Description

Field of the invention

The invention relates to an automatic two-chamber injector comprising a barrel having a first end with a receiving portion for an injection needle and a second end with a slideable plunger, said receiving portion being sealed prior to use, said barrel comprising two chambers being separated by a migrationproof membrane, said membrane being adapted to rupture when the plunger is displaced towards said first end of the barrel.

The invention also relates to a method for mixing a solution by means of the automatic two-chamber injector and to a cartridge for the two-chamber injector.

Background of the invention

Automatic injectors have been developed specially for use by persons who for some reason must inject a solution into their own body at a time which cannot be predicted, e.g. soldiers who have been subjected to nerve gas in war. These injectors are stored for years and are further more often subjected to hard conditions during the time the potential user carries it, which sometimes may be long. When the automatic injector finally is to be used it must work with a great reliability when an injection is to be carried out. At such a critical moment it is important that the injector can be handled and activated in a simple and quick manner. Consequently, there are special requirements on automatic injectors of the type mentioned above regarding reliability and simplicity in both handling and operation.

Lately effective antidotes against nerve gases have been developed, said antidotes being stable in the form of a powder, but having proved difficult to make stable in solution, especially during the long storage periods being normal in this field of application. Consequently there is a demand for automatic injectors which are simple, quick and reliable and in which it is possible to store two substances separately for a long period and wherein said substances also easily can be mixed before use.

Some different types of automatic two chamber injectors are previously known:
US Patent No. 4,529,403 discloses an automatic two-chamber injector with an ampoule located between the injection needle and the plunger. The ampoule is provided with one or several pistons of flexible material, as rubber, keeping the injection solutions separated from each other. In the front part of the ampoule there are sidewardly arranged channels or sections, which permit the injection solutions to pass the piston or pistons.

US Patent No. 4,413,991 discloses another system for an automatic two chamber injector, in which a plunger drives an injection needle through two separate chambers containing different solutions. The injection needle is provided with side-openings interconnecting the two chambers during injection.

US Patent No. 4,202,314 discloses a system with two chambers whose contents are mixed and then automatically injected. Two driving systems are arranged, one for mixing and the other for injection. The injection needle is located inside the cartridge.

In the embodiment disclosed in US Patent No. 4,214,584, separate chambers are concentrically arranged with and separated by a cylindrical wall from a first chamber. In order to mix the contents of the chambers, the cylindrical wall is screwed upwards by which means the chambers are united with the first chamber. In this embodiment as well, the injection needle is arranged inside the cartridge prior to use.

The previously known automatic two chamber injectors have a number of disadvantages:
The use of polymer material to separate a solution from a powder, alternatively a solution from a solution, has the consequence that a permeation of liquid to some extent is inevitable during a long storage period.

The mixing of the separated medical substances is incomplete and may in some cases be non-existent.

To mount the injection needle inside the cartridge in an injection solution involves a great risk that the injection needle will be corroded during a long storage period.

If a complicated operation to achieve a sufficient mixture of the substances has to be carried out, in conjunction with a lack of a precise control of the operation, there is a risk that the injector may be used in a erroneous way, causing non-appearance of medical effects and even a risk of accidents.

There is no possibility to replace the cartridge whilst preserving the sterile conditions.

Further, US-A-2,708,438 (Fig 1) discloses a hypodermic syringe comprising a barrel having a first end with a receiving portion for an injection needle and a second end with a slideable plunger, said receiving portion being sealed prior to use, said barrel comprising two chambers being separated by a migrationproof membrane, said membrane being adapted to rupture when the plunger is displaced towards said first end of the barrel. Syringes of this kind are also disclosed in US-A-2,778,360 (Fig 1) and US-A-1,943,120 (Fig 2).

Summary of the invention

The object of the present invention is to solve the above problems by providing an automatic two-chamber injector having a cartridge, in which the two substances are separated in a way that permits safe and long storage and where a complete mixing of the substances will be achieved. The operation of the injector is quick and simple and, due to the construction of the injector, it is impossible to use the injector wrongly.

In particular, the invention can be used for mixing two or several medical substances immediately before use, one of the substances being a liquid and the other/others being in powder or liquid form, and for a subsequent injection of the mixed solution. The device makes it possible to store medical preparations separately and under sterile conditions, to mix the preparations immediately before injection and to inject the fresh and completely mixed solution into the body tissue.

An automatic two-chamber injector as described by way of introduction is in accordance with the invention characterized in that a front cover cooperates rotatably with the barrel, that the plunger is displaceable to a limited extent in a powder chamber arranged in said second end of the barrel, that one of said chambers is arranged in said powder chamber, and in that said barrel is adapted to bring said powder chamber in the direction of said plunger upon rotation of said front cover.

Other advantageous features of the invention will become apparant from the following description of embodiments of the invention and from the dependent claims.

According to the invention the advantage is obtained that the membrane, which separates the two chambers form each other, prevents liquid migration and this fact results in an increased durability for the contents of the cartridge. Furthermore, the position of the injection needle outside the barrel itself, without any contact with the injection solution, contributes to an increased durability since the risk of corrosion is avoided.

By the design of the front cover and its interaction with the barrel, the operation of the device is sequentially completely controlled with a complete mixing and a subsequent activation and injection. The construction of the device only permits an operation in predetermined steps following each other, which results in a simple and, above all, a safe function. A fine motoric action by means of a hand movement is required to operate the front cover rotatingly. This is an additional safety aspect since an unintentional actuation is impossible, for instance due to influences in the form of for example thrusts or pressure or due to that a part gets caught in an adjacent object.

The rotatable front cover is designed in such a way as to be rotatable in one direction only, which means there is a possibility of control if the injector has been activated prematurely and if the mixing phase has been activated long before the injector is to be used.

The two-chamber injector according to the invention is manufactured of simple materials and is simple in its construction which means that it is well suited for use as a disposable injector. The barrel with the injection needle together forms a separate, detachable unit which gives additional fields of application and additional advantages. After an injection the front cover can be dismounted and the used cartridge can be exchanged for a new one. The driving unit is re-loaded and the front cover is mounted, whereafter the injector is ready for use again. Since the cartridge with its contents often may have a shorter durability than the mechanical unit, it is a great advantage to be able to store the cartridge separately at a prolonged storage, e.g. for military use. If the stored injectors have not been used during their life-spann, the cartridge can be exchanged and replaced by a new one, which situation should be compared with a situation where the entire two-chamber injector must be replaced. This system also gives a possibility to choose between different medical substances in alternative cartridges which means there is a possibility of adaptation to different expected situations.

The two-chamber injector according to the invention is mainly intended for military purposes, but it is also suitable for use in other human medical disciplines as well as in veterinary medicine.

Brief description of the drawings

An embodiment of an automatic two-chamber injector according to the invention and modifications thereof will be described in detail below in connection with the accompanying drawings, where

- Figure 1 shows a longitudinal sectional view through a first embodiment of the two-chamber injector prior to use,
- Figure 2 a - b show a side elevation view and a longitudinal sectional view of the guide sleeve according to Figure 1,
- Figure 3 a - b show a side elevation view and a longitudinal sectional view of the barrel according to Figure 1,
- Figure 4 shows the powder-chamber, somewhat enlarged,
- Figure 5 shows a side elevation view of the spring carrier,
- Figure 6 a - b show a side elevation view and

a longitudinal sectional view of the front cover,

- Figure 7 shows a longitudinal sectional view of a second embodiment of the two-chamber injector prior to use,
- Figure 8 shows a longitudinal sectional view of a second embodiment of the guide sleeve,
- Figure 9 a - b show a side elevation view and a longitudinal sectional view of the barrel according to Figure 7,
- Figure 10 a - b show a side elevation view and a longitudinal sectional view of the plunger according to Figure 7,
- Figure 11 a - d show parts of the two chamber injector according to Figure 1 during different phases of actuation, where Figure 11 a shows the starting phase, Figure 11 b shows the mixing phase, Figur 11 c shows the injection phase and Figure 11 c shows the phase of completed injection,
- Figure 12 shows a longitudinal sectional view of the rearward cover in a position when the spring is released,
- Figure 13 is a schematic view showing the inner surface of the front cover with the cover slit and unfolded in the plane of the paper.

Detailed description of preferred embodiments of the invention

The embodiment of the two-chamber injector shown in Figures 1 - 6 comprises a body which consists of a locking sleeve (1) and a guide sleeve (2), which is attached onto the locking sleeve (1) by means of threads. The locking sleeve (1) comprises an annular groove (3) and is further split into a number of resilient longitudinal arms (4), preferably four, which at their free ends form diverging tongues (5). Interior of the free ends of the arms (4) radial flange portions (6) are provided which form a seat for a spring (7) mounted inside the locking sleeve (1). The guide sleeve (2), shown in Figure 2 a - b, comprises two diametrically opposed running grooves (8) extending outside the area of the threaded part, said running grooves ending with stop lugs (9). The other end of the sleeve is provided with a number of external pins (10).

A barrel (11), shown in Figure 3 a - b, is slidably displaceable in the guide sleeve (2) by means of two sliding lugs (12) which are positioned externally and diametrically opposed on the barrel and run in the running grooves (8) of the guide sleeve. A sliding lug (12) comprises a through hole for the enclosure of a ball (13) and comprises further a resilent tongue (14). The barrel (11) is sealed at a front end to form a receiving portion (15) in which a needle holder (16) with a hollow injection needle (17) is slidably displaceable. The receiving portion (15) has a centrally placed aperture into which the rear part of the injection needle (17) is inserted and in whose bottom a piercable membrane (18) is arranged. The front part of the injection needle (17) is enclosed by a protective bellows (19) in order to keep the injection needle sterile.

The barrel (11) with the injection needle (17) and the guide sleeve (2) are surrounded by a front cover (20) which is rotatable on the guide sleeve (2) and which is shown in Figure 6 a - b. The front cover is provided with external ribs in order to ensure a safe grip on the cover. A number of internal locking lugs (21) are adapted for interaction with the pins (10) of the guide sleeve. The front cover is closed at its front end, said front end having a central part (22) formed with a wall thickness which is considerably thinner than the wall thickness of the other parts. At the rear end of the front cover a prolonged part (23) is formed on about half the circumference of the cover. The part of the front cover which surrounds the guide sleeve (2) has two internal slide-ways (45) being displaced 180° in relation to each other and being arranged for interaction with the sliding lugs (12) of the barrel. A number of additional grooves are arranged in this part of the front cover, which will be described in detail below.

Inside the barrel (11), at the end opposite to the receiving portion, a powder chamber (24) according to Figure 4 is arranged. The envelope surface of the powder chamber is provided with a circumferential external groove (25) to receive the ball (13) of the sliding lug of the barrel. An additional annular groove is arranged for a seal. An internal bead (26) forms a seat for a plunger (27) being displaceable in the powder chamber (24) to a limited extent, said plunger being provided with a sealing against the inner surface of the powder chamber at one end. An aluminum-membrane (28) with a plastic coating is welded at the inner end of the powder chamber (24) and defines a chamber (29) together with the plunger (27) for one of the substances. In the barrel (11), a second chamber (30) is formed on the other side of the aluminum-membrane (28), said second chamber containing the second substance.

The plunger (27) bears, with its non-sealed, open end, on a contact ring (33) on a spring carrier (31), also shown in Figure 5. The spring carrier comprises a cone-shaped centering portion (32) located on the front end and being arranged on the contact ring, said portion being inserted into the open end of the plunger. The rear end of the spring carrier has a locking head (34) and a flanged middle part extends between the two ends. The locking head (34) interacts with locking lugs in the flange parts (6) on the arms of the locking sleeve

for a compression of the spring (7) being arranged around the spring carrier (31) between the flange parts (6) and the contact ring (33).

The locking sleeve (1) is surrounded by a displaceable rearward cover (35), said rearward cover extending up to the edge of the annular groove (3) of the locking sleeve. The opposite end of the rearward cover is closed by an activating knob (36) having a cylindrical guiding flange (37) which extends into the rearward cover. The rearward cover is widened internally in the area of the cylindrical guiding flange (37) in order to form a circumferential internal guiding channel (38) at the extreme end of the rearward cover.

A resilient safety ring (39) is arranged in the cylindrical groove (3) of the locking sleeve between the rearward cover (35) and the front cover (20), said ring having a circumferential extent of about 220°. A thin ring (40) is arranged in the groove (3) alongside the safety ring (39), said ring (40) and said safety ring (39) being interconnected by means of a loose loop (not shown), the purpose being to keep the safety ring with the injector even after it has been detached from the groove.

Figures 7 - 10 show a second embodiment of a two-chamber injector, which differs from the embodiment according to Figures 1 - 6 only by an alternative embodiment of the guide sleeve (2), the barrel (11) and the plunger (27). The guide sleeve (2), shown in Figure 8, differs from the embodiment in Figure 2 only by an alternative embodiment of the running groove 8. In order to prevent an unintentional displacement of the barrel (11) and the powder chamber (24) towards the plunger (27) and thereby causing a premature mixing process, the running groove (8) is provided with a second stop lug (48) which interacts with the sliding lug (12) to stop said sliding lug (12) against further displacement in a position of the sliding lug which corresponds to the starting point of the oblique slide-way. A resilient tongue (49) is arranged along one longitudinal side of the running groove (8) opposite to the stop lug (48). When the mixing phase is due the oblique slide-way (45) presses against the rounded edges of the sliding lug (12) with a force that presses the resilient tongue (49) outwards, allowing the sliding lug (12) to pass the stop lug (48) and the mixing takes place. On each side of the two sliding lugs (12) of the barrel there are slits (41) (see Figure 9 a - b) in order to permit the respective sliding lug (12) to move resilently. Spherical knobs (42) are arranged on the inner surfaces of the lug for interaction with the circumferential grooves (25) of the powder chamber (24). Furthermore, the front part of the barrel is provided with a circumferential cylindrical channel (43) surrounding the receiving portion (15). The plunger (27), shown in Figure 10 a - b, is provided with one or several piercing means (44), which are inserted in the cylindrical channel (43) of the barrel (11) surrounding the receiving portion when the plunger (27) is in its extended position. The piercing means (44) are arranged on the plunger to mechanically rupture the membrane (28) when the barrel and powder chamber is displaced towards the plunger.

The operation of the two chamber injector comprises two steps, one mixing step and one releasing and injecting step. These steps will be described below in detail with reference to Figure 11 a - d showing parts of the two-chamber injector in different phases.

Figure 11 a shows the injector in its initial position in which position it contains a liquid in one chamber (30) separated from a powder in the second chamber (29) by an aluminum-membrane (28). In the initial position the prolonged part (23) of the front cover covers the safety ring (39) in a way that makes it impossible to release the safety ring prematurely. In order to mix the two substances the front cover (20) is rotated, whereby the sliding lugs (12) slide on the oblique slide-ways (45), thus being pressed rearwards in the running grooves (8). The balls (13)/the lugs (12) are pressed against the circumferential grooves (25) of the powder chamber by the inner surface of the front cover (20), which results in that both the barrel (11) and the powder chamber (24) are displaced backwards together with the sliding lugs (12). The powder chamber is thereby displaced towards the plunger (27), whereby the pressure in the chamber (29) increases and the aluminum-membrane (28) ruptures, alternatively the piercing means rupture the aluminum-membrane (28).

Figure 11 b shows a position where the aluminum-membrane has been ruptured and the powder is pressed out of its chamber (29) to be mixed with the liquid. When the sliding lug (12) reaches the end of the oblique slide-way (45) the whole cartridge (11, 16, 17) and the powder chamber (24) are moved back to a position where the end surfaces of the plunger (27) and the powder chamber (24) are located in one common plane and the contact ring (33) of the spring carrier bears on the internal bead (26) of the powder chamber. The mixing phase is now completed but it can be complemented, if necessary, by an agitation of the injector.

After the mixing phase the front cover is in such a relative position of rotation that the prolonged part in the outer end covers the opening of the safety ring (39) at the same time as the sliding lugs (12) are located in longitudinal grooves D,D' - (see Figure 13) in the front cover, said grooves permitting the balls (13)/the spherical knobs (42) to be freed from the circumferential grooves (25) of the powder chamber. The two-chamber injector is

now ready for a triggering and injection phase which is started by disengaging the safety ring (39) from the cylindrical groove (3) of the locking sleeve after which the injector is placed against the part of the body into which the injection is to take place.

The activating knob (36) and the rearward cover (35) are pressed and displaced towards the front cover. This is now possible since the safety ring (39) is disengaged. The displacement of the rearward cover relative to the backing sleeve will achieve a release of the spring (7) in a way shown in Figure 12. The diverging tongues (5) of the locking sleeve are guided into the guiding channel (38), whereby the flange parts of the resilient arms diverge and the locking head (34) of the spring carrier, as well as the spring (7), are released.

Figure 11 c shows the two-chamber injector in a position in which the injection has started. The spring (7) presses the powder chamber (24) and the plunger (27) forward together. Since the balls (13)/the lugs (12) now can be forced up into the grooves in the front cover, the powder chamber is released from the barrel (11). The plunger presses against the liquid which transmits the pressure hydraulically to the barrel which is driven forwards, by which means the injection needle (17) penetrates the thin material in the central part (22) of the front cover. When the protection bellows (19) is compressed, the needle holder (16) is pushed into the receiving portion (15) and the rear point of the injection needle (17) penetrates the membrane (18). In this position a connection between the mixed solution and the injection needle is obtained and the injection starts and continues during the common forward movement of the powder chamber (24) and the plunger (27).

Figure 11 d shows the position when the injection is finished and the barrel (11), the powder chamber (24) and the plunger (27) all have been displaced to their respective end positions under the influence of the spring and all the mixed solution have been injected into the patient.

Figure 13 is a schematic view showing the inner surface of the front cover (20) and the way of the sliding lugs (12, 12′) along said inner surface when the front cover is rotated. When the front cover is mounted, it is guided over the guide sleeve in such a way that the sliding lug (12) (corresponding to the second lug 12′ with 180° displacement) is moved along the groove A and the locking lugs (21) passes between the pins (10). All grooves are formed with a sharp edge in "the direction of non-rotation" for interaction with the resilent tongue (14) of the sliding lugs which falls in behind the sharp edge and thereby prevents a rotation of the front cover (20) in the wrong direction. Subsequently, the front cover is rotated one step further until the sliding lug (12) reaches groove B. Groove B constitutes the starting position for the operation of the two-chamber injector. If the front cover is rotated, the sliding lug (12) is moved along the oblique slide-way (45) and the rotation movement is stopped when the sliding lug (12) meets the internal edge (46). The sliding lug is now positioned in a groove D which is the groove wherein the sliding lug (12) is located in the releasing and injection phase, said groove having a depth which will allow the ball (13)/the spherical knob (42) to be released from the circumferential groove (25) of the powder chamber. During the injection phase the sliding lug (12) moves along the groove D where it will reach its final position if the two-chamber injector is not to be re-used. For the dismounting of the front cover, the cover is rotated one further step whereby the sliding lug passes below the edge (46) and into the groove A′, being displaced 180° in relation to groove A. In this position the front cover can be dismounted from the guide sleeve since the locking lugs will be free from the pins (10).

The invention is in no way limited to the embodiments described above and several possible modifications of the invention are possible within the scope of the claims. For example, the membrane, which separates the chambers from each other, can be made of other migrationproof materials. The number and the design of the perforating means for the mechanical rupture of the membrane can also be varied.

Claims

1. Automatic two-chamber injector comprising a barrel (11) having a first end with a receiving portion (15) for an injection needle (17) and a second end with a slideable plunger (27), said receiving portion (15) being sealed prior to use, said barrel (11) comprising two chambers (29, 30) being separated by a migrationproof membrane (28), said membrane being adapted to rupture when the plunger (27) is displaced towards said first end of the barrel (11), **characterized** in that a front cover (20) cooperates rotatably with the barrel (11), that the plunger (27) is displaceable to a limited extent in a powder chamber (24) arranged in said second end of the barrel, that one of said chambers (29) is arranged in said powder chamber (24), and in that said barrel is adapted to bring said powder chamber (24) in the direction of said plunger (27) upon rotation of said front cover (20).

2. Automatic two-chamber injector according to claim 1, **characterized** in that said membrane (28) is adapted to rupture by mechanical ac-

now ready for a triggering and injection phase which is started by disengaging the safety ring (39) from the cylindrical groove (3) of the locking sleeve after which the injector is placed against the part of the body into which the injection is to take place.

The activating knob (36) and the rearward cover (35) are pressed and displaced towards the front cover. This is now possible since the safety ring (39) is disengaged. The displacement of the rearward cover relative to the backing sleeve will achieve a release of the spring (7) in a way shown in Figure 12. The diverging tongues (5) of the locking sleeve are guided into the guiding channel (38), whereby the flange parts of the resilient arms diverge and the locking head (34) of the spring carrier, as well as the spring (7), are released.

Figure 11 c shows the two-chamber injector in a position in which the injection has started. The spring (7) presses the powder chamber (24) and the plunger (27) forward together. Since the balls (13)/the lugs (12) now can be forced up into the grooves in the front cover, the powder chamber is released from the barrel (11). The plunger presses against the liquid which transmits the pressure hydraulically to the barrel which is driven forwards, by which means the injection needle (17) penetrates the thin material in the central part (22) of the front cover. When the protection bellows (19) is compressed, the needle holder (16) is pushed into the receiving portion (15) and the rear point of the injection needle (17) penetrates the membrane (18). In this position a connection between the mixed solution and the injection needle is obtained and the injection starts and continues during the common forward movement of the powder chamber (24) and the plunger (27).

Figure 11 d shows the position when the injection is finished and the barrel (11), the powder chamber (24) and the plunger (27) all have been displaced to their respective end positions under the influence of the spring and all the mixed solution have been injected into the patient.

Figure 13 is a schematic view showing the inner surface of the front cover (20) and the way of the sliding lugs (12, 12′) along said inner surface when the front cover is rotated. When the front cover is mounted, it is guided over the guide sleeve in such a way that the sliding lug (12) (corresponding to the second lug 12′ with 180° displacement) is moved along the groove A and the locking lugs (21) passes between the pins (10). All grooves are formed with a sharp edge in "the direction of non-rotation" for interaction with the resilent tongue (14) of the sliding lugs which falls in behind the sharp edge and thereby prevents a rotation of the front cover (20) in the wrong direction. Subsequently, the front cover is rotated one step further until the sliding lug (12) reaches groove B. Groove B constitutes the starting position for the operation of the two-chamber injector. If the front cover is rotated, the sliding lug (12) is moved along the oblique slide-way (45) and the rotation movement is stopped when the sliding lug (12) meets the internal edge (46). The sliding lug is now positioned in a groove D which is the groove wherein the sliding lug (12) is located in the releasing and injection phase, said groove having a depth which will allow the ball (13)/the spherical knob (42) to be released from the circumferential groove (25) of the powder chamber. During the injection phase the sliding lug (12) moves along the groove D where it will reach its final position if the two-chamber injector is not to be re-used. For the dismounting of the front cover, the cover is rotated one further step whereby the sliding lug passes below the edge (46) and into the groove A′, being displaced 180° in relation to groove A. In this position the front cover can be dismounted from the guide sleeve since the locking lugs will be free from the pins (10).

The invention is in no way limited to the embodiments described above and several possible modifications of the invention are possible within the scope of the claims. For example, the membrane, which separates the chambers from each other, can be made of other migrationproof materials. The number and the design of the perforating means for the mechanical rupture of the membrane can also be varied.

Claims

1. Automatic two-chamber injector comprising a barrel (11) having a first end with a receiving portion (15) for an injection needle (17) and a second end with a slideable plunger (27), said receiving portion (15) being sealed prior to use, said barrel (11) comprising two chambers (29, 30) being separated by a migrationproof membrane (28), said membrane being adapted to rupture when the plunger (27) is displaced towards said first end of the barrel (11), **characterized** in that a front cover (20) cooperates rotatably with the barrel (11), that the plunger (27) is displaceable to a limited extent in a powder chamber (24) arranged in said second end of the barrel, that one of said chambers (29) is arranged in said powder chamber (24), and in that said barrel is adapted to bring said powder chamber (24) in the direction of said plunger (27) upon rotation of said front cover (20).

2. Automatic two-chamber injector according to claim 1, **characterized** in that said membrane (28) is adapted to rupture by mechanical ac-

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tuation or by a pressure difference between the chambers (29, 30).

3. Automatic two-chamber injector according to claim 2, **characterized** in that the powder chamber (24) is displaceable in the barrel (11) in one rotational position of the front cover (20) and is locked in the barrel (11) in all other rotational positions of the front cover (20).

4. Automatic two-chamber injector according to claim 2, **characterized** in that oblique slideways are arranged on the inner surface of the front cover (20) for interaction with sliding lugs (12) on the barrel (11) to displace the barrel when said front cover (20) is rotated.

5. Automatic two-chamber injector according to claim 4, **characterized** in that each sliding lug (12) comprises a knob (13; 42) arranged for interaction with a groove (25) in the powder chamber (24), to lock the powder chamber (24) in the barrel (11).

6. Automatic two-chamber injector according to claim 5, **characterized** in that at least one groove (D) is arranged in the inner surface of the front cover (20) to accommodate parts of a respective sliding lug (12) in one of the rotational positions of the front cover (20) in order to allow the powder chamber (24) to disengage from the barrel (11).

7. Automatic two-chamber injector according to claim 6, **characterized** in that the injection needle (17) is displaceable in the receiving portion (15) and is sterilely surrounded by a protective bellows (19) prior to use, said receiving portion (15) being sealed from the barrel (11) by means of a membrane (18) which is penetrated when said injection needle (17) is displaced in said receiving portion (15).

8. Automatic two-chamber injector according to claim 7, **characterized** in that the barrel (11) with the powder chamber (24) and the plunger (27) forms a replaceable unit together with the injection needle (17) which is surrounded by the protective bellows (19).

9. Automatic two-chamber injector according to claim 8, **characterized** in that one or several piercing means (44) are arranged on the plunger (27) in order to pierce the membrane (28), said piercing means (44) being accommodated in an interior cylindrical channel (43) at said first end of the barrel (11) when said plunger (27) is positioned in its most protruding position.

10. A method of mixing and injecting a solution by means of an automatic two-chamber injector according to claim 1, comprising the steps of
    - rotating said front cover (20), resulting in that said membrane (28) between said two chambers (29, 30) in said barrel (11) is ruptured and that the contents of said two chambers are mixed,
    - disengaging a safety ring in order to enable a relative movement between said front cover and a rearward cover for releasing a spring (7) pressing the mixed solution through said injection needle (17) by means of said plunger (27).

11. Method according to claim 10, **characterized** in that said barrel (11) is displaced towards said plunger (27) by means of said rotation of said front cover (20) to rupture said membrane (28).

12. Cartridge for use in a two-chamber injector according to claim 1, **characterized** in that said barrel (11) with said two chambers (29, 30) separated by said migration-proof membrane (28) together with said plunger (27) forms a replaceable unit, said membrane (28) being adapted to rupture when said plunger (27) is displaced in said barrel (11).

13. Cartridge according to claim 12, **characterized** in that said receiving portion (15) is sealed prior to use, said injection needle (17) being displaceable in said receiving portion (15) and being sterilely surrounded by a protective bellows (19) prior to use.

Patentansprüche

1. Automatische Zweikammerspritze mit einem Zylinder (11) mit einem ersten Ende mit einem Aufnahmeteil (15) für eine Injektionsnadel (17) und einem zweiten Ende mit einem gleitfähigen Plunger (27), wobei der Aufnahmeteil (15) vor Verwendung dicht verschlossen ist, und wobei der Zylinder (11) zwei Kammern (29, 30) aufweist, die durch eine migrationsdichte Membran (28) getrennt sind, wobei die Membran so ausgelegt ist, daß sie zerreißt, wenn der Plunger (27) zum ersten Ende des Zylinders (11) hin verschoben wird, dadurch gekennzeichnet, daß eine vordere Abdeckung (20) drehbar mit dem Zylinder (11) zusammenwirkt, daß der Plunger (27) in beschränktem Ausmaß in einem im zweiten Ende des Zylinders angeordneten Pulvergehäuse (24) ver-

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schiebbar ist, daß eine der Kammern (29) im Pulvergehäuse (24) angeordnet ist und daß der Zylinder so ausgelegt ist, daß er das Pulvergehäuse (24) bei Drehung der vorderen Abdekkung (20) in die Richtung des Plungers (27) bringt.

2. Automatische Zweikammerspritze nach Anspruch 1, dadurch gekennzeichnet, daß die Membran (28) so ausgelegt ist, daß sie durch mechanische Betätigung oder durch einen Druckunterschied zwischen den Kammern (29, 30) zerreißt.

3. Automatische Zweikammerspritze nach Anspruch 2, dadurch gekennzeichnet, daß das Pulvergehäuse (24) in einer Drehstellung der vorderen Abdeckung (20) im Zylinder (11) verschiebbar und in allen anderen Drehstellungen der vorderen Abdeckung (20) im Zylinder (11) verriegelt ist.

4. Automatische Zweikammerspritze nach Anspruch 2, dadurch gekennzeichnet, daß schräge Gleitbahnen an der inneren Oberfläche der vorderen Abdeckung (20) zum Zusammenwirken mit Gleitansätzen (12) am Zylinder (11) vorgesehen sind, um den Zylinder bei Drehung der vorderen Abdeckung (20) zu verschieben.

5. Automatische Zweikammerspritze nach Anspruch 4, dadurch gekennzeichnet, daß jeder Gleitansatz (12) eine Nase (13; 42) aufweist, die so angeordnet ist, daß sie mit einer Nut (25) im Pulvergehäuse (24) zusammenwirkt, um das Pulvergehäuse (24) im Zylinder (11) zu verriegeln.

6. Automatische Zweikammerspritze nach Anspruch 5, dadurch gekennzeichnet, daß mindestens eine Nut (D) in der inneren Oberfläche der vorderen Abdeckung (20) angeordnet ist, um Teile eines entsprechenden Gleitansatzes (12) in einer der Drehstellungen der vorderen Abdeckung (20) aufzunehmen, um eine Entkupplung des Pulvergehäuses (24) vom Zylinder (11) zu ermöglichen.

7. Automatische Zweikammerspritze nach Anspruch 6, dadurch gekennzeichnet, daß die Injektionsnadel (17) im Aufnahmeteil (15) verschiebbar und vor Verwendung von einem schützenden Faltenbalg (19) steril umgeben ist, wobei der Aufnahmeteil (15) mittels einer Membran (18) gegenüber dem Zylinder (11) dicht verschlossen ist, die durchdrungen wird, wenn die Injektionsnadel (17) im Aufnahmeteil (15) verschoben wird.

8. Automatische Zweikammerspritze nach Anspruch 7, dadurch gekennzeichnet, daß der Zylinder (11) mit Pulvergehäuse (24) und Plunger (27) zusammen mit der vom schützenden Faltenbalg (19) umgebenen Injektionsnadel (17) eine ersetzbare Einheit bildet.

9. Automatische Zweikammerspritze nach Anspruch 8, dadurch gekennzeichnet, daß ein oder mehrere Perforationsmittel (44) am Plunger (27) angeordnet sind, um die Membran (28) zu durchstechen, wobei die Perforationsmittel (44) sich in einem inneren zylindrischen Kanal (43) am ersten Ende des Zylinders (11) befinden, wenn sich der Plunger (27) in seiner am meisten vorgerückten Position befindet.

10. Verfahren zum Mischen und Injizieren einer Lösung mittels einer automatischen Zweikammerspritze nach Anspruch 1 mit den Schritten
- des Drehens der vorderen Abdeckung (20), was dazu führt, daß die Membran (28) zwischen den zwei Kammern (29, 30) im Zylinder (11) zerrissen wird und daß der Inhalt der zwei Kammern gemischt wird,
- des Außereingriffbringens eines Sicherheitsringes, um eine Relativbewegung zwischen der vorderen Abdeckung und einer hinteren Abdeckung zur Freigabe einer Feder (7) zu ermöglichen, die die gemischte Lösung mittels des Plungers (27) durch die Injektionsnadel (17) drückt.

11. Verfahren nach Anspruch 10, dadurch gekennzeichnet, daß der Zylinder (11) mittels der Drehung der vorderen Abdeckung (20) zum Zerreißen der Membran (28) zum Plunger (27) hin verschoben wird.

12. Patrone zur Verwendung in einer Zweikammerspritze nach Anspruch 1, dadurch gekennzeichnet, daß der Zylinder (11) mit den zwei durch die migrationsdichte Membran (28) getrennten Kammern zusammen mit dem Plunger (27) eine ersetzbare Einheit bildet, wobei die Membran (28) so ausgelegt ist, daß sie zerreißt, wenn der Plunger (27) im Zylinder (11) verschoben wird.

13. Patrone nach Anspruch 12, dadurch gekennzeichnet, daß der Aufnahmeteil (15) vor der Verwendung dicht verschlossen ist, wobei die Injektionsnadel (17) im Aufnahmeteil (15) verschiebbar und vor Verwendung von einem schützenden Faltenbalg (19) steril umgeben ist.

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Revendications

1. Seringue automatique d'injection à deux chambres, comprenant un corps (11) comportant une première extrémité pourvue d'une partie de réception (15) agencée pour recevoir une aiguille d'injection (17) et une seconde extrémité munie d'un piston ou plongeur (27), monté glissant, ladite partie de réception (15) étant scellée de façon étanche avant l'utilisation, ledit corps (11) comprenant deux chambres (29, 30) séparés par une membrane à l'épreuve de la migration (28), ladite membrane étant agencée pour se rompre lorsque le plongeur (27) est déplacé vers ladite première extrémité du corps (11), caractérisée en ce qu'un capuchon avant (20) coopère en rotation, avec le corps (11), en ce que le plongeur (27) est mobile de façon limitée dans une chambre de poudre (24) agencée dans ladite seconde extrémité du corps,en ce que l'une desdites chambres (29) est agencée dans ladite chambre de poudre (24), et en ce que ledit corps est adapté pour avancer ladite chambre de poudre (24) dans la direction dudit plongeur (27) lors de la rotation dudit capuchon avant (20).

2. Seringue d'injection automatique à deux chambres selon la revendication 1, caractérisée en ce que ladite membrane (28) est agencée pour se rompre par une manoeuvre mécanique ou par la pression différentielle régnant entre les chambres (29, 30).

3. Seringue d'injection automatique à deux chambres selon la revendication 2, caractérisée en ce que la chambre de poudre (24) peut être déplacée dans le corps (11) dans une position de rotation du capuchon avant (20) et est bloquée dans le corps (11) dans toutes les autres positions de rotation du capuchon avant (20).

4. Seringue d'injection automatique à deux chambres selon la revendication 2, caractérisée en ce que des glissières obliques sont ménagées sur la surface intérieure du capuchon avant (20) de manière à agir solidairement avec des pattes ou bossages glissants (12) ménagés sur le corps (11), de manière à déplacer le corps lors de la rotation dudit capuchon avant (20).

5. Seringue d'injection automatique à deux chambres selon la revendication 4, caractérisée en ce que chaque bossage glissant (12) comporte un bouton (13; 42) agencé pour agir solidairement dans une rainure (25) ménagée dans la chambre de poudre (24), pour bloquer la chambre de poudre (24) dans le corps (11).

6. Seringue d'injection automatique à deux chambres selon la revendication 5, caractérisée en ce qu'au moins une rainure (D) est agencée dans la surface intérieure du capuchon avant (20) pour recevoir les éléments d'un bossage glissant correspondant (12) dans l'une des positions de rotation du capuchon avant (20), pour pouvoir dégager la chambre de poudre (24) du corps (11).

7. Seringue d'injection automatique à deux chambres selon la revendication 6, caractérisée en ce que l'aiguille d'injection (17) est mobile dans la partie de réception (15) et est entourée de façon stérile par un soufflet de protection (19) avant l'utilisation, ladite partie de réception (15) étant rendue étanche par rapport au corps (11) au moyen d'une membrane (18) qui est perforée lors du déplacement de ladite aiguille d'injection (17) dans ladite partie de réception (15).

8. Seringue d'injection automatique à deux chambres selon la revendication 7, caractérisée en ce que le corps (11), la chambre de poudre (24) et le plongeur (27) forment un ensemble interchangeable conjointement avec l'aiguille d'injection (17) entourée par le soufflet de protection (19).

9. Seringue d'injection automatique à deux chambres selon la revendication 8, caractérisée en ce qu'un ou plusieurs moyens de perforation (44) sont agencés sur le plongeur (27) pour perforer la membrane (28), ledit moyen de perforation (44) étant logé dans un canal cylindrique intérieur (43) de ladite première extrémité du corps (11) lorsque ledit plongeur (27) est déplacé en position déployée à fond.

10. Un procédé de mélange et d'injection d'une solution au moyen d'une seringue d'injection automatique à deux chambres selon la revendication 1, comprenant les étapes
    - de rotation dudit capuchon avant (20) entraînant la rupture de ladite membrane (28) entre lesdites deux chambres (29, 30) dudit corps (11) et le mélange du contenu desdites deux chambres,
    - de dégagement d'une bague de sécurité pour permettre un déplacement relatif entre ledit capuchon avant et un couvercle arrière, afin de libérer un ressort (7) pour refouler la solution de mélange à travers ladite aiguille d'injection (17) au moyen dudit plongeur (27).

11. Procédé selon la revendication 10, caractérisé

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en ce que ledit corps (11) est déplacé vers ledit plongeur (27) par ladite rotation dudit capuchon avant (20) de manière à provoquer la rupture de ladite membrane (28).

12. Cartouche prévue pour être utilisée dans une seringue d'injection à deux chambres selon la revendication 1, caractérisée en ce que ledit corps (11) dont lesdites deux chambres (29, 30) sont séparées par ladite membrane à l'épreuve de la migration (28), conjointement avec ledit plongeur (27) constitue un bloc ou ensemble interchangeable, ladite membrane (28) étant agencée pour se rompre lorsque ledit plongeur (27) est déplacé dans ledit corps (11).

13. Cartouche selon la revendication 12, caractérisée en ce que ladite partie de réception (15) est rendue étanche avant l'utilisation, ladite aiguille d'injection (17) étant déplaçable dans ladite partie de réception (15) et étant entourée de façon stérile par un soufflet de protection (19) avant l'utilisation.

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