Sept. 4, 1951 T. E. WATSON 2,567,001

HYPODERMIC SYRINGE

Filed Feb. 6, 1950 2 Sheets-Sheet 1

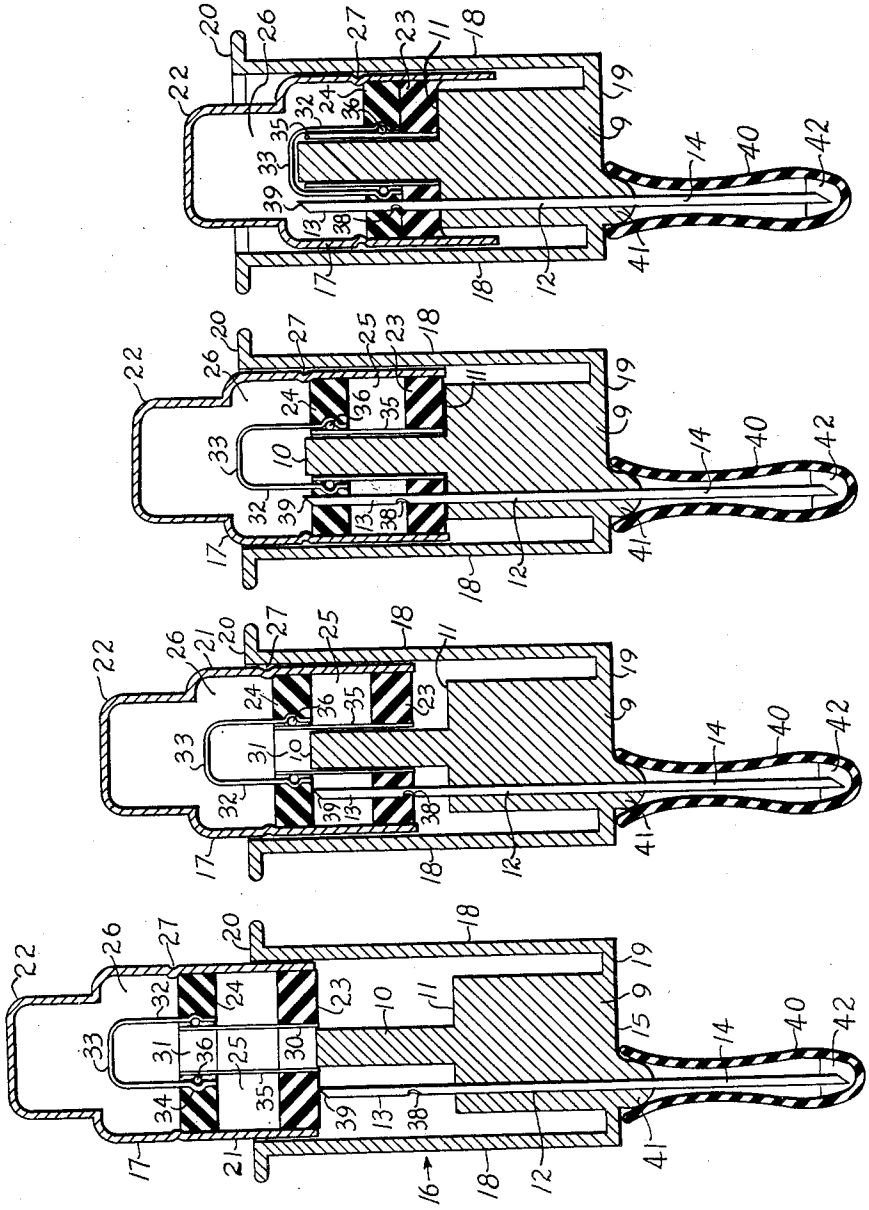


Fig. 4

Fig. 3

Fig. 2

Fig. 1

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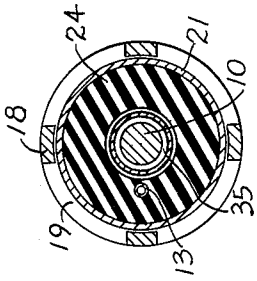


Fig. 8

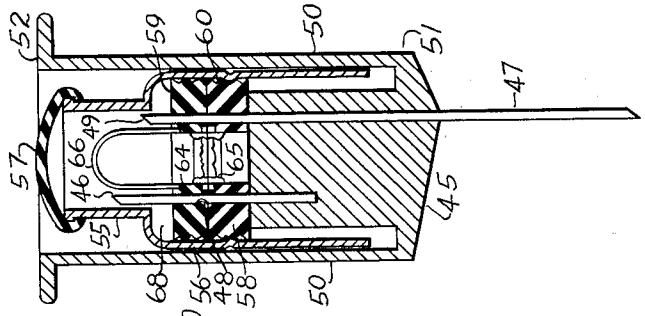


Fig. 7

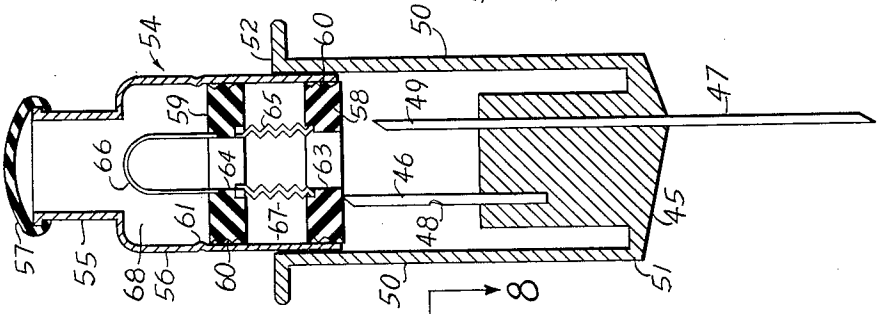


Fig. 6

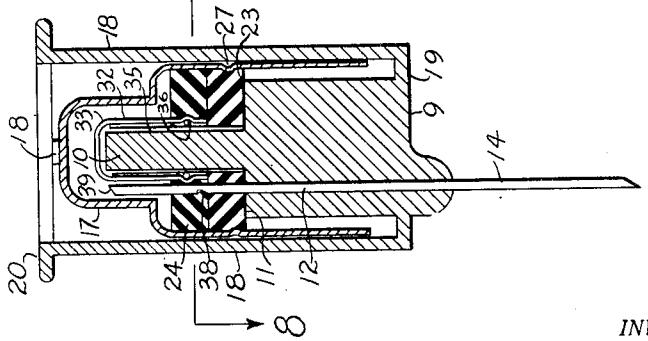


Fig. 5

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HYPODERMIC SYRINGE

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12 Claims. (Cl. 128—218)

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This invention relates to hypodermic syringes and more particularly to disposable syringes and medicament cartridges therefor for use in parenteral administration of medicaments which require reconstitution or dissolution by the addition of water or other liquids before they may be injected.

In current medical practice it is frequently desirable to have medicaments for hypodermic injection prepared in advance in exact dosages. It is furthermore desirable that these dosages be stored in disposable ampoules or cartridges, not to be refilled, so that danger of contamination of a subsequent reloading may be eliminated. While disposable ampoules for storing a single liquid preparation ready for injection have heretofore appeared, cartridges designed to hold separately two or more ingredients, such as a powder and a liquid in which the powder is soluble, and to provide for the mixing of these ingredients momentarily before their injection, have not to my knowledge been available in a form in which they could be inserted unbroken into a syringe, and discarded after use. Furthermore, when many patients are to be treated, as in mass innoculations or in a field hospital or other emergency station, it may be very desirable to have available at low cost a large number of simply constructed syringes and suitable medicament cartridges therefor, all of which can be used and thrown away with little economic loss, or the cartridges may be thrown away, and the syringes may be saved for subsequent re-sterilization and re-loading when opportunity is present.

It is accordingly an object of this invention to provide a hypodermic syringe and a prefillable ampoule for use therewith, of such simple and economical construction that the ampoule may be discarded after use, or alternatively the entire syringe may be disposed of with little economic loss.

A further object of the invention is to provide a disposable dual-chambered ampoule for use with a hypodermic syringe, arranged to hold separately two medicaments, or a medicament and a reconstituting liquid, and to permit the mixture of these materials just prior to their injection. Examples of such materials, in addition to lyophilized, dessicated, or sublimated medicaments requiring liquefaction, are penicillin and its salts which it is desirable to administer in the form of crystals to insure prolonged adsorption and which are unstable if suspended in an aqueous solution for too long a period of time, and materials which in suspension tend to calc or lump or in which the crystals tend to grow if prepared too long a time before use.

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Other objects of the invention are to provide an ampoule or cartridge for the purpose above stated so constructed that it may be used with a minimum of wastage of medicaments, that it may be filled easily and inserted in the syringe rapidly, and that it may provide for aspiration by the medical attendant to insure proper intravenous location of the hypodermic needle.

Other objects and useful advantages of my invention will be specifically set forth as the following description of preferred and modified embodiments of my invention proceeds, or will be apparent from the description considered in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a preferred form of my improved syringe, showing the dual-chambered ampoule or cartridge inserted therein in a position in which it might be carried prior to use;

Figures 2, 3, 4, 5 are sectional views on the same plane of section as Figure 1, showing successive stages of movement of the cartridge as it is put into use, Figure 2 showing one of the chambers of the cartridge punctured by a cannula, Figure 3 showing both of the chambers punctured and joined by the cannula, Figure 4 showing the first chamber contracted to expel its contents to the second chamber; and Figure 5 showing the second chamber contracted to expel the mixture of contents through the hypodermic needle;

Figure 6 is a longitudinal sectional view of a modified form of syringe and cartridge, shown in the same relative positions as the showing of Figure 1;

Figure 7 is a view of the modified form in the same relative position as the showing of Figure 5; and

Figure 8 is a transverse sectional view taken on the plane of section indicated by the line 8—8 of Figure 5.

Having reference now to the details of the drawings and particularly to the details of that embodiment of my invention illustrated in Figures 1 to 5, I have shown a cylindrical block 9 which serves as a needle holder and has a projection 10 centrally disposed at one end and surrounded by a flat annular surface 11 which, as will hereinafter be seen, forms an abutment or plunger head for effecting movement of the syringe parts. A cannular needle 12, of the type commonly used for hypodermic injection of

medicaments, is mounted in the needle holder 9 and has one end, which may be termed a cannula 13, extending from the abutment 11 parallel to the projection 10, and its injection end 14 extending from the opposite end 15 of the needle holder. From the end 15 of the needle holder there extends outwardly and then towards and beyond the abutment end 11, a cartridge guide 16, adapted to receive slidably a medicament cartridge 17. The cartridge guide 16 may be in the form of a cylindrical sleeve, but preferably it is simply a plurality of guide rails 18 joined to the end 15 of the needle holder 10 by a spider 19 and joined at their other ends by an annular flange 20 which provides a finger grip for the practitioner. The spider 19 holds the guide rails 18 sufficiently spaced from the needle holder 9 to permit the shell of the cartridge 17 to encompass the needle holder.

The cartridge 17 has a tubular body or shell 21 preferably constricted at one end to form a dome 22 which is sealed. A dam 23 closes the other end of the cartridge body 21, and intermediately of the dam 23 and the dome 22 is another dam 24, the interior cavity of the cartridge being thus divided into chambers 25 and 26. The dams 23 and 24 fit slidably in the cartridge body 21, in the manner of plunger heads. The cartridge body just above the inner dam 24 may be scored to produce an interior annular ridge 27 of sufficient height to resist inward sliding movement of the dam 24 under light pressure. The dams 23 and 24 are, however, made of puncturable material, such as rubber, and this material is sufficiently yielding to permit both the dams to be pushed past the ridge 27, as will be hereinafter described. It may be here noted that the dams 23 and 24 are of substantial and approximately equal thickness and that the depth of the chamber 25 between the dams is substantially equal to the sum of the thicknesses of the dams.

The dams 23 and 24 have, respectively, central orifices 30 and 31, the orifice 31 in the inner dam 24 being slightly larger than the orifice 30. A hollow cylindrical member 32, having a closed end 33, is fitted into the orifice 31, the end 33 extending inwardly so as to enter the dome 22 as a dome within a dome. The member 32 has an annular corrugation 34, convex on its outer side, which serves, among other purposes, to retain the member 32 posited against the wall of the orifice 31. A sleeve 35, of suitable diameter to enter the tubular body of the member 32, is fitted into the orifice 30 of the dam 23 and is sealed externally to the member 32 by a packing ring 36, which may be a rubber O-ring, nested in the concavity of the corrugation 34. The domed end 33 of the member 32 has sufficient height to permit the sleeve 35 to enter it to the extent required when the dams 23 and 24 are contiguous.

At a height above the abutment 11 substantially equal to the thickness of either of the dams 23 and 24, the cannula 13 is provided with a lateral orifice 38. The cannula 13 extends above the orifice 38 approximately three times the height of the orifice above the abutment 11, so that when the abutment is in contact with the dam 23, the orifice 38 will be just within the chamber 25 and the cannula will extend through the chamber 25 and through the dam 24 with its sharpened end 39 just within the chamber 26.

A needle guard 40 is provided which may be removably pressed upon a boss 41 on the needle holder 9, and which contains in its lower end a sealing compound such as soft wax 42, into which the injection end 14 of the needle 13 extends so as to be sealed thereby until the needle guard is removed.

In the operation of the above-described embodiment of my invention, the sublimated or crystalline medicament is placed in the chamber 26 and the dam 24, with the tubular member 32 and O-ring 36 in place, is pushed into position against the annular ridge 27. The chamber 25 is then filled with water or other suitable liquid and the dam 23 is then placed in the open end of the cartridge with the sleeve 35 extending into the tubular member 32 and being sealed by the O-ring. Surplus liquid caught within the passage formed by the sleeve 35 and tubular member 32 may then be poured off.

When the cartridge 17 is inserted between the cartridge guides 18 and pressed inwardly, the cannula 13 will puncture the dam 23 and extend across the chamber 25, as shown in Figure 2. At the same time, the projection 10 will enter the sleeve 35 and tend to keep the dam 23 from becoming disoriented or twisted within the cartridge shell 21 as a result of off-center pressure exerted by the cannula upon the dam. Little liquid, if any, will be lost through the lateral orifice 38 before it is sealed by the dam 23, as after the cannula has pierced the dam its progress will be rapid and there will be insufficient pressure upon the dam to force liquid from the chamber 25. Further pressure upon the cartridge 17 will cause the cannula to puncture the dam 24 and will bring the orifice 38 into the chamber 25 and the abutment 11 into contact with the dam 23, as shown in Figure 3. The projection 10 and sleeve 35 meanwhile slide within the tubular member 32 to maintain the dam 24 in alignment while it is being punctured. Continued pressure on the cartridge will cause the abutment 11 to press the dam 23 inwardly against the dam 24, as illustrated in Figure 4, the liquid contents of the chamber 25 thus being expelled through the cannula into the chamber 26 as the chamber 25 is collapsed under pressure.

With both the liquid and solid contents of the cartridge now consolidated in the chamber 26, the syringe may be shaken to cause liquefaction of the medicament, and the needle guard 40 may be removed, thus unsealing the needle. When the needle has been inserted in the patient, the cartridge may be pressed home against the abutment 11, forcing both the dams 23 and 24 past the annular ridge 27 to the position shown in Figure 5. Both the cannula 13 and the domed tubular member 32 enter the dome 22 of the cartridge, expelling the liquid mixture therefrom so that there is little loss of medicament.

In Figures 6 and 7, I have illustrated a modified form of my invention in which a needle holder 45 holds individually a cannula 46 and a hypodermic needle 47. The cannula 46 has a lateral orifice 48 and is of the same general proportions as the previously described cannula 13. The needle 47 has a cannular end 49 extending in the same direction as the cannula 46, but to a lesser height, the point of the cannular end 49 being approximately the thickness of one dam below the tip of the cannula. The cannula 46 and needle 47 are preferably disposed diametrically oppositely in the needle holder 45; therefore they will exert pressure on opposite sides of the dams, and a central guiding projection may be dispensed with. Cartridge guide rails 50, spaced from the needle holder 45 by a spider 51 and connected by an annular flange 52 are provided as and for the purpose hitherto mentioned.

Modifications may also be made in the cartridge 54. The constricted portion 55 of the cartridge shell 56 may be open at its outer end and may there be provided with a flexible rubber closure 57. Puncturable dams 58 and 59 may have corrugated margins 60 to reduce friction. If the corrugations on the margins 60 are proportioned to receive the annular ridge 61 on the cartridge shell 56, it will be found that they will hold the dams normal to the axis of the cartridge as they successively receive the ridge.

The dams 58 and 59 have, respectively, central orifices 63 and 64, the adjacent margins of which are connected and sealed by a pliable tube 65, of material such as thin rubber sheeting, adapted to bend and fold in the manner of an accordion as the dams approach one another. The inner dam 59 has a tubular member 66 mounted in the inner margin of its orifice 64, this tubular member being closed to form a dome adapted to enter the constricted portion or dome 55.

To fill the cartridge 54, the dam 59 is inserted in the open end of the cartridge shell and pushed in until the dam 58 is about to seal the cartridge. Liquid is then injected into the chamber 67 between the dams under the edge of the dam 58 and the two dams are pushed into place, any suitable rod being inserted through the orifices 63 and 64 and the pliable tube 65 to push the dam 59 against the ridge 61. The solid medicament may then be placed in the inner chamber 68 through the constriction 55 which is then sealed by the cap 57.

When the cartridge 54 is inserted between the guide rails 50 and pressed toward the needle holder 45, the cannula 46 and cannular needle end 49 will successively puncture the dams 58 and 59. The cannula acts in the same manner as in the preferred form of the invention to admit the liquid in the chamber 67 to the chamber 68. From the beginning of the movement of the dam 58 to collapse the chamber 67, the cannular needle end 49 is sealed against or in the dam 59; therefore liquid can not be expelled from the chamber 67 directly to the needle, and the necessity for a needle guard and wax seal is obviated. The practitioner will normally point the needle injection end upward when the cannular end 49 has entered the inner chamber 68.

The pliable rubber closure 57 permits the practitioner to aspirate blood from the patient when the needle has penetrated the chamber 68, in order to ascertain whether the needle has been placed in a blood vessel.

The cartridge 54 may also be used with the needle holder 9 and cartridge guide 16 of the preferred embodiment of my invention, as the orifices 63 and 64, pliable tube 65, and tubular member 66 form a passage which may receive the projection 10. When either form of cartridge, 17 or 54, has been used with either syringe body, it may be quickly removed therefrom, to be discarded, as the spaced guide rails 18 or 50 permit the practitioner to place his fingers under the lower edge of the cartridge to exert retracting force. It will be seen that the syringe bodies themselves are of very simple construction and with the exception of the needles and cannulas may be extruded from plastic material at little cost, and therefore constitute no great economic loss if also discarded when time is lacking for sterilization.

I wish it to be understood that changes may be made in the form and arrangement of my improved syringe and yet fall within the scope and spirit of my invention, and that this detailed description and showing of preferred and modified embodiments of my invention is not to be taken in a limiting sense, as the invention is best defined in the appended claims.

I claim:

1. A hypodermic syringe comprising: a cartridge having a closed end; a plurality of transverse dams of puncturable material slidably carried within the internal cavity of said cartridge and normally dividing said cavity into a plurality of chambers arranged in succession longitudinally of said cartridge; guide means having a needle holder at one end, for guiding said cartridge in movement toward said needle holder, said needle holder having an abutment adapted to enter said cartridge to first move the outermost of said dams into contiguity with the next inwardly succeeding dam and then to move the contiguous dams towards said closed end so as successively to collapse said chambers; and cannular means carried by said needle holder and inclusive of a hypodermic needle, for successively puncturing said dams to permit evacuation of the contents of said chambers requisite to the collapse of said chambers, and having a lateral opening arranged to permit the contents of one chamber to flow into the succeeding chamber when the intervening dam has been punctured, said opening being so spaced from said needle holder as to be sealed by one of said dams when all but the last of said chambers has been collapsed said sealing then directing flow of the contents of said last chamber through said needle.

2. A hypodermic syringe comprising: a needle holder; a cartridge; guide means extending from said needle holders for guiding said cartridge in movement toward said needle holder; a hypodermic needle rigidly held by said needle holder and extending therethrough and outwardly therefrom oppositely to said guide means; a cannula rigidly held by said needle holder and extending therefrom in the same direction as said guide means, and having a sole lateral opening; a plurality of puncturable dams mounted slidably within said cartridge and dividing said cartridge into chambers normally sealed one from another; said cannula being arranged and adapted to puncture said dams successively and to provide communication from one of said chambers to a succeeding chamber through said lateral opening, said needle communicating with chambers entered by said cannula; and means responsive to advancement of said cartridge toward said needle holder for moving one of said dams into contiguity with the next succeeding dam and then for moving said dams as a unit to expel the contents of said chambers through said needle.

3. A hypodermic syringe according to claim 2 in which said cannula and said needle are integral and form a continuous passage.

4. A hypodermic syringe according to claim 2 in which said needle is distinct from said cannula and has a portion extending from said needle holder in the direction in which said cannula extends, said portion being of lesser extent than said cannula.

5. A hypodermic syringe comprising: a needle holder; a cartridge; guide means extending from said needle holder for guiding said cartridge in movement toward said needle holder; a hypodermic needle extending through said needle holder and outwardly therefrom oppositely to said guide means; a cannula held by said needle

holder and extending therefrom in the same direction as said guide means, and having a lateral opening; a plurality of puncturable dams mounted slidably within said cartridge and dividing said cartridge into chambers normally sealed one from another; each of said dams having a central orifice; tubular means connecting the margins of said orifices and forming a sealed passage between said dams; a dome on the innermost of said dams extending into the innermost of said chambers and forming a continuation of said sealed passage; and a projection on said needle holder adapted to enter said passage substantially coincidentally with contact of said cannula with the outermost of said dams, for maintaining alignment of said dams during puncture thereof by said cannula.

6. A hypodermic syringe comprising: a needle holder; a cartridge; guide means extending from said needle holder for guiding said cartridge in movement toward said needle holder; a hypodermic needle extending through said needle holder and outwardly therefrom oppositely to said guide means; a cannula held by said needle holder and extending therefrom in the same direction as said guide means, and having a lateral opening; a plurality of puncturable dams mounted slidably within said cartridge and dividing said cartridge into chambers normally sealed one from another; each of said dams having a central orifice; a tube of pliable material connecting the orifices of adjacent dams and forming a sealed passage between said dams; and an abutment on said needle holder adapted to enter an end of said cartridge to cause movement of said dams toward the other end of said cartridge.

7. A hypodermic syringe comprising: a cartridge; a plurality of transverse dams of puncturable material slidably carried within the internal cavity of said cartridge and normally dividing said cavity into a plurality of chambers arranged in succession longitudinally of said cartridge; a needle holder; a hypodermic needle extending through said holder and having an inner end adapted to puncture said dams; guide means for slidably holding said cartridge for movement toward said needle end; plunger means adapted to enter an end of said cartridge for moving said dams toward the other end of said cartridge to collapse said chambers; and cannula means carried by said plunger means and having a sharp end for successively puncturing said dams and having a lateral opening spaced from said sharp end to permit flow of the contents of one chamber to another chamber when said cannula means has punctured the intervening dam.

8. A cartridge for use in a hypodermic syringe comprising: a tubular body; and a plurality of transverse dams of puncturable material slidably mounted in said body and dividing said body into chambers adapted to communicate one with another when the intervening dams are punctured and to be successively collapsed by

movement of one dam into contiguity with a succeeding inward dam and then by movement of said dams as a unit longitudinally of said body.

9. A cartridge for use in a hypodermic syringe, comprising: a tubular body constricted at one end to form a tubular dome, and a plurality of transverse dams slidably mounted in said body and dividing said body into chambers, that one of said dams adjacent said body end having a cylindrical raised portion adapted to enter said dome to displace the contents thereof when said one dam is moved toward said dome.

10. A cartridge for use in a hypodermic syringe, comprising: a tubular body constricted at one end to form a tubular dome, and a plurality of transverse dams slidably mounted in said body and dividing said body into chambers, that one of said dams adjacent said body end having a tubular dome adapted to enter the dome of said body, and the next adjacent dam having guide means adapted to enter slidingly the dome of said one dam whereby said dams are maintained in parallel relationship transversely of said body while being moved therein.

11. A cartridge for use in a hypodermic syringe, comprising: a tubular body constricted at one end to form a tubular dome; a plurality of transverse dams slidably mounted in said body and dividing said body into chambers, that one of said dams adjacent said body end having a central orifice and a tubular dome surmounting and sealed to the margins of said orifice and adapted to enter said body dome, and the next adjacent dam having a central orifice; and a tube of pliable material connecting the margins of said orifices and forming a sealed passage therebetween and adapted to fold when subjected to end pressure.

12. A cartridge for use in a hypodermic syringe, comprising: a tubular body; a plurality of transverse dams slidably mounted in said body and dividing said body into a succession of chambers, said dams being of material adapted to be punctured by a cannular needle; and a pliable closure for the end of said body toward which said needle would be moved in puncturing said dams, whereby that chamber adjacent said closure may be used as an aspiration chamber when said needle has entered therein.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,929,616	Vopata	Oct. 10, 1933
2,132,763	Smith	Oct. 11, 1938
2,193,322	Lozier et al.	Mar. 12, 1940
2,283,234	Smith	May 19, 1942
2,445,477	Folkman	July 20, 1948