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M. L. LOCKHART
HYPODERMIC SYRINGES
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2,893,390

FIG. 3

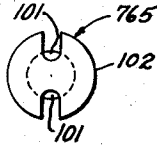


FIG. 4

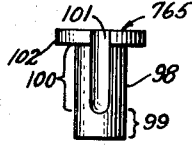


FIG. 1

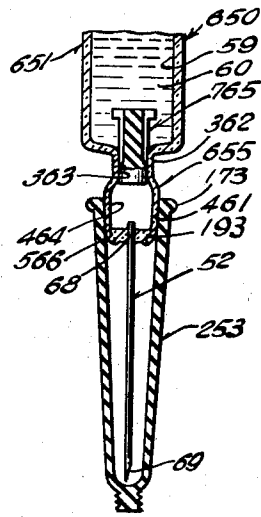


FIG. 6

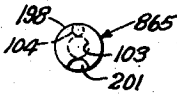


FIG. 7

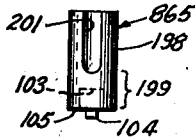


FIG. 2

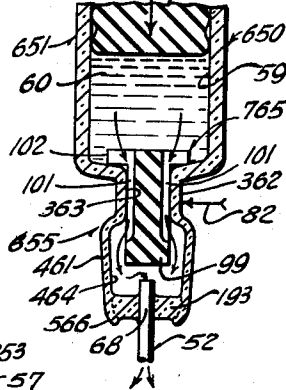


FIG. 8

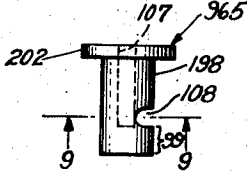


FIG. 5

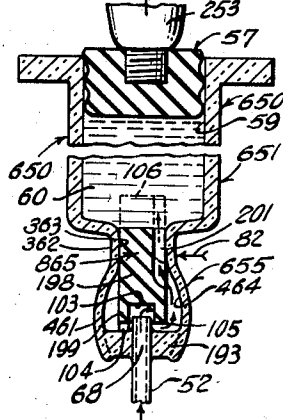
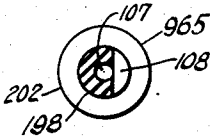


FIG. 9



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HYPODERMIC SYRINGES

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9 Claims. (Cl. 128—218)

The present invention relates to hypodermic syringes of the loaded type wherein a tubular ampule structure or barrel carries a single dosage of parenteral liquid medication expellable therefrom through an injective cannula, and may be of the form frequently termed "disposable" in that they may be discarded after one use in the hypodermic administration of their contents.

A general object of the present invention is to provide embodiments of such hypodermic syringes which are so constructed with respect to head means thereof that support, or are adapted to support, injective cannula means as to isolate effectively the head means from contained parenteral liquid by hydraulically-displaceable partition plug means.

A more specific object of the present invention is to provide in such hypodermic syringes a capacity-reducible liquid compartment loaded with parenteral liquid medication effectively blocked off from contact with other syringe elements, such as head structure and injective cannula means that may be supported on the latter, by partition plug means hydraulically-displaceable by initial reduction of the capacity of the liquid-loaded compartment to permit efficient hypodermic administration of the liquid upon further reduction of the capacity of this compartment.

Another object of the invention is to provide in such hypodermic syringe structure a rear expelling liquid compartment loaded with parenteral liquid medication and an "empty" head compartment which may contain sterile gaseous medium, such as air, at atmospheric pressure, separated from each other by partition plug means readily slidable forward by hydraulic pressure of the parenteral liquid to a position of communication of the compartments permitting efficient hypodermic administration of the liquid through the head compartment and out through a hollow hypodermic needle connected to the head compartment.

A further object of the present invention is to provide such a hypodermic syringe in a disposable form, preferably made from glass, or the like, assuring long non-contaminable or non-deteriorating storage life for contained parenteral liquid medication effectively housed or isolated in an elongated barrel chamber by walls of the glass-like material and plugs of non-contaminable elastic material at opposite ends of the chamber, one plug serving as a hydraulic pressure-developing and liquid-expelling piston plug and the other serving as an outlet gate plug which when slid forward hydraulically by action of the piston plug efficiently permits hypodermic administration of the parenteral liquid by the latter.

A still further object of the present invention is the provision of structural embodiments of the hypodermic device which are readily constructed and assembled on an economical mass production basis, which assure effi-

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cient non-deteriorating storage of parenteral liquid medicaments for prolonged periods and which permit efficient hypodermic use and operation in very simple manners.

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 enlarged axial section, with parts broken away, of an embodiment of the hypodermic syringe of the present invention, showing the slidable partition plug means partly in section and partly in elevation;

Fig. 2 is an enlarged sectional detail of the head end of the embodiment of the device illustrated in Fig. 1, showing the position of the partition plug means after hydraulic sliding manipulation thereof and illustrating the manner in which it permits passage of parenteral liquid contents of the barrel for hypodermic administration of the latter;

Fig. 3 is an end elevation of the partition plug means used in the embodiment illustrated in Figs. 1 and 2;

Fig. 4 is a side elevational view of the partition plug means shown in Fig. 3;

Fig. 5 is a sectional view with parts broken away, somewhat similar to Fig. 2, of a still further embodiment, differing chiefly from the structure shown in Fig. 2 in the gate plug employed therein and illustrating aspirating action for a show of blood as distinguished from the parenteral liquid expulsive action illustrated in Fig. 2;

Fig. 6 is an end elevational view similar to Fig. 3 of the gate plug of the Fig. 5 embodiment;

Fig. 7 is a side elevational view similar to Fig. 4 of the gate plug illustrated in Figs. 5 and 6;

Fig. 8 is a side elevational view similar to Fig. 4 of a further modified form of the gate plugs illustrated in Figs. 1 to 7 incl. and employable in the syringe structure illustrated in Figs. 1, 2 and 5; and

Fig. 9 is a sectional view taken substantially on line 9—9 of Fig. 8.

It has been proposed, prior to the present invention and the developments of the embodiments hereof, to supply parenteral liquid medication in loaded hypodermic syringes of the disposable single-dosage type wherein, during storage and distribution, cannula means thereof were isolated from contact by the liquid contents. Some such proposals have employed puncturable or valved diaphragm means for the isolating function but have been uneconomical and difficult to manufacture and have not assured, to a desired degree, the isolation desired. Other such proposals have involved the employment of gaseous medium at elevated pressures with the differential in pressure tending to maintain closed isolating valve means.

Such devices employing gaseous medium at elevated pressures have been considered by some customers to be inadequately free of likelihood of breakage with attendant loss of gas pressure causing opening of the valve means. Also, possible storage of certain parenteral liquid medicaments to assure against contamination and deterioration thereof for unusually long periods, e.g., for a number of years, has led some retailers to demand packaging in glass-like material or glass capsules and bottles suitably stoppered by rubber and like non-contami-

nating materials; others have demanded such type of packaging for certain medicaments, such as poliomyelitis prophylactics. These and other problems of the prior art and demands of the trade have been efficiently solved and satisfied by the present invention.

Referring to the drawings, in which like numerals identify similar parts throughout, and more specifically, to Figs. 1 to 4 inclusive, it will be seen that an embodiment of the present invention may comprise a loaded hypodermic syringe 650 of the single dosage, disposable type, including a tubular ample structure 651, cannula means 52, and a protective cover 253 for the latter. The tubular ampule structure 651 of the Figs. 1 to 4 inclusive embodiment includes side wall means in the form of a tubular barrel, preferably formed of transparent glass, having head end wall means 655 in the form of front end structure, and back end wall means which may be in the form of a piston plug 57 slidably fitted in the open back end of the barrel, together to define an internal chamber 59 loaded with a quantity or body 60 of parenteral liquid medicament.

Figs. 1 to 9 inclusive illustrate embodiments of the present invention wherein the partition plug means, in the form of a gate plug, is not completely expelled into the head compartment for communicating the latter with the liquid-containing rear compartment. As illustrated in Figs. 1 and 2, barrel 651 may have a head end structure 655, including an integral constricted neck 362 and terminating in a bulbous integral head 461, with these parts all preferably formed of transparent glass although they may be integrally molded from any other suitable rigid or relatively stiff, light-transmitting composition, such as polystyrene, thick polyethylene, etc. Injective needle 52 preferably is made of steel and its inner end 68 preferably is provided with a glass hub 193 in the form of a silica blob which is fused to the needle and into the intumed tip end 566 of the bulbous head, as is more clearly illustrated in Fig. 2. As is best seen in Fig. 4, gate plug 765 preferably is in the form of an elongated cylindrical member having a shank 98 provided with a solid tip portion 99 and a rear portion 100 which has at least one longitudinally-extending fluid way but preferably two of the latter in the form of a pair of diametrically-opposite grooves 101, 101. The gate plug 765 also is preferably, though not necessarily, provided with an enlarged back end head 102, through which the flow ways or grooves 101, 101 extend. Initially, the solid cylindrical tip portion 99 of the slidable gate plug 765 is located in the passage seat 363 intervening the rear compartment 59 and the head compartment 464 so as to isolate those compartments from each other in a fluid flow-preventing manner. This is the rear-most flow-blocking position of the gate plug, as illustrated in Fig. 1.

When hydraulic pressure is applied to the gate plug 765 of the Fig. 1 structure by reduction of the internal volumetric capacity of the rear compartment 59 upon forward thrust of the piston plug 57, the gate plug is slid forward to a flow-permitting position illustrated in Fig. 2. In this position, the grooves 101, 101 extend from points back of the inner end of the partition seat 363 to points forward thereof in the empty head compartment 464 so as to provide flow-ways allowing the parenteral liquid medicament 60 to be expelled from the rear compartment 59 with further forward thrust of the piston plug 57, out through the head compartment and thence through the bore of the injective needle 52, as illustrated by the arrows in Fig. 1. Of course, the longitudinal grooves 101, 101 also provide reverse aspirating ways when the piston plug 765 is in its forward flow-permitting position, illustrated in Fig. 2, to test for a show of blood and flow of the latter will be immediately adjacent the inside wall of neck 362 as it is conducted back through the longitudinal grooves for ready observation.

As illustrated in Figs. 5, 6 and 7, a gate plug 865, sim-

ilar in some respects to gate plug 765 of Figs. 1 and 2, may be employed in the hypodermic syringe structure 650. It is usual to have the needle inner end 68 extend appreciably into the head compartment 464 beyond the silica blob 193 to avoid necessity for meticulous placement of the needle inner end in the blob wall while assuring that the bore of the needle will not be blocked off by the silica material when fused between the needle and the bulbous head 461. This, of course, limits the space in which a slidable gate plug of the type illustrated in Figs. 1 and 2 may operate since the tip end of the gate plug must not block off the needle bore when thrust forward. As illustrated in Figs. 5, 6 and 7, slidable gate plug 865 is of such structure as to accommodate these requirements.

The gate plug 865 is in the form of a cylindrical body 198 having a cylindrical tip portion 199 which is provided with an axially-extending socket 103 of a diameter appreciably larger than the outer diameter of the needle inner end 68 to form a skirt for loosely housing the latter. A projection 104 on the tip end 199 is adapted to abut the silica hub 193 if need be so that the inner end or the bottom of the socket 103 will not contact the needle inner end 68. Stop projection 104 also assures spacing of the front edge 105 of the skirt formed by the socketed tip 199 from the silica hub to permit free aspirated flow back through groove 201 via compartment 464 from the needle bore into socket 103 and between skirt edge 105 and the silica hub 193, and free expulsive flow in the reverse direction. The gate plug 865 is also preferably provided with only one, relatively large, longitudinally-extending, side groove 201, which provides communication between the liquid-containing rear compartment 59 and the head compartment 464 and in which flowing blood may be readily observed through transparent neck 362. The rear-most flow-blocking position of the gate plug 865 is indicated in dotted lines at 106 in Fig. 5 and its forward flow-permitting position is shown in full lines therein. Also, Fig. 5 illustrates by arrows aspirating action of the syringe 650 when equipped with the gate plug 865 after the latter has been hydraulically thrust forward to its full line position.

In the Figs. 1 to 4 inclusive and 5 to 7 inclusive embodiments, the light-transmitting or transparent head end structure 655 provides efficient blood telltale means since flow of blood is diverted laterally to adjacent the inner walls of the transparent bulbous head 461 and the neck 362 for ready observation of flow in the grooves 101, 101 and 201. Also, the skirt provided by the socketed tip 199 of gate plug 865 forms flow diverting means to assure blood flow laterally to adjacent the inner wall of the transparent bulbous head 461. Of course, the tip of gate plug 765 may be socketed for a like purpose.

As illustrated in Figs. 8 and 9, a slidable gate plug 965 of the type illustrated in Figs. 1 and 2 may have its flow way provided by an axial bore 107 extending from the back end or the top of the head 202 to tip portion 99 and a side notch 108 communicating between the exterior surface of the shank 198 and the bore. If desired, tip portion 99 of gate plug 965 may also be socketed to a limited degree in the manner of socketing tip portion 199 of gate plug 865 for a similar purpose.

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 the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A hypodermic syringe structure comprising in combination, an elongated tubular barrel having a front end structure and an open back end defining therebetween a parenteral liquid rear compartment, a piston plug slidably fitted in said barrel and closing off its back end, said front end structure comprising a head having cannula-supporting means and a head compartment with which the bore of an injecting cannula communicates when supported on said head, means forming a constricted passage of certain length between said compartments to serve as a gate plug seat, and a gate plug slidably fitted in said seat in a rear-most flow-blocking position and there cooperating with said piston plug in confining in said rear compartment a body of parenteral liquid medicament, said gate plug being substantially longer than said seat with a flow way extending from the vicinity of its back end forward short of its head end to define a way-equipped back end section and a head end section with the latter blocking flow through said seat when said head end section is located in said seat, said gate plug being slidable forward hydraulically in said seat passage when the internal capacity of the rear compartment is reduced by forward thrust of said piston plug to locate said way-equipped back end section in said seat passage with the way permitting flow of parenteral liquid from the barrel rear compartment through the head compartment.

2. A hypodermic syringe structure comprising, in combination; an elongated tubular barrel of substantially rigid, light-transmitting material having an open back end and a front end structure defining therebetween a parenteral liquid compartment, said front end structure including a relatively small hollow head having an outlet and an intervening neck provided with a communicating passage forming a gate plug seat of certain length, said front end structure having tip means for support of an injecting cannula with the bore of the latter in communication with the outlet; a piston plug of elastic material slidably fitted in the back end of said barrel; a gate plug of elastic material slidably fitted in said seat in a rear-most position blocking fluid flow through the seat passage, said gate plug being an elongated generally cylindrical element having a front end section and a back end section with the front end section effectively blocking fluid flow through the seat passage when located in the latter, the back end section of said gate plug having a longitudinal way longer than said seat to permit flow through the seat passage when said gate plug is thrust forward; and a body of parenteral liquid confined in said barrel compartment between said plugs to apply hydraulic pressure to said gate plug and slide it forward to position the back end section of the latter in said seat when said piston plug is thrust forward initially to reduce the capacity of the barrel compartment, said piston plug thereafter in further forward thrust applying expelling pressure to the liquid in the barrel compartment to force it from the latter through the seat passage by way of the gate plug way and then through the outlet passage for hypodermic administration through such cannula.

3. The hypodermic syringe structure as defined in claim 2 characterized by an injecting cannula being sealed to said tip means with the cannula bore communicating through the latter with the outlet of said front end structure, said hollow head having at least a portion integral with said barrel to be generally transparent for facilitating observation of an aspirated show of blood in the hollow head.

4. A disposable hypodermic syringe comprising, in combination, an elongated cylindrical barrel of transparent glass-like material having an open back end and an integral head end structure defining therebetween a cylindrical parenteral liquid chamber, said head end structure providing a neck for said barrel having an elongated passage substantially circular in cross-section and

forming a gate plug seat, a gate plug of elastic material slidably fitted in said seat in an initial flow-blocking position, a piston plug of elastic material slidably mounted in and closing off the back end of said barrel chamber with a body of parenteral liquid confined in the latter between said plugs, said head end structure having a relatively small hollow head beyond said neck with which said seat passage communicates when unblocked and providing an outlet passage of a lateral dimension greater than that of the seat passage, an injecting cannula sealed to said hollow head with its bore in communication with the latter and isolated from the parenteral liquid by said gate plug, and an elongated protective cover over said cannula and removably mounted to said head while being telescopically receivable in said barrel chamber for forward thrust of said piston plug; said gate plug being an elongated, substantially cylindrical body appreciably longer than said seat and having a solid front end section slidably seated initially in said seat to block flow through the seat passage, said gate plug also having a rear end section initially extending into said chamber and having a longitudinally-extending way longer than the seat passage through which parenteral liquid may flow when said rear end section is moved forward into said seat, said gate plug being slidable forward hydraulically to flow-permitting position with forward thrust of said piston plug to replace in said seat the front end section of said gate plug with its rear end section.

5. The hypodermic syringe as defined in claim 4 characterized by said gate plug being provided with its longitudinally-extending way in the form of a side groove in which aspirated flow of blood may be readily observed through the adjacent side wall portion of said transparent neck.

6. The hypodermic syringe as defined in claim 4 characterized by said hollow head having a front wall, said cannula having its back end projecting through and beyond and sealed in said front wall of said hollow head, said gate plug having a recess of a lateral dimension greater than the lateral dimension of said projecting back end of said cannula with the bottom of the recess being stopped short of this cannula back end when said gate plug is hydraulically moved forward to the flow-permitting position.

7. The hypodermic syringe as defined in claim 6 characterized by projecting means on said gate plug to assure stopping of the latter with the recess bottom short of the cannula back end.

8. The hypodermic syringe as defined in claim 7 characterized by said projecting means being on the front of the front end section to abut said hollow head front wall.

9. A hypodermic syringe structure comprising, in combination, means providing a front end structure, means providing an elongated tubular barrel located behind said front end structure and defining a parenteral liquid chamber, a piston plug slidably fitted in the back end of said barrel and closing off the back end of said chamber, said front end structure comprising head means defining therein in front of said barrel chamber a communicating space, a single-ended injecting cannula having its shank carried by said head means with its bore in communication with the head space, means between said head means and the front end of said barrel defining a communicating passage between the chamber and head space, and a gate plug slidably fitted in said passage in rear-most flow-blocking position and there cooperating with said piston plug in confining in said chamber a body of parenteral liquid medicament, said gate plug being substantially longer than the communicating passage with a flow way extending from the vicinity of its back end forward short of its front end to define a way-equipped back end section and a head end section with

the latter located in the passage and blocking flow therethrough, said gate plug being slidable hydraulically forward in the passage when the internal capacity of the chamber is reduced by forward thrust of said piston plug to move said way-equipped back end section into said passage with the way permitting flow of parenteral liquid from the chamber to the cannula bore.

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