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MULTI-CHAMBER SYRINGE

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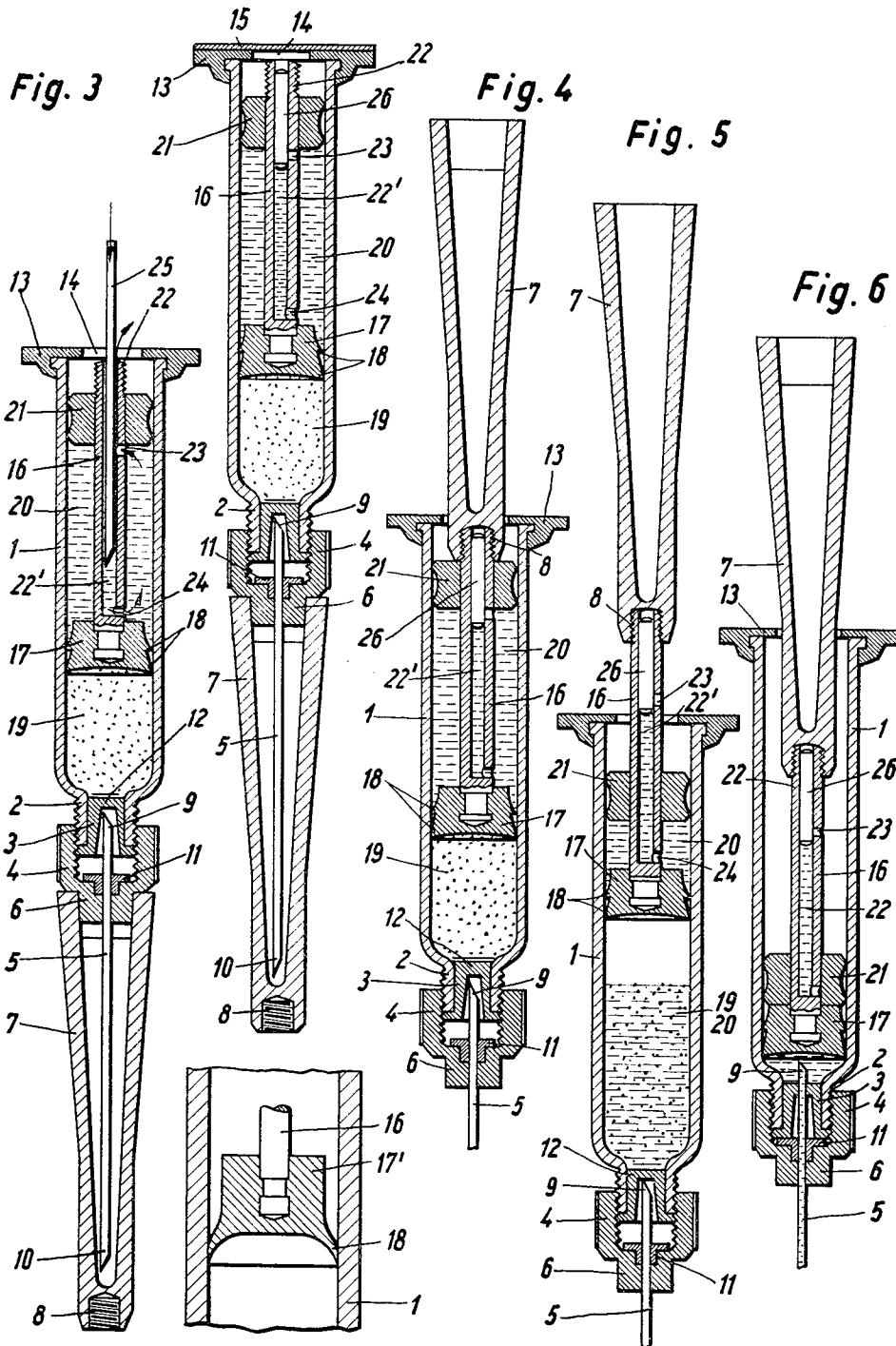


Fig. 1

Fig. 2

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MULTI-CHAMBER SYRINGE

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5 Claims

ABSTRACT OF THE DISCLOSURE

A syringe, which comprises a vial cylinder and a piston axially movable in the vial cylinder and dividing the vial cylinder into at least two separate chambers. The piston has means permitting liquid movement from a front to a rear chamber but blocking movement of said liquid in the opposite direction. A piston rod is non-movably secured to and displaces the piston, which is movable in the vial cylinder towards the injection end thereof. At least one stopper has a central bore and is disposed in and seals the vial cylinder, permitting independent and free movement of the piston during its forward movement, and the piston rod projects through and is guided by the stopper.

The present invention relates to a syringe, and in particular to a two-chamber syringe, which is adapted for a singular application and which is delivered ready for use with its content of the medicine.

Such multi-chamber syringes have the advantage that the medicine to be injected and the medicine, and the solvent suitable therefor, respectively, is preserved in a vial chamber and is admixed only immediately prior to the injection.

In known syringes of this type, the separation of the two vial chambers is brought about by means of a stopper, which divides the vial cylinder into two separate chambers and which is displaceable by means of a piston rod. In order to render possible this movement, either a complicated piston- or piston rod-structure is required, which makes possible the piercing or breaking of the stopper separating the two medicines from each other or a special vial is used, which has at its center outwardly projecting by-pass channels, which make possible the transfer of, for instance, the solvent to the medicine around the outside of the stopper, as soon as the stopper is in the position required therefor. Such embodiments of syringes are technically complicated and, for this reason, too expensive for a singular use of the syringe. They have only a low operational safety and a short storage life. Furthermore, they require a change of the habits by the physician for handling a syringe.

It is one object of the present invention to provide a syringe, in particular a two-chamber syringe, wherein the drawbacks of the known structures are completely removed.

It is another object of the present invention to provide a syringe, and in particular a two-chamber syringe, wherein a piston is only passable towards the injection end and is mounted non-displaceably on a piston rod leading to the outside and wherein the piston rod guides itself at the rear end of the vial cylinder in a stopper sealingly closing the latter, which stopper is designed such, that the advance stroke of the piston is not interfered with. Preferably, the stopper is designed as a piston sealing to the inside and to the outside, which piston joins the advance stroke of the main piston.

It is still another object of the present invention to provide a syringe, and in particular a two-chamber syringe, wherein the piston rod, while passing through the stopper,

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terminates inside of the vial cylinder and is equipped with a collar, a thread or the like, for mounting a piston rod extension. By this arrangement, the possibility is provided to close up the vial end additionally in a suitable manner, whereby the storage capability can be further increased. Thus, simultaneously a safety against an unintended movement of the main piston during a storage period of the syringe is provided. Finally, it is also still further possible, however, to mount additional separating stoppers on the piston rod. In order to increase the sealing cap ability and additionally provide a better piston guide a piston can be used, which has a plurality of sealing lips disposed behind each other.

It is yet another object of the present invention to provide a syringe and in particular a two-chamber syringe, in which the piston rod has a filling channel extending over the length of and terminating closely behind the piston, in order to permit filling of the syringe with the medicine and the solvent, respectively, in simplest manner, which filling channel communicates with the inside area of the vial inner chamber, which is limited by the piston and the stopper by means of at least one radial bore provided adjacent the piston and the stopper and which filling channel is closed up after the filling with the medicine or with the solvent towards the outside by means of a filler, which extends at least to the radial bore provided adjacent the stopper.

With these and other objects in view which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawing, in which:

FIG. 1 is a longitudinal section of the two-chamber syringe immediately after its filling;

FIG. 2 is a fragmentary section of another embodiment of the piston, shown at an enlarged scale;

FIG. 3 is a longitudinal section of the syringe in its storage state;

FIGS. 4 and 5 are longitudinal sections of the syringe immediately prior to using the syringe, indicating two different working positions; and

FIG. 6 is a longitudinal section through the same syringe after the injection.

Referring now to the drawing, the syringe comprises a vial cylinder 1, the front end of which forms a neck portion 2 having an outer thread, into which neck portion 2 is rigidly inserted a closing stopper 3 in sterile manner, closing the vial content. A screw cap 4 is screwed on the outside of the neck portion 2, which screw cap 4 carries an injection needle 5 and a collar 6. A cap 7 is mounted on the collar 6 and surrounds the injection needle 5 in a sterile arrangement, which cap 7 provides simultaneously a protection for the injection needle 5. The cap 7 is equipped at its outer free end with a threaded bore 8, which is to be described below. The hollow injection needle 5 has a point 9 and 10, respectively, at both ends and is rigidly connected with a disc 11, which is mounted in the screw cap 4.

It is of importance that the screw cap 4 together with the injection needle 5 is at first screwed onto the neck portion 2 of the vial cylinder 1 only to such extent, that the point 9 of the injection needle 5 is disposed inside of the closing stopper 3 cannot pierce a closing membrane 12 provided in the closing stopper 3.

A holding or gripping plate 13 is mounted on the rear end of the vial cylinder 1. The holding plate 13 has a bore 14, which has a diameter smaller than the clear width of the vial cylinder 1 at its rear end and which bore 14 is closed during the storage period of the filled syringe by means of a cover 15 or a pasted-on member or the like.

A main piston 17 and 17' (FIGS. 1 and 2), respectively, is rigidly mounted inside the vial cylinder 1 at the front

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end of a piston rod 16, which main piston 17 and 17', respectively, is made preferably of elastic materials, as rubber or synthetic material, and is equipped with one or a plurality of sealing lips 18 engaging the inside of the vial walls. It is to be understood that the material of the pistons 17 and 17', respectively, must be resistant to the medicine used in the syringe.

The piston 17 divides the vital cylinder 1 into two chambers 19 and 20, in which, for instance, two liquid medicines, which are to be preserved separately from each other, may be contained or the chamber 19 contains, as shown in the drawing, a powderlike medicine or drug and the chamber 20 contains a solvent therefor. At the rear end, the vial cylinder 1 is sealingly closed by means of a closing stopper 21, which is suitably of the same material as the piston 17. This closing stopper 21 can likewise be designed as a piston, which guides itself by means of sealing lips at the inner wall of the vial cylinder 1, as well as on the piston rod 16. The piston rod 16 extends with a threaded extension 22 beyond the stopper 21, which, however, terminates still inside of the vital cylinder 1, so that the piston rod 16 is protected particularly by the cover 15 and cannot be displaced unintentionally during its storage period.

The piston rod 16 has a longitudinal bore 22' which terminates short of the piston 17 and communicates by means of a radial bore 23 short of the closing stopper 21 and an additional radial bore 24 short of the piston 17 with the inner chamber 20 of the vial cylinder 1. A thin filler tube 25 can be inserted into the longitudinal bore 22', which filling tube has the shape of a hollow needle. After filling of the syringe and removal of the filling tube 25, the longitudinal bore 22' is rigidly closed up to the bore 23 by means of a filling mass or another stopper 26.

The filling of the medicine, for instance in powder form, into the chamber 19 takes place after insertion of the piston 17 into the cylinder 1 through the neck portion 2. Thereafter, the piston 17 with its piston rod 16 and the closing stopper 21 are inserted to about the position shown in FIG. 1. Now, by means of the filler tube 25, the filling of the liquid takes place into the chamber 20 of the vital cylinder 1 (FIG. 1) and thereafter the closing of the hollow piston rod 16 with the mass or the stopper 26. Finally, the bore 14 in the plate 13 is closed up by means of a cover 15, a label or the like (FIG. 3). In this state, the syringe filled with the medicine and with a medicine and a solvent, respectively, can be stored for any selected time.

If the syringe designed in accordance with the present invention is to be used, the cap 7 is first removed from its seat 6 and is screwed with its thread 8 to the threaded projection 22 of the piston rod 16 from behind, since the inner thread 8 of the cap 7 has a thread complementary to the outer thread of the threaded projection 22, after the cover 15 has been first removed or pierced (FIG. 4).

With the piston rod 16, which is now extended by means of the cap 7 screwed thereto, the piston 17 can be withdrawn in the vial cylinder 1. The liquid container in the chamber 20, which cannot be compressed, flows thereby around the piston 17 and its sealing lips 18, respectively, in front thereof and enters the chamber 19. Here, the liquid is admixed with the powder-like or liquid medicine disposed in the chamber 19 (FIG. 5). In this manner, it is possible to empty by a simple withdrawal of the piston 16 the content of the chamber 20 into the chamber 19 and the medicines can be transformed into their usable state, respectively. During withdrawal of the piston rod 16, the closing stopper 21 can only be joined up to the abutment on the plate 13, which prevents the removal of the piston-stopper combination 16, 17 and 21 from the vial cylinder 1.

Now, the screw cap 4 can be screwed completely on the vial neck portion 2. By this activity, the injection needle 5 pierces with its inner point 9 through the bottom 12 of the insert or stopper 3. Only now, the air con-

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tained in the syringe is pushed out in a conventional manner, due to the displacement of the piston 17. Only then is it possible to start with the injection and with the injecting of the medicine. By this arrangement, the piston 17 is pushed down to the vial neck portion 2 by means of the piston rod 16 jointly with the cap 7. The closing stopper 21 joins in this movement due to the pressure below atmospheric pressure formed between the piston 17 and the closing stopper 21.

By mounting further displaceable stoppers on the piston rod 16, further additional chambers for medicines or solvents can be formed. In a three-chamber syringe, for instance, an additional piston, corresponding as to design with the piston 17, sits on the piston rod 16, whereby the chamber 20 is additionally divided. The operation with such syringe is then the same as described above in connection with the two-chamber syringe. During withdrawal of the piston rod 16, the individual stoppers and finally, the piston abut on the closing stopper, whereby the individual chambers are emptied successively, and at the end of the movement, all medicines and possible solvent are combined or joined in front of the piston 17, so that they can be injected jointly.

While I have disclosed several embodiments of the present invention, it is to be understood that these embodiments are given by example only and not a limiting sense.

I claim:

1. A syringe comprising a vial cylinder, a piston axially movable in said vial cylinder and dividing said vial cylinder into at least two separate chambers constituting a rear chamber and a front chamber, said piston having means permitting liquid movement from said rear chamber to said front chamber, said means blocking the movement of said liquid in the opposite direction, a piston rod secured to said piston, said piston being movable in said vial cylinder towards the injection end thereof, at least one sealing stopper having a central bore and disposed in said rear chamber and sealing said vial cylinder, permitting independent and free movement of said piston during its forward movement, and moved during the forward stroke of said piston with the latter by the pressure below atmospheric pressure prevailing in said emptied rear chamber, and said piston rod projecting through and being guided by said stopper.
2. The syringe, as set forth in claim 1, wherein said stopper comprises a piston sealing at its outer face as well as at its inner face of said bore and adapted to join the forward movement of said first mentioned piston.
3. The syringe, as set forth in claim 1, wherein said piston rod terminates within said vial cylinder and has at its free end extension receiving means, and a piston rod extension secured to said extension receiving means of said piston rod.
4. The syringe, as set forth in claim 1, which includes at least one additional stopper disposed between said piston and said first mentioned stopper in said vial cylinder, in order to divide the latter into additional chambers.
5. The syringe, as set forth in claim 1, wherein said piston rod has an axial filling bore extending along the greater part of its axial length and terminating short of said piston, and said piston rod having at least two radial bores leading from said filling bore into that portion of said chamber defined by said vial cylinder which is disposed between said piston and said stopper, one of said radial bores is disposed adjacent said piston and the other of said radial bores is disposed adjacent said stopper, and which includes

a filler means inserted into said axial filler bore, after filling medicine into said vial cylinder, and extending in said axial filler bore beyond said radial bore disposed adjacent said stopper.

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