barrel socket and having a closed proximal piston end slidably received in said barrel socket for pumping action therein and an initially open distal end closed by a piston plug slidably mounted therein with said tubular cap being freely slidable in said ampule behind said piston plug, and transverse and laterally-extending flexible flange structure on the tip end of said cap having flexible outer edges of an effective outer diameter slightly greater than the internal diameter of the ampule tubular side wall for snug insertion therein after said cap is twisted free from said neck temporarily to hold said removed cap as a piston when inserted through the open distal end of the latter means in said ampule in any axially adjusted position.

8. A cartridge syringe device comprising, in combination, a unitary casing structure in the form of a cylindrical barrel molded from elastic plastic of appreciable rigidity in relatively thick section having an open distal end and a proximal end closed by an integral crosshead and defining with the latter a cartridge-receiving aspirating barrel socket providing a head space adjacent the inner face of said crosshead, an integral elongated tubular structure extending axially outwardly from said crosshead and closed off on its tip end, said tubular structure being defined into a tubular neck and an elongated cover cap by an intervening weakened annular zone permitting said cap to be readily manually twisted free from said neck for cap removal, and a double-ended cannula needle having a through bore and fixed in and extending through said neck, said needle having a proximal outer end for subcutaneous insertion housed in said cap and a distal piston plug-piercing inner end extending back into the barrel socket, a tubular cartridge telescopically mounted in the barrel socket and having a piston head closure means closing off its proximal end and slidably and snugly received in said socket for pumping action to aspirate the head space through the needle bore, said needle inner end being provided in the immediate vicinity of the crosshead inner face with a hole in one side thereof extending to its bore to provide a by-pass passage communicating the head space with the needle bore for expulsion of head space air to atmosphere before subcutaneous insertion of the needle proximal end.

9. In a device of the cartridge syringe type an ampule-receptive casing structure comprising, in combination, a cylindrical barrel having a circular open distal end and a proximal end closed off by a crosshead together defining a cylindrical ampule-receiving pumping barrel socket with the latter providing a head space adjacent the inner face of said crosshead, a cylindrical ampule telescoped for forward thrust and retraction in said barrel socket and having a needle-pierceable closed leading head end provided with piston structure slidably and snugly received in said socket for piston action therein to aspirate the head space upon forward thrust and retraction of the ampule in the socket, and a double-ended cannula needle having a through bore and fixedly mounted through said crosshead with an outer end thereof extending beyond said crosshead for subcutaneous insertion and an inner end extending back into the socket for piercing through such ampule closed head end to the interior of such ampule for communication of the needle bore with the interior of the latter, said needle inner end being provided with a by-pass side hole in the immediate vicinity of the inner face of said crosshead communicating the head space with the needle bore whereby the latter serves to communicate the head space with surrounding atmosphere before subcutaneous insertion of the needle outer end to expel trapped head space air to the atmosphere upon thrust forward of the leading head end of said ampule in the socket to the vicinity of the inner face of said crosshead.

10. The device as defined in claim 9 characterized by said ampule comprising a side wall tube freely received for reciprocative action in said barrel socket and having its closed head end carrying as said piston head structure an elastic annular enlargement slidably and snugly re-

ceived in said pumping barrel socket for forward thrust to said crosshead with the distal end of said tube closed off by an expelling piston plug slidably mounted therein and with a chamber defined between said closing member and piston plug being loaded with liquid medicament for injection, said head closing member having at its leading end a relatively thin needle-pierceable diaphragm aligned with said needle inner end and movable forward to the by-pass hole upon forward thrust of said ampule with puncture of said diaphragm by said needle inner end for communicating the latter with the medicament in the chamber.

11. The device as defined in claim 9 characterized by said ampule having an evacuated body fluid-collecting chamber comprising a side wall tube freely received for reciprocative action in said barrel socket and having its distal end closed off, said tube carrying on its proximal end as said piston structure a closing elastic piston head plug having an enlarged leading nose slidably and snugly received in said pumping barrel socket for forward thrust to said crosshead, said piston head plug having a closed elongated needle-receptive recess in its nose extending back to the vicinity of the plug back end defining a rear relatively thin needle-pierceable diaphragm to be punctured by said needle inner end upon forward thrust of said nose to the by-pass hole for drawing body fluid through said needle.

12. The device as defined in claim 9 characterized by said ampule having an evacuated body fluid-collecting chamber comprising a substantially cylindrical tube freely received for reciprocative action in said barrel socket and closed off at its distal end, said ampule carrying on its proximal head end closing needle-pierceable means having a relatively thin needle-pierceable diaphragm aligned with said needle inner end and movable forward to puncture by the latter upon forward thrust of said ampule, said head end of said ampule carrying as said piston head structure an elastic annular enlargement slidably and snugly received in said barrel socket for pumping action therein by said ampule.

13. In a syringe including a tubular barrel of certain internal diameter closed off at its proximal end adapted for connection to an injection needle to extend outwardly therefrom with the needle bore constituting an outlet passage, said barrel being closed off at its distal end by a slidable piston plug, the combination therewith of a combined needle-protective cap and piston plug thrust post comprising an elongated imperforate tubular body molded from plastic material having appreciable rigidity in relatively thick section and flexibility in relatively thin section and having a base and a closed tip with an elongated, needle-receptive recess extending from an open mouth at the base to a closed end at a point short of the tip with said cap base mountable to said barrel proximal end in a demountable manner, said cap having a main section of a transverse dimension less than the internal diameter of said barrel for telescope thereinto, an integral enlargement about the recess mouth at the cap base connected to said main section and having a transverse digit-engaging surface for application of manual thrust when the cap is used in demounted condition as a piston plug thrust post, and an integral transverse and laterally-extending flange structure coaxially mounted on the closed tip having flexible thin edges spaced transversely a distance slightly greater than the internal diameter of the tubular barrel for insertion into the latter behind the slidable piston plug with backward flexure of said transverse flange structure for gripping engagement to provide temporary connection while permitting forward thrust into the barrel for pushing said piston plug forward.

14. In a syringe including a tubular barrel of certain internal diameter closed off at its proximal end adapted for connection to an injection needle to extend outwardly therefrom with the needle bore constituting an outlet passage, said barrel being closed off at its distal end by a slidable piston plug, the combination therewith of a combined needle-protective cap and piston plug thrust post comprising an elongated imperforate tubular body molded from plastic material having appreciable rigidity in relatively thick section and flexibility in relatively thin section and having a base and a closed tip with an elongated, needle-receptive coaxial recess extending from an open mouth at the base to a closed end at a point short of the tip with said cap base mountable to said barrel proximal end in a demountable manner, said cap having a main section of a transverse dimension less than the internal diameter of said barrel for telescope thereinto, an integral transverse coaxial flange extending annularly about the recess mouth at the cap base connected to said main section and having a transverse digit-engaging end surface when in demounted condition, an integral transverse flange structure coaxially mounted on the closed tip and laterally notched at circumferentially-spaced points to define a plurality greater than two substantially equally spaced radial arms terminating in outward flexible thin edges transversely spaced at points of maximum lateral extension a distance slightly greater than the internal diameter of the tubular barrel for slidable insertion and motion therein behind the slidable piston plug with backward flexure of said transverse flange structure for gripping engagement while permitting forward push of said piston plug thereby, and a plurality of integral longitudinal ribs substantially equally spaced circumferentially about said cap body at less than 180° apart and extending between said radial arms and annular base flange with one rib aligned with each radial arm, outer edges of said ribs being arranged on a circle of a diameter slightly less than the internal diameter of the barrel.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,115,875 December 31, 1963

Edgar H. Wilburn

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 71, for "substantialy" read -- substantially --; column 7, line 40, strike out "the", first occurrence; column 12, lines 10 and 11, strike out "when inserted through the open distal end of the latter" and insert the same after "position", in line 12, same column 12.

Signed and sealed this 19th day of May 1964.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents

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