

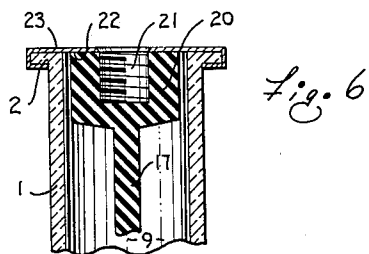
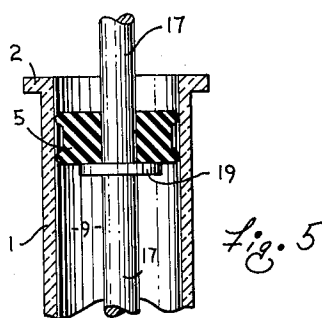
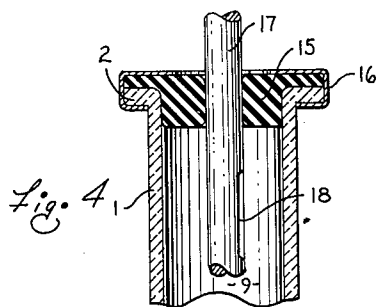
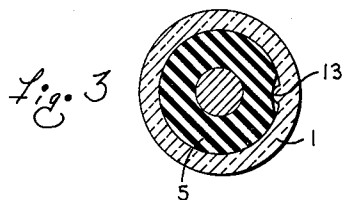
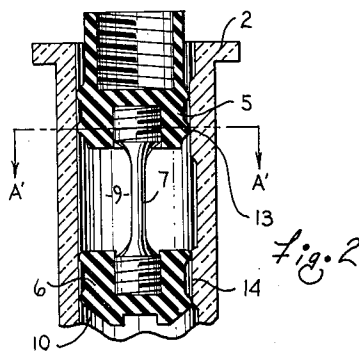
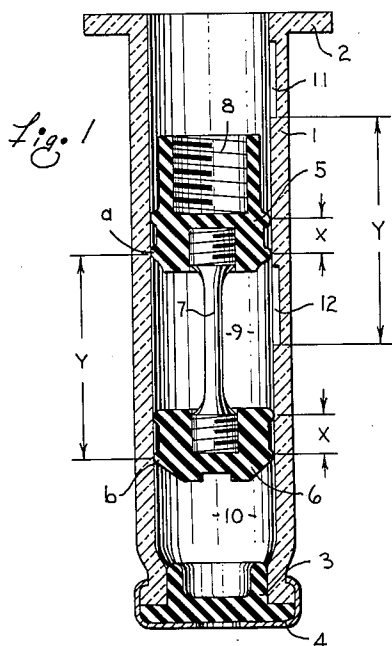
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3,058,467

HYPODERMIC SYRINGES

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3,058,467

HYPODERMIC SYRINGES

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The various operations which are necessary in order to inject a medicament require a certain amount of practice and even a certain manual skill. It is in fact relatively difficult to draw-off the liquid to be injected from the reservoir ampoule in which the said liquid is preserved, when using the hypodermic syringe for this purpose. The difficulties are even more appreciable when the product to be injected is not stable in solution, it being necessary in such a case to keep the said product in powder form so that it is mixed with its vehicle agent only at the time of the injection. In fact, in this case, an additional operation is necessary, since the liquid solvent which serves as a vehicle agent should be taken from its sterile container and injected into the vessel containing the powder to be dissolved. When the powder and vehicle have been suitably mixed together, the solution or product in suspension thus obtained is again drawn-off and injected into the patient by means of the hypodermic syringe. These various operations are long and difficult; moreover, they can never be carried out under perfect conditions of asepsis since they are necessarily effected in a medium which, in principle, is not sterile.

There exist ampoule-syringes which combine in a single instrument the operational properties of a reservoir ampoule and of a hypodermic syringe, thus making it possible to eliminate the operations involved in extracting the liquid.

There also exist ampoule-syringes having two separate compartments, one containing the drug in powder or tablet form and the other containing the liquid intended to serve as a vehicle agent.

In an ampoule-syringe of this known type, the mixture of the powder with its vehicle is thus carried out just before injection, which obviously permits the use of non-stable medicated solutions.

However, these ampoule syringes of known type have considerable drawbacks which are mainly due to the fact that during the mixing process prior to injection, it is difficult to control with any accuracy the passage of the liquid from one compartment to the other. In fact this transfer of liquid is usually carried out by the removal of a plug which separates the two compartments, this removal being effected by virtue of the pressure applied to the said plug through the intermediary of the liquid, which is in turn forced by a piston actuated by the operator.

The present invention has for its object an ampoule-syringe having two compartments, of small overall size, and permitting of perfectly aseptic preservation and independently of the drug and its vehicle as well as easy and safe handling during injection.

The ampoule-syringe in accordance with the present invention has the following features:

(1) Its tubular reservoir is divided into two fluid-tight compartments by the head of a piston: the first of these compartments, which is intended to receive the medicament in powder or tablet form, is sealed at its extremity by a fluid-tight cap which can be perforated and to which a hypodermic needle can be fitted by perforation in accordance with a known method; the second compartment, which is located at the piston-rod end and intended to receive the liquid, is limited at its extremity oppositely facing the head of the said piston by a suitable fluid-tight device through which the piston-rod passes.

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(2) Hollowed-out portions or ribbed portions are formed in the wall of the tubular reservoir at a suitable distance from the said capping ampoule, in such manner that, during the movement of withdrawal of the piston, the said ribbed or hollowed-out portions put the two compartments into communication when the said piston reaches their level; the fluid-tight device which limits the second compartment is so designed that, when the piston head comes opposite to the said hollowed-out portions, this device provides a passage for the atmospheric pressure, which drives the liquid into the first compartment in which a vacuum has been created as a result of the withdrawal of the piston.

Further features and advantages of the present invention will be set forth in the description which follows below, reference being made to the accompanying drawings, in which:

FIG. 1 is a view in longitudinal cross-section of the ampoule-syringe in accordance with the present invention.

FIG. 2 is a fragmentary view in longitudinal cross-section of a modification of the invention.

FIG. 3 shows a view in cross-section taken along the line AA' of FIG. 2.

FIGS. 4, 5 and 6 are fragmentary views in longitudinal cross-section of three different embodiments of the fluid-tight device which closes the second compartment.

Referring to FIGURE 1, a tube 1 of glass or of synthetic material is provided at one of its orifices with a flared portion 2, its other orifice being closed in a manner known per se by a cap 3 of rubber or of any other similar material, held in position by an annular metallic cap 4.

A piston having two heads 5 and 6 of rubber which are coupled together by a rigid rod 7 of glass or of plastic material, is adapted to slide in the tube 1.

In the upper portion of the head 5 is arranged a threaded portion 8 intended to receive the threaded extremity of a piston-rod which is not shown in the drawing.

These two piston heads divide the ampoule-syringe into two compartments 9 and 10.

In the upper half of the tube 1 and in its internal wall there are formed recesses 11 and 12, the height of which is slightly greater than the thickness X of the piston heads.

The distance Y which separates the lower lips of these recesses 11 and 12 is substantially equal to the distance which separates the points of fluid-tight closure a and b, located respectively at the bases of the piston heads 5 and 6.

The compartment 10 contains the product which is not stable in solution, in the form of powder. The compartment 9 contains the liquid which serves as a vehicle agent for the powdered product.

In order to put the powder and the vehicle into contact with each other, it is only necessary at the moment of injection to displace the two-headed piston towards the top by actuating its piston-rod, which is not shown in the drawing. As a result of this, a vacuum is created in the compartment 10 and when the point of fluid-tight closure b arrives opposite the recess 12, the liquid of the compartment 9 is thus sucked into the compartment 10. The point of fluid-tight closure a of the head 5 being then opposite the recess 11, this latter permits the entry of the atmospheric pressure which can thus be applied to the liquid and forces this latter through the said recess 12 into the low-pressure compartment 10.

When the mixture of the powder and its vehicle agent has been correctly completed throughout the compartment 10, it only remains to proceed as in the case of a normal injection, after placing in position an injection needle which is fitted to the cap after perforation of this latter.

The dimensions and in particular the distance which

separates the cap 3 from the recess 12 should be so calculated that the vacuum set up at 10 by the withdrawal of the piston 6 should be sufficient to enable the suction of the liquid which is present at 9 to take place entirely while the compartments 9 and 10 are put into communication with each other.

It is necessary, furthermore, that the space which is left free between the bottom of the recess 12 and the cap 3 is sufficient to contain the mixture of powder and the vehicle which is added to it, when once the solution or suspension has been completed. This condition should in fact be fulfilled so that, during the injection, the movement of thrust of the piston 6 does not have the effect of forcing back the liquid of the compartment 10 into the compartment 9 through the recess 12.

The space between the upper extremity of the recess 12 and the lower extremity of the recess 11 should be sufficiently great to ensure that the plug 5 can be placed therein, in the storage position, without entailing the risk of being accidentally displaced towards one recess or the other.

On account of its position and its length, the recess 11 can enable the ampoule-syringe to be filled with liquid by means of a vacuum in accordance with a method which is known per se. In fact, if the recess 11 is longer than the recess 12, it is possible in a certain position of the two-headed piston to provide a communication between the external medium and the compartment 9 without providing any actual communication between the compartments 9 and 10. This is in fact the case when the piston head 5 comes opposite to the recess 11 while the piston-head 6 has not yet come opposite to the recess 12.

In this position of the two-headed piston, it is easy to carry out the automatic filling of the compartment 9. The extremity 2 of the ampoule-syringe is in fact immersed in the solution with which the compartment 9 is intended to be filled, and the creation of a vacuum around the ampoule syringe—which has not yet been capped at its other extremity—and the gradual restoration of atmospheric pressure result in the automatic filling of the compartment 9. When the double-headed piston is returned to its fluid-tight position, the fluid-tight conditioning of the liquid in the compartment 9 can thus be ensured.

In accordance with an alternative form of construction shown in FIGS. 2 and 3, the recesses 11 and 12 are replaced by bulges 13 and 14 formed on the internal surface of the tube 1. When one of the piston heads 5 and 6 of rubber comes into contact with the corresponding bulge, the said piston head is elastically deformed without however closely fitting the profile of the said bulge and consequently leaves a passage which allows communication either between the compartments 9 and 10 in the case of the piston 6 or between the compartment 9 and the exterior, in the case of the piston 5.

In the forms of embodiment of the ampoule-syringe in accordance with the present invention as described above, the access of atmospheric pressure into the compartment 9 is ensured by causing the piston 5 to come opposite to either the recess 11 or the bulge 13 which are formed at the orifice of the tube 1.

It is quite obvious that any other device which ensures this admission of the atmospheric pressure into the compartment 9, in synchronization with the establishment of communication between the compartments 9 and 10, will fall within the scope of the present invention.

FIG. 4 shows one of these forms of embodiment. In this device, the piston-head 5 is replaced by a fluid-tight elastic ring 15 fixed at the extremity of the tube 1 by means of a metallic cap 16 and gripping the piston rod 17. The upper portion of this rod has a cylindrical section which ensures perfect fluid-tightness of the compartment 9 when the piston-head 6 (not shown in the

drawing) is in the storage position. The portion of the rod 17 which is located directly beneath this portion having a cylindrical section is provided either with grooves 18 or bulges which form an air passage when, as a result of the withdrawal of the piston 6 and of the rod 17, the said grooves or bulges come opposite to the elastic ring 15.

FIG. 5 shows a form of construction in which the piston head 5 is completely disengaged from the tube 1, instead of co-operating with a recess or bulge at the time of the air penetration stage.

In this form of construction the piston head 5 actually plays the part of a simple plug.

A ring 19 which is rigidly fixed to the rod 17 of the piston 6 (not shown) and disposed at the base of the plug 5 applies an effort on this latter during the movement of withdrawal of the piston caused by the action of the operator on the rod 17. This effort tends to completely disengage the plug 5 from the tube 1. As the plug 5 is constituted by a ring which is inserted with slight friction on to the rod 17, it follows as a result that during the movement of injection, the plug 5 slides on the rod 17 without again passing into the tube 1. Friction which is undesirable during the injection, is thus considerably reduced.

FIG. 6 shows a form of embodiment which completely eliminates the piston-head 5 or its equivalent. In accordance with this form of embodiment, the rigid rod 17 which is rigidly fixed to the piston 6 (not shown), terminates at the level of the upper lip 2 of the tube 1 in a non-fluidtight end portion 20 tapped at 21 and intended to receive the threaded extremity of a piston rod which is not shown in the drawing. The upper lip 2 of the tube 1 and the external edge 22 of the end-pieces 20 are coupled together by means of a capsule 23 constituted by a thin skin of thermo-weldable material which ensures the fluid-tightness of the compartment 9. This thin capsule is easily torn by the withdrawal of the end-piece 20 when a movement of withdrawal is imparted to the said rod after the piston rod is screwed into the tapped emplacement 21.

The tearing of the thermo-weldable capsule thus gives access to the atmospheric pressure in the compartment 9.

It is understood that the scope of the present invention could cover any alternative form of embodiment in which the admission of the atmospheric pressure into the compartment 9 is effected by means of the tearing of a capsule, irrespective of the position of the said capsule or of the manner in which it is torn. This tearing process could in fact be carried out by hand, for example, or it could also be produced by the perforation of the capsule caused by screwing the piston-rod into the tapped emplacement, the orifice of which could be covered for this purpose by the capsule itself.

What I claim is:

1. A syringe vial for storing two substances in separate chambers and for permitting mixing thereof comprising, in combination: a substantially tubular body; a fluid tight cap closing off one end of said tubular body, said cap being capable of being perforated; a resilient piston head disposed in said tubular body and sealingly and slidably contacting the internal wall thereof, said piston head dividing said tubular body into two isolated chambers, one of which is located between said cap and said piston head and the other of which is located between said piston head and the other end of said tubular body; a piston rod secured to said piston head for effecting longitudinal movement thereof within said body; means on said tubular body cooperable with said piston head for placing the chambers in communication with each other when said piston head is at a predetermined location within said body; means cooperating with said piston rod for closing off the other end of said other chamber, said last-named means including means responsive to longitudinal move-

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ment of said piston head toward the other end of said body for placing said other chamber in free communication with the atmosphere through said other end of said tubular body when said piston head is in said predetermined location, such longitudinal movement of said piston head also creating a vacuum in said one chamber so that liquid in the other chamber will be drawn into said one chamber when said piston head is in said predetermined location.

2. A syringe vial according to claim 1 wherein said means for closing off the other end of said other chamber comprises a second resilient piston head secured to said piston rod and slidably and sealingly contacting the internal wall of said tubular body; means on said tubular body cooperable with said second piston head for providing a passage between said second piston head and said tubular body to thereby place the other chamber in communication with the atmosphere when said first-mentioned piston head is in said predetermined location.

3. A syringe vial according to claim 2 wherein said tubular body has a pair of circumferentially extending grooves in the internal wall thereof of axial thickness greater than the axial thickness of said piston heads, said grooves being axially spaced a distance corresponding to the spacing of said piston heads so that said piston heads can simultaneously be aligned with said grooves, one of said grooves defining said means for placing said chambers in communication with each other and the other groove defining the means for placing the other chamber in communication with the atmosphere when said first-mentioned piston head is in said predetermined location.

4. A syringe vial according to claim 2 wherein said tubular body has a pair of inwardly extending projections on the internal wall thereof, said projections being axially spaced a distance corresponding to the spacing of said

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piston heads so that said piston heads can simultaneously be deformed by said projections, one of said projections defining said means for placing said chambers in communication with each other and the other projection defining the means for placing the other chamber in communication with the atmosphere when said first-mentioned piston head is in said predetermined location.

5. A syringe vial according to claim 1 wherein said means for closing off the other end of said other chamber is an annular cap through whose central opening said piston rod extends; said piston rod having an axially elongated groove in the periphery thereof for forming a passage connecting the atmosphere to said other chamber when said piston head is in said predetermined location.

6. A syringe vial according to claim 1 wherein said means for closing of the other end of said other chamber is a second piston head slidably mounted on said piston rod so that it may be completely removed from said tubular body when the first-mentioned piston head is in said predetermined location.

7. A syringe vial according to claim 1 wherein said means for closing off the other end of said other chamber includes a rupturable sheet.

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