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Wimmer

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[54] **TWO COMPARTMENT AMPUL SYRINGE**

[75] Inventor: **Hans Wimmer**, Vicht, Germany

[73] Assignee: **The West Company**, Phoenixville, Pa.

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Related U.S. Application Data

[63] Continuation of Ser. No. 791,093, Jan. 14, 1969, abandoned, which is a continuation-in-part of Ser. No. 703,149, Feb. 5, 1968, abandoned.

[30] **Foreign Application Priority Data**

Jan. 26, 1968 Austria 4A784/68

[52] **U.S. Cl.** .. **128/218 M**, 128/218 P, 128/218 PA, 222/80, 222/136

[51] **Int. Cl.** **A61m 5/00**

[58] **Field of Search** ..... 128/215, 218 R, 218 M, 128/218 P, 220, 234, 235, 236, 237, 272, 276, 218 N, 218 NV, 218 D, 218 PA; 222/136, 137

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Primary Examiner—Richard A. Gaudet
Assistant Examiner—J. C. McGowan
Attorney—Howson & Howson

[57] **ABSTRACT**

A two-chamber syringe ampul with an ampul cylinder which at one end runs into a mouthpiece, designed to take an injection needle and which is as a rule closed in the first place, with at the end of the ampul cylinder opposite the mouthpiece an elastic closure piston which seals against the exterior, and with a separating piston which divides the ampul cylinder into two chambers, and with at least one pusher element acting on the separating piston, characterized in that the separating piston and/or an associated pusher element, passing through the separating piston and displaceable, has or forms a connection channel bridging over the separating piston, which channel prior to use of the syringe ampul is closed, and can be opened by an axial movement of the pusher element relatively to the separating piston, and in that both pistons are made displaceable, and during the injection can be connected together so as to be displaceable in common.

2 Claims, 2 Drawing Figures

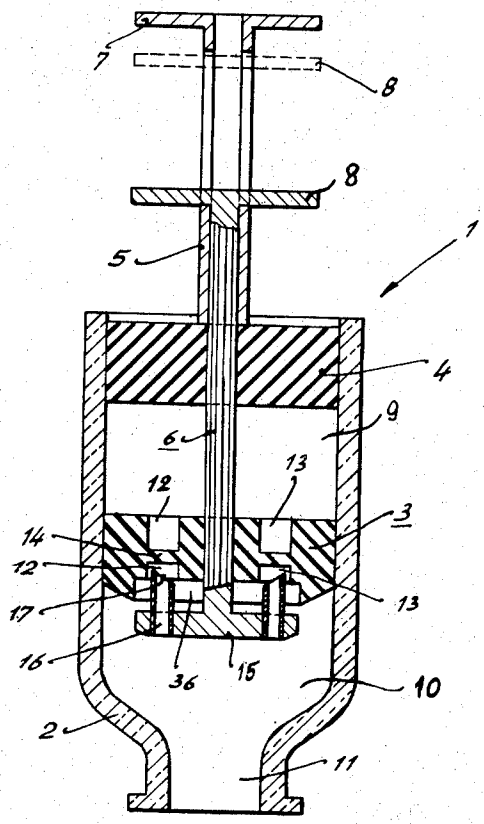


FIG. 1.

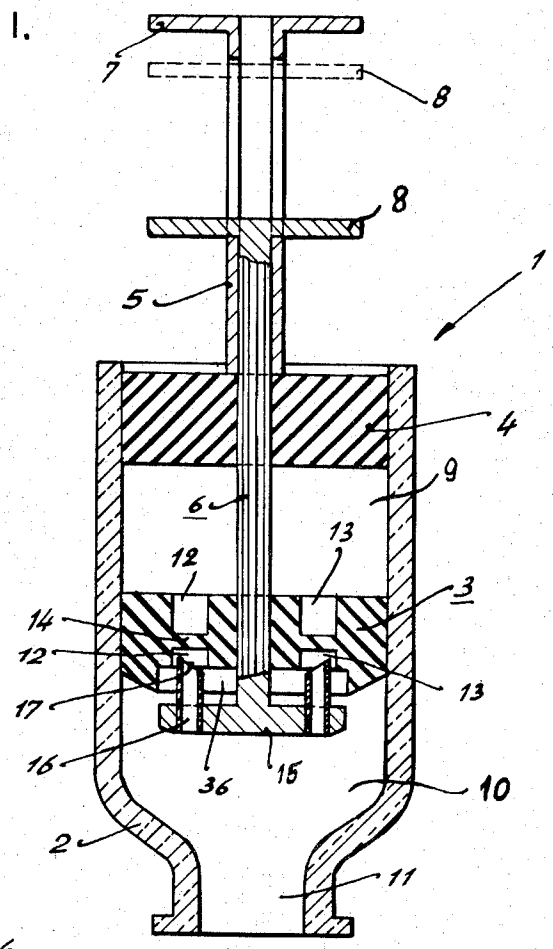
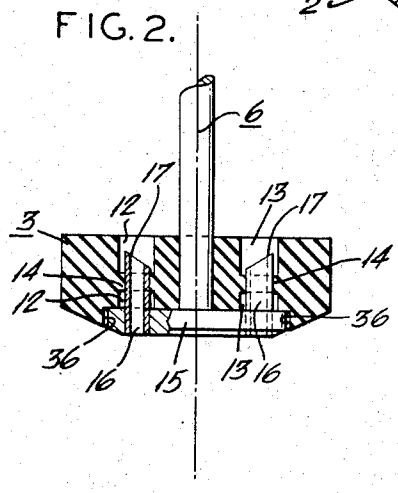

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FIG. 2.


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TWO COMPARTMENT AMPUL SYRINGE

This is a continuation application of my prior application Ser. No. 791,093, filed Jan. 14, 1969, now abandoned, which was a continuation-in-part application of my prior application Ser. No. 703,149, filed Feb. 5, 1968, now abandoned.

The invention concerns a two-chamber syringe ampul with an ampul cylinder, which at one end terminates in a mouthpiece, which is as a rule at first closed and is designed to take an injection needle, with an elastic closure piston which closes from the exterior the end of the ampul cylinder turned away from its mouthpiece, and with a separating piston which divides the ampul cylinder into two chambers, and with a pull rod which acts at least on the separating piston.

There are already known syringe ampul of the aforesaid kind, with which the separating piston has an overflow channel closed by a membrane and which during use, through the movement of the closure piston toward the mouthpiece designed to take the injection needle, and through the thus-produced pressure of fluid, becomes burst, provided that it is ensured that the separating piston is seated so tightly in the ampul cylinder that the pressure needed to burst the membrane does not suffice to overcome the adhesion-friction of the separating piston. Such a tight fit of the separating piston is however undesirable from the point of view of a smooth performance of the injection so that the patient is to a great extent spared pain. The space delimited by the separating piston and the mouthpiece for taking the injection needle must also be large enough to take, in addition to the preparation contained there, usually powder, also the fluid preparation present between the separating piston and the closure piston.

There are also known syringe ampullas having a separating piston with an overflow channel and also an immovable closure stopper, with which the overflow channel can be opened or closed by means of an outwardly-extending rotatable actuating rod. Because this makes necessary rotation-prevented guidance of the separating piston, the known syringe ampullas have in association with their separating piston an uneconomical complicated design with an elliptical or oval cross-section. Because the closure stopper is in this case not movable, there exists the drawback that during the pushing forward of the separating-piston a vacuum becomes formed behind it during the injection, and this makes the injection operation more difficult.

The purpose of the present invention consists of removing the said drawback. The fundamental problem of the invention is to create a two-chamber syringe ampul which in comparison with prior-art arrangements has the advantage of the least-possible dimensions of the ampul cylinder, easy-running displaceability of the separating piston, convenient manipulation, and an economical method of production. Finally, simple filling-in of the medicament is desired.

This problem is solved in that the separating piston and/or an associated pull rod passing through the separating piston and displaceable has or forms a connection channel bridging over the separating piston, and closed before use of the syringe ampul, and openable through an axial movement of the pull rod relatively to the separating piston, and in that both pistons are made displaceable and during the injection can be connected so as to be displaceable in common.

The arrangement can also be such that the connection channel bridging over the separating piston is formed through a greatly diminished cross section of the end section of the pull rod which during use passes into the passageway opening in the separating piston, in that a connection channel remains between the two chambers along the diminished cross-section end section of the piston rod when this end section with the pull rod pulled back passes through the separating piston, and that the part of the pull rod not diminished in cross section prior to use passes fluid-tight through each passageway opening of the closure piston and of the separating piston.

The form of construction can also be such that the diameter of the end section and of the next-greater diameter of the pull rod are so matched to the outer and inner diameter of the elastic separating piston that this piston rests sealingly against the wall of the ampul cylinder as well as against the pull rod when it sits upon the part of the pull rod having the greater diameter, that however the separating piston contacts the cylinder wall only lightly, or no longer contacts it, when the end section of the decreased cross section of pull rod passes through this separating piston.

It is also possible for the pull rod to have at the part of it with the full cross section, but adjacent however, to the part of decreased cross section, a flange with a sawtooth profile matching a corresponding peripheral groove in the central passageway opening in the closure piston, whose beveled edge tapers down toward the ampul mouthpiece that takes the injection needle, and that during use the full-section part of the pull rod can be pulled out of the separating piston, and the flange can be brought into engagement with the closure piston.

The separating piston may also have in its central passageway opening peripheral groove corresponding to the profile of the flange and which prior to use can be brought into engagement with the flange.

The piston stop may also be made as a cross-pin or a disk with at least one axial passageway, which extends radially substantially as far as to the cross-section surface of the piston-rod at its end section of diminished cross section.

There may also be such a form of construction that the end section of the pull rod of full cross section has a diameter somewhat greater than that of the central passageway in the separating piston after the end section of the pull rod of full cross section is pulled out of its central passage-way opening, which has a diameter smaller than when the piston-rod is pushed in.

The mouthpiece of the ampul cylinder designed to take an injection needle can prior to use be hermetically closed, preferably by means of a nozzle-closer that can be cut off and/or a closure cap.

It is also possible to have such an arrangement that the projection from the pull rod and the passageway through the separating piston, and also the piston-stop in the hollow space in the separating piston, are so matched to one another that with the pull rod pulled back relatively to the separating piston the front end of its projection just reaches the end of the outlet, so that there the separating piston forms with the projection a one-way valve, which at the pulling back of the pull rod lets fluid flow out of the one chamber into the other

chamber, but which, however, seals when the piston-rod is pushed back.

It is also possible to have such a form of construction that in the separating piston there is prior to use a connection channel closed by a membrane, and the pull rod, which by its inner end seals an opening in the separating piston, however passes slidably through it, and has at that end a stop disposed at a spacing from the associated piston surface, and this stop carries, on the prolonged axis of each connection channel, a connecting cannula which, with a suitable axial displacement of the piston-rod, becomes stuck through the corresponding membrane.

The pull rod may also have at its inner end a connection channel open in the direction toward the injection needle, and the channel's rear opening, ending at the peripheral surface of the pull rod, is arranged so that, prior to use of the syringe ampul, it is surrounded sealingly by the separating piston, and becomes unobstructed when the pull rod stop rests against its associated piston surface.

For coupling between the separating piston and the closure piston, the cannula protective-sleeve can be removed from the needle and be screwed on the piston-rod, bearing hereby against the outer end face of the closure piston.

In the hollow space in the separating piston there may be provided, preferably on the piston-stop of the pull rod, return-movement elements, for example elastic abutment-noses, which close the one-way valve when the piston-rod does not become pulled back.

In accordance with the patent application, there is obtained the advantage that the two chambers can be kept so small that their volume is not appreciably greater than that of the preparations to be contained therein and to be mixed together. During a movement of the inner piston toward the outer piston the fluid preparation present in the outer chamber is spurted into the other chamber near the injection needle, in which there was initially present only a preparation in the form of a powder, whereby an intense spurting of the fluid preparation present in the first chamber into the second chamber makes possible a thorough mixing together of the two preparations. Because during the mixing process the fluid preparation from the chamber remote from the injection needle only becomes forced into the second chamber, no over-pressure is produced as the inner piston approaches the outer piston. Because during the performance of the injection itself both pistons become moved in common toward the injection-needle end of the ampul cylinder, there is also no vacuum produced behind the piston at the needle side. The person operating the syringe can without any great expenditure of force perform the injection, which is very essential for steady holding of the syringe ampul, and thus for effecting an injection as free of pain as possible. The last-named advantage is particularly valuable because the friction of the inner piston against the ampul cylinder is with the syringe ampul of the invention kept relatively small.

Through the arrangement of the elastic separating piston, which prior to use has passing through it the part of the piston-rod of greater diameter and during use has passing through it the greatly reduced rod diameter, there is obtained the advantage that the separating piston, prior to use of the syringe ampul, is prestressed radially by the adjusting device against the ampul cylinder, thus obtaining good sealing, whereas on the other hand and after use, with the pull rod pulled back, the separating piston is relieved of radial stress and becomes contracted, whereby then the outer diameter of the separating piston preferably becomes somewhat less than the inner diameter of the ampul cylinder. In this way, during the performance of the injection the friction of the inner piston against the inner surface of the ampul cylinder is practically eliminated.

Through making use of a conical flange disposed on the piston-rod, which flange during the pulling-back of the piston becomes caught in a peripheral groove in the closure piston, there is obtained the advantage that only a single common pull rod is associated with the separating piston and the closure piston, through operating which rod there can be effected both a mixing of two preparations contained in the ampul cylinder, as well as the injection itself.

In the following the essentials of the invention are described in more detail by the aid of a number of examples of construction shown in the drawings. To different scales:

FIG. 1 is a longitudinal sectional view of a two compartment syringe constructed in accordance with the present invention; and

FIG. 2 is a fragmentary sectional view of the separating piston and pull rod after actuation of the pull rod to penetrate the diaphragm.

There is illustrated in FIGS. 1 and 2 of the drawing a two compartment syringe constructed in accordance with the present invention wherein, the powdered preparation can prior to use be separated by a fixed membrane **14** from the second chamber. A syringe ampul, designated as a whole by **1**, has an ampul cylinder **2** made of glass, has a separating piston **3** as well as a closure piston **4** which is connected to a pusher element **5**, and it also has a pull rod **6**. At the outer end of the pusher element **5** and of the pull rod **6** is in each case a double-grip **7** and **8** respectively. The closure piston **4**, disposed at the end of the ampul cylinder **2** closes that cylinder from the exterior, and during the injection it drives the separating piston **3** ahead of it. That piston in the first place, prior to making ready for the injection that is, is situated about in the middle of the inner space of the cylinder, and it divides the volume enclosed by the ampul cylinder **2** and the closure piston **4**, into two chambers **9** and **10**. In the chamber **10**, turned toward the mouthpiece **11**, is situated a (not shown) powdered preparation; and in the chamber **9** is situated a fluid preparation, distilled water for example.

In accordance with an essential characteristic of the invention, the example of construction of FIGS. **1** and **2** has in the separating piston **3** two channels **12** and **13** designed to connect the chambers **9** and **10**, which are in the first place separated from one another by a membrane **14**. In the hollow pusher element **5** of the closure piston **4** is disposed the pull rod **6**. The closure piston **4** surrounds it and seals it from the exterior. In the internal space of the cylinder this pull rod passes sealingly through the separating piston **3**, but it is however displaceable, and it carries at its inner end a stop **15**, to which are fastened, coaxially with the connection channels **12** and **13**, connection canullas **16**, whose pointed openings **17** end near the membranes **14** when the pull rod **6** is situated in its inner or initial position (FIG. 1).

When it is desired to make the syringe ampul **1** ready for use, it is only necessary to move the double-grip **8**,

connected to the pull rod 6, in the direction toward the double-grip 7 of the piston-rod 5 (see the dotted-lines position of the double-grip 8 in FIG. 1). The pull rod 6 thus moves into its outermost position, and it presses the stop 15 into the recess 36 in the separating piston 3, which because of the fluid present in the chamber 9 can deviate not at all or only immaterially. Through this the connection canullas 16 become stuck through the membranes 14 (FIG. 2) so that the fluid becomes spurted into the chamber 10 and becomes mixed with the powdered preparation contained there.

In the outermost position of the pull rod 6 the stop 15 is situated in the recess 36 of the piston, so that this piston has a continuous surface. This surface rests with its rear side against the separating piston 3.

The form of construction according to FIGS. 1 and 2 has the advantage that it is possible to make the membranes 14 so thick that there is a sufficiently reliable separation of the chambers 9 and 10 while taking into account a possible diffusion effect with the membranes 14; and hereby an undesirable rigid clamping seat of the separating piston 3 is not needed during the injection. With both forms of construction of the syringe ampul 1 it is advantageous to make the separating piston 3 and the closure piston 4 of an elastic material, rubber for example.

I claim:

1. A two-compartment syringe comprising an ampul cylinder having openings at opposite axial ends adapted to mount an injection needle at one axial end, a first elastic closure piston at the opposite end of said ampul cylinder, a second elastic separating piston normally dividing the ampul cylinder into two chambers, one of said chambers for a powder medicament and the other of said chambers for a fluid additive to be mixed with the powder medicament, said separating piston having at least one connecting channel for establishing fluid communication between the chambers, a membrane normally closing said channel, at least one pull rod assembly engaging through said closure and separating pistons and operatively associated with said separating piston, said pull rod assembly having a stop member on the end of the pull rod within the ampul which carries a connecting cannula aligned with said channel, said cannula having a passageway therethrough communicating with one of said chambers and operable upon axial displacement of said pull rod to pierce said membrane to establish fluid communication between said chambers, a pusher element engaging said first elastic closure piston and operatively associated with said pull rod in a manner whereby both said first and second pistons can be displaced and actuated as a unit during injection, finger engaging means on both the pull rod and the pusher element, and means mounting said pusher element and pull rod assembly for telescoping movement axially relative to one another facilitating actuation of said pull rod assembly to pierce said membrane and movement of said pusher element to displace said first and second pistons as a unit.

2. A two-compartment syringe in accordance with claim 1 characterized in that said separating piston has a recess capable of receiving the stop fastened to the pull rod.

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