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Description

The invention relates to an automatic syringe for injecting two or more different injection liquids which may not be in contact with each other for long periods of time, a so-called "plural injecting device".

In an automatic syringe, an ampoule and a hypodermic needle in operative association therewith is driven by the force of a power source so as to insert the needle and then to inject the injection liquid present in the ampoule. Such a syringe comprises a combination of a discharge mechanism, a cartridge holder and a cartridge which is slidably accommodated in the cartridge holder and which comprises an ampoule, a piston which is movable in the ampoule and seals same, and a hypodermic needle which is connected to the front of the ampoule and, if desired, is covered by a flexible sheath to maintain the needle in a sterile condition. The discharge mechanism is provided with a power source which can move the cartridge from an inoperative condition to an operative condition. The syringe furthermore comprises locking means to control the actuation of the power source and preferably a safety device to block said locking means.

Automatic syringes have been developed especially for use by persons who have to administer an injection into their own body at an instant which is not known beforehand. These persons include, for example, persons having an increased risk of cardial infarct or soldiers after having been exposed to an enemy's battle gas, for example, a nerve gas. It should therefore be obvious that stringent requirements have to be imposed upon automatic syringes as regards the reliability and the handleability. Such syringes are usually stored for years at a stretch and in addition are carried with the potential user under varying conditions for a long period of time. Moreover operation of the syringe must be sufficiently ensured at the critical instant. When said critical moment has come, it must be possible to handle the syringe rapidly and easily, and to use the syringe in an efficacious manner.

It may be desired, however, to be able to inject several medicaments at that instant which are not compatible during the storage period. In particular for military applications, the administration of several medicaments or antidotes is often necessary, for instance to reach an effective therapy, or because it is not known beforehand which battle gas as to nature and composition will be used by the enemy. Said medicaments are often not compatible with each other during the long storage period of the syringe.

It is not advisable to use several automatic syringes filled with different injection liquids in the above-described emergency situation. Since there is a fair chance that a mistake may be made in choosing the correct syringes, it would take too long for all of the desired medicaments to be injected, and it is objectionable for a person to carry several syringes with him for a long period of time.

Therefore, a single device is desired in which more different injection liquids which may not be in contact with each other for a long period of time can be stored while separated from each other, but with which, if necessary, the injection liquids can be injected simultaneously or substantially simultaneously.

Such a syringe is known from United States Patent Specification 3,572,336. Injection liquids which are poorly compatible or are not at all compatible with each other can be injected simultaneously by means of the syringe described and shown in said Patent Specification. For that purpose, a number of medicament holders are in operative association with a number of needles or with one needle via a mixing chamber. A piston is present in each medicament holder, while the collective pistons are connected *via* separate piston rods to one common piston rod so that under the influence of a coiled spring the medicament holders can simultaneously be emptied. The syringe known from the above-mentioned United Sates Patent Specification is very complicated and hence less reliable than would be desired. In fact, the possibility of a component not operating satisfactorily, as a result of which the syringe would fail at the critical moment, becomes greater when the device comprises more components which are to give the desired result in cooperation with each other. In addition, the cost-price of such a complicated device will be high, as a result of which one may be inclined to replace the device less rapidly than is desirable; as a result of this the reliability of the system is also adversely influenced.

Another "plural injecting device" is known from European Patent Application 14006. The device described in said Application consists of a number of separate automatic single-compartment syringes which are assembled together in one outer casing in such manner that upon activation of one of the syringes the remaining syringes also become operative so that all of the injection liquids are simultaneously injected. This syringe is destined in particular for military application. The composition of enemy's battle gases varies regularly so that it is desired to replace from time to time in stored automatic syringes an antidote which is active against a given gas component.

This can be done particularly easily in the "plural injecting device" known from the last-mentioned Patent Application, namely by simply replacing one of the single-compartment syringes therein with one having a different antidote. However, the disadvantages of the "plural injecting device" described in the above mentioned Patent Application is the bulkiness and the weight of the syringe, as a result of which said syringe is less easy to carry and to use in case of need.

In United States Patent Specification 3914419 a two compartment manual syringe is described having a by-pass means in the forward end of the container wall. From British Patent Specification 1449986 an automatic hypodermic syringe is known intended for accommodating a single injection liquid.

The syringe known from US 3914419 would not be operable if used in an automatic device, because without any further provision the forwardmost plug would block access to the needle upon actuation of the syringe. Further in this syringe there is required an extra manual procedure before actuation can take place, namely, removal of a cover or cap which seals the tip of the container and prevents leakage of the forward medicament dosage therefrom. Moreover because of the above-mentioned stringent demands on automatic syringes, which may be stored for up to five years, compared to the far less stringent demands on manual syringes, the construction of manually operated syringes is not easily applicable to automatic syringes. This particularly applies to the divider plug or stopper. Such a stopper should be suitable, not only to separate the injection liquids for a long storage period, but also after this period to participate in the injection of the liquids by being movable within the ampoule upon actuation of the syringe.

Finally, last but not least if the construction of the manual syringe described in US 3914419 should be used in an automatic injection device as disclosed in GB 1449986, the fulfilment of the stringent requirements specified above, viz. reliability, handleability, long term stability and life-dependent criticality of operability, should not be warranted.

It is the object of the invention to provide an automatic syringe for injecting two or more different injection liquids which may not be in contact with each other for a long period of time, which syringe must satisfy the above conditions, e.g. easy handleability, reliability, and simplicity of construction so that the cost of manufacture can be kept low.

This object can be achieved by means of an automatic syringe, comprising a combination of a discharge mechanism, a cartridge holder and a cartridge which is slidably accommodated in the cartridge holder and which comprises an ampoule, a piston which is movable in the ampoule and seals same, and a hypodermic needle which is connected to the front of the ampoule, and, if desired, is covered by a flexible sheath to maintain the needle in a sterile condition, which syringe according to the invention is characterized in that the needle is connected to the ampoule by means of a needle mount, comprising a collar connected to the front of the ampoule in a sealing manner and slidably bearing against the cartridge holder in order to allow forward movement of the cartridge in said holder upon actuation of the syringe, a neck in which the injection needle is connected, and an entirely or substantially circular-cylindrical shaft between collar and neck; said syringe being further characterized in that the ampoule between the piston and the needle mount comprises one or more stoppers (32, 33) which are movable in the ampoule and which, before use of the syringe, keep the injection liquids present in the ampoule separated from each other in that their circumference adjoins the inner wall of the ampoule in a sealing manner; said syringe being still further characterized in that the inner wall of said shaft and the rear face of said neck of the needle holder include a by-pass means through which the injection liquid or liquids present behind the stopper or stoppers can reach the needle past the stopper or stoppers when during use of the syringe the stopper or stoppers is or are moved forward into the shaft of the needle mount, said by-pass means extending longitudinally for a distance slightly greater than the length of the stopper or collection of stoppers.

A very important additional advantage of the syringes according to the invention over the known automatic plural injection devices mentioned before is the flexibility of the liquid compartments. In the known syringes the volume of the liquid compartments is determined by the dimensions of the medicament holders, while the number of liquid compartments is entirely fixed once a given construction has been chosen. On the other hand, the volume of the liquid compartments of the syringe according to the invention is fully variable because the distance between the piston and the stopper, between the stopper and the needle connection, and, if more stoppers are present, between the stoppers mutually, can be adjusted at will. The number of liquid compartments can also be chosen at will by varying the number of stoppers in the ampoule between piston and needle connection; only the length of the by-pass means must be adapted to the overall length of the collective stoppers.

In the syringe according to the invention the needle is connected to the ampoule by means of a needle mount comprising a collar provided on the front of the ampoule in a sealing manner, a neck in which the injection needle is connected and an entirely or substantially circular-cylindrical shaft between collar and neck. As will be clear from a detailed description hereinafter, said collar favours the cooperation between cartridge and cartridge holder in that it bears slidably against the cartridge holder. This syringe is further characterized in that the inner wall of the shaft and rear face of the neck include a by-pass means through which the injection liquid or injection liquids present behind the stopper or stoppers can reach the needle past the stopper or stoppers when during use of the syringe the stopper or stoppers is or are moved into the shaft of the needle mount.

The above by-pass means in the needle mount may comprise at least one slot extending from the rear end of the shaft to the rear aperture of the needle. This slot is recessed in the inner wall of the shaft and the rear face of the neck. The room

bounded by the inner wall of the shaft and the rear face of the neck, apart from said slot, has approximately the same diameter as the stopper or the collection of stoppers, so that the stopper or the collection of stoppers in the extreme forward position can fill this room substantially entirely but does not cover the end of said slot adjoining the ampoule.

A needle mount comprising a by-pass means in the form of one or more slots recessed in its inner wall is described in British Patent Specification 2010681. This needle mount, however, is only intended for use in a disposable manually-operated single compartment syringe, so an injection device without cartridge holder, etc.

In another embodiment of the syringe of the present invention the rear face of the neck of the needle mount may be provided with a plurality of spacing supports, while the room bounded by the inner wall of the shaft and the spacing supports on the rear face of the neck has a slightly larger circumference than the stopper and is slightly longer than the stopper or the collection of stoppers, so that the stopper or the collection of stoppers in the extreme forward position can fill this room substantially entirely, in which, however, an aperture remains around the stopper or stoppers.

In still another embodiment of the syringe of the invention the front face of the stopper nearest to the needle mount may comprise a plurality of spacing supports, while the room bounded by the inner wall of the shaft and the rear face of the neck of the needle holder has a slightly larger circumference than the stopper and is slightly longer than the stopper or the collection of stoppers, including the spacing supports, so that the stopper or the collection of stoppers in the extreme forward position can fill this room substantially entirely but in which an aperture remains around the stopper or stoppers.

As already explained, the number of liquid compartments in the syringe according to the invention may be varied at will by providing more or fewer stoppers in the ampoule between the piston and the needle mount. When the length of the stoppers is fixed, the syringe according to the above-described preferred embodiments of the invention may simply be provided with a needle mount having a matching shaft length.

Alternatively, the above-defined object of the invention can be achieved by means of an automatic syringe, comprising a combination of a discharge mechanism, a cartridge holder and a cartridge which is slidably accommodated in the cartridge holder and which comprises an ampoule, a piston which is movable in the ampoule and seals same, and a hypodermic needle which is connected to the front of the ampoule, and, if desired, is covered by a flexible sheath to maintain the needle in a sterile condition, wherein the inner surface of the cartridge holder is substantially circular-cylindrical over substantially the entire length travelled by the cartridge upon actuation of the syringe, said syringe being characterized in that the ampoule between the piston and the needle connection comprises one or more stoppers which are movable in the ampoule and which, before use of the syringe, keep the injection liquids present in the ampoule separated from each other in that their circumference adjoins the inner wall of the ampoule in a sealing manner; said syringe being still further characterized in that the cartridge includes a by-pass means, said by-pass means comprising a local deformation of the inner wall of the ampoule between the needle connection and the stopper or foremost stopper, said local deformation comprising at least one radially inward ridge which extends in the longitudinal direction of the ampoule for a distance slightly greater than the length of the stopper or collection of stoppers in such manner that upon actuation of the syringe a by-pass is formed through which the injection liquid or injection liquids present behind the stopper or stoppers can reach the needle past the stopper or stoppers. For this purpose the front of the ampoule may be narrowed so that a mouth or spout is formed wherein the needle is sealingly connected. Preferably, however, the needle is connected to the ampoule by means of a separate hub mounting the needle, or a needle mount. A suitable needle mount consists of a sleeve made of plastic or of a suitable metal like aluminium. The rearward side of this sleeve is sealingly connected to the ampoule, e.g. by shrinking or folding around an outwardly extending flange at the front of the ampoule, while the forward side of the needle mount is narrowed to a hub or spout, wherein the needle is sealingly connected, e.g. by shrinking or folding. Such a needle mount is especially well suited for accommodating a membrane to prevent the foremost injection liquid from coming into contact with the metal of the needle during storage of the syringe, e.g. a burstable membrane with a prestretched central portion. The inner wall of the ampoule at the area of the deformation has at least one radially inward ridge which extends in the longitudinal direction of the ampoule. Such ridge or ridges can very easily be provided as will be explained further. In this embodiment the syringe of the invention presents an advantageous interrelationship between cartridge and cartridge holder, because the inwardly directed ridge or ridges of the ampoule allow(s) the inner surface of the cartridge holder to be substantially circular-cylindrical over substantially the entire length travelled by the cartridge upon actuation of the syringe.

The wall of a glass ampoule can be locally deformed by locally heating the glass wall and depressing it to form one or more inward ridges, with the aid of the known techniques available for this purpose. Local deformations of plastic ampoules can be achieved by using suitable moulds.

The injection liquid in the foremost compartment, i.e. the compartment before the stopper, or, in the event more separating stoppers are present

in the ampoule, the foremost stopper, is situated between this stopper and the rear end of the needle of the needle connection. If it is undesirable to leave the injection liquid which is present in this compartment during storage of the syringe in contact with the metal of the injection needle, a membrane should preferably be sealingly provided behind the rear end of the needle. Such a membrane is preferably accommodated in the needle mount (see above). If there is a possibility that the stopper or foremost stopper may close the rear aperture of the needle during actuation of the syringe, this stopper is preferably provided on its front side with spacing supports, e.g. three or four projections, or, alternatively, the rear face of the needle connecting means may be provided with spacing supports.

The invention will now be described in greater detail with reference to preferred embodiments which are shown in the drawings, in which

Figure 1 is a longitudinal sectional view of a syringe according to the invention in the condition in which it can be transported and stored;

Figure 2 is a cross-sectional view through the needle mount of the syringe of Figure 1, namely taken on the line II—II of Figure 1, viewed in the direction of the stopper;

Figure 3 is a cross-sectional view through the needle mount of a syringe taken along the same line as shown in Figure 1, but this time of a different embodiment of the needle mount of the syringe in accordance with the invention;

Figure 4 shows a different embodiment of a syringe according to the invention, partly in side-view and partly in longitudinal sectional view, in a condition wherein the syringe can be transported and stored; and

Figure 5 is a cross-sectional view through the ampoule of the syringe of Figure 4, namely taken on the line V—V of Figure 4.

The syringe shown in Figures 1 and 2 comprises a cylindrical outer sleeve 11 in which a cartridge assembly 12 is provided so as to be slidable, said cartridge assembly comprising a cartridge holder sleeve or inner sleeve 13 fitting in the outer sleeve, a cylindrical glass ampoule 14 containing injection liquids, a piston 15 at one end and a needle mount 16 with injection needle 17 at the other end of the ampoule. At each end the ampoule comprises a radially outwardly projecting flange around which on the side of the injection needle the needle mount is connected by means of a collar 18. The needle holder furthermore comprises a shaft 19, which is cylindrical for the most part, and a neck 20 in which the needle 17 covered by a flexible needle guard 21 is connected. A slot or by-pass 22 is recessed in the inner wall of the shaft and the rear wall of the neck. An externally cylindrical sliding sleeve 23 which is slidable in the cartridge holder sleeve 13 is connected around the flange at the other end of the ampoule. The cartridge assembly 12 is provided in the outer sleeve 11 in such manner that the closed end of the needle guard 21 bears against the end of the cartridge holder sleeve 13 having a bore 24.

The outer sleeve 11 has a length such that the cartridge assembly 12 is accommodated in one end thereof and the discharge mechanism 25 is accommodated in the other end thereof. The discharge mechanism comprises a coil spring 26 as a power source, locking means 27 and a safety device 28. After removing the safety device, the syringe is actuated by placing the forward end of the syringe on the body of the user and exerting a backward movement of cartridge holder sleeve 13 with cartridge assembly 12 relative to outer sleeve 11, as a result of which the locking means 27 is released and the spring is expanded.

Internally the ampoule 14 is divided into three separated liquid compartments 29, 30 and 31 by means of two cylindrical stoppers 32 and 33 which, like the piston, have a slightly larger diameter than the inside diameter of the ampoule. These stoppers, as well as the piston, are manufactured from a flexible material, preferably rubber of a pharmaceutical quality. The shaft of the needle mount, apart from the by-pass, has an inside diameter which is approximately equal to, but preferably slightly larger than that of the ampoule. Furthermore, the shaft of the needle mount is slightly longer than the two stoppers collectively, so that the end 34 of the by-pass adjoining the ampoule has just become uncovered when the stoppers are moved forward entirely to against the rear face of the neck of the needle mount.

When the syringe shown in Figures 1 and 2 is actuated, the cartridge assembly moves forward under the influence of the spring, the sliding sleeve 23 moving in the cartridge holder sleeve. The needle guard is compressed, the needle perforating the closed end of the needle guard and entering into the body at the point where the injection is to be administered. When the needle is in its foremost position, in which the needle mount is stopped when the front part 35 of the needle mount connecting the shaft and the neck abuts against a shoulder 36 formed by a constriction in the cartridge holder neck, the forward movement of the piston begins under the influence of the same spring, so that the actual injection is begun. The injection liquid in compartment 29 is now injected, the whole assembly of piston 15, stoppers 32 and 33 and liquid columns 30 and 31 moving forward. When the stopper 32 has moved in the shaft over a distance such that the rear of said stopper has passed the end 34 of the by-pass adjoining the ampoule, the injection liquid in compartment 30 can reach the needle *via* the by-pass. When all the injection liquid from the compartments 29 and 30 has been injected, the front face of stopper 32 is positioned against the rear face of the neck of the needle mount and stoppers 32 and 33 bear against each other. At that instant stopper 33 has moved forward over such a distance that the rear face of said stopper leaves the end 34 of the by-pass 22 adjoining the ampoule just uncovered so that the injection liquid in compartment 31 can also reach the needle and can be injected.

In another embodiment the diameter of the shaft

of the needle mount is slightly larger than that of the stoppers so that the injection liquids behind the stoppers can pass the stoppers when they have been moved into the shaft. The shaft of the needle mount may have a circular or oval cross-section; the latter shape is shown in Figure 3. The rear face of the neck of the needle mount or the front face of the front stopper comprises spacing supports 37, for example, in the form of caps or truncated cones. The cross-section shown in Figure 3 is viewed in the direction of the front stopper 32, the front face of the stopper comprising three projections 37.

The syringe shown in Figure 4 comprises partially the same components as the syringe shown in Figure 1. These identical parts have the same reference numbers, viz. outer sleeve 11, cartridge assembly 12, inner sleeve 13, piston 15, needle guard 21, discharge mechanism 25, coil spring 26, locking means 27 and safety device 28.

Internally the ampoule 44 of the syringe shown in Figure 4 is divided into two separated liquid compartments 40 and 41 by means of a cylindrical rubber stopper 42, which has a slightly larger diameter than the inside diameter of the ampoule. The front of the ampoule is sealingly provided with an aluminium needle mount 43; in this needle mount the needle is sealingly connected (not shown in the Figure). Behind the rear end of the needle and sealingly closing the liquid compartment 41 towards the needle a membrane is accommodated in the needle mount.

In front of the stopper 42, towards the needle connection, the wall of the ampoule is locally deformed. This deformation has the form of a ridge 45 which extends radially inwardly in the longitudinal direction of the ampoule. This feature is more clearly visible in Figure 5, which is a cross-sectional view through the ampoule of the syringe taken on the line V—V of Figure 4, at the moment that the stopper 42 upon actuation of the syringe has been moved into the forward position. The ridge 45 is slightly longer than the stopper 42 and may be formed on the inner wall of the ampoule by locally heating the glass wall of the ampoule and depressing it.

In general the actuation of the syringe shown in Figures 4 and 5 is the same as described for the embodiments shown in Figures 1 through 3. After rupture of the membrane the injection liquid in compartment 41 is expelled through the needle. Meanwhile the stopper 42 is pushed forward under the influence of the spring force until it abuts against a shoulder 47 of the ampoule 44. As a result of the deformation of the stopper, small ducts are formed on either side of the ridge 45 (see Figure 5). The injection liquid present in compartment 40 can pass the stopper *via* the ducts and can thus reach the cannula and be expelled.

When the injection liquid between stopper and piston has been expelled as completely as possible, the front of the piston contacts the rear side of the stopper. It will be obvious that the front of the piston and the rear side of the stopper are substantially complementary and are preferably substantially flat faces in order to keep the residual volume of injection liquid as small as possible.

Claims

1. An automatic syringe for injecting two or more different injection liquids which may not be in contact with each other for long periods of time, comprising a combination of a discharge mechanism (25), a cartridge holder (13) and a cartridge (12) which is slidably accommodated in the holder and which comprises an ampoule (14), a piston (15) which is movable in the ampoule and seals same, and a hypodermic needle (17) connected to the front of the ampoule and, if desired, covered by a flexible sheath (21) to maintain the needle in a sterile condition; said syringe being characterized in that the needle is connected to the ampoule by means of a needle mount (16), comprising a collar (18) connected to the front of the ampoule in a sealing manner and slidably bearing against the cartridge holder in order to allow forward movement of the cartridge in said holder upon actuation of the syringe, a neck (20) in which the injection needle is connected, and an entirely or substantially circular-cylindrical shaft (19) between collar and neck; said syringe being further characterized in that the ampoule between the piston and the needle mount comprises one or more stoppers (32, 33) which are movable in the ampoule and which, before use of the syringe, keep the injection liquids present in the ampoule separated from each other in that their circumference adjoins the inner wall of the ampoule in a sealing manner; said syringe being still further characterized in that the inner wall of said shaft and the rear face of said neck of the needle holder include a by-pass means (22) through which the injection liquid or liquids present behind the stopper or stoppers can reach the needle past the stopper or stoppers when during use of the syringe the stopper or stoppers is or are moved forward into the shaft of the needle mount, said by-pass means extending longitudinally for a distance slightly greater than the length of the stopper or collection of stoppers.

2. A syringe as claimed in claim 1, characterized in that said by-pass means comprises at least one slot (22) extending from the rear end of the shaft (19) to the rear aperture of the needle (17), said slot being recessed in the inner wall of the shaft and the rear face of the neck (20), said syringe being further characterized in that the room (29) bounded by the inner wall of the shaft and the rear face of the neck, apart from the said slot, has approximately the same diameter as the stopper or stoppers and is slightly longer than the stopper or the collection of stoppers, so that the stopper or the collection of stoppers in the extreme forward position can fill this space substantially entirely but does not cover the end (34) of the said slot or slots adjoining the ampoule.

3. A syringe as claimed in Claim 1, characterized

of the needle mount is slightly larger than that of the stoppers so that the injection liquids behind the stoppers can pass the stoppers when they have been moved into the shaft. The shaft of the needle mount may have a circular or oval cross-section; the latter shape is shown in Figure 3. The rear face of the neck of the needle mount or the front face of the front stopper comprises spacing supports 37, for example, in the form of caps or truncated cones. The cross-section shown in Figure 3 is viewed in the direction of the front stopper 32, the front face of the stopper comprising three projections 37.

The syringe shown in Figure 4 comprises partially the same components as the syringe shown in Figure 1. These identical parts have the same reference numbers, viz. outer sleeve 11, cartridge assembly 12, inner sleeve 13, piston 15, needle guard 21, discharge mechanism 25, coil spring 26, locking means 27 and safety device 28.

Internally the ampoule 44 of the syringe shown in Figure 4 is divided into two separated liquid compartments 40 and 41 by means of a cylindrical rubber stopper 42, which has a slightly larger diameter than the inside diameter of the ampoule. The front of the ampoule is sealingly provided with an aluminium needle mount 43; in this needle mount the needle is sealingly connected (not shown in the Figure). Behind the rear end of the needle and sealingly closing the liquid compartment 41 towards the needle a membrane is accommodated in the needle mount.

In front of the stopper 42, towards the needle connection, the wall of the ampoule is locally deformed. This deformation has the form of a ridge 45 which extends radially inwardly in the longitudinal direction of the ampoule. This feature is more clearly visible in Figure 5, which is a cross-sectional view through the ampoule of the syringe taken on the line V—V of Figure 4, at the moment that the stopper 42 upon actuation of the syringe has been moved into the forward position. The ridge 45 is slightly longer than the stopper 42 and may be formed on the inner wall of the ampoule by locally heating the glass wall of the ampoule and depressing it.

In general the actuation of the syringe shown in Figures 4 and 5 is the same as described for the embodiments shown in Figures 1 through 3. After rupture of the membrane the injection liquid in compartment 41 is expelled through the needle. Meanwhile the stopper 42 is pushed forward under the influence of the spring force until it abuts against a shoulder 47 of the ampoule 44. As a result of the deformation of the stopper, small ducts are formed on either side of the ridge 45 (see Figure 5). The injection liquid present in compartment 40 can pass the stopper *via* the ducts and can thus reach the cannula and be expelled.

When the injection liquid between stopper and piston has been expelled as completely as possible, the front of the piston contacts the rear side of the stopper. It will be obvious that the front of the piston and the rear side of the stopper are substantially complementary and are preferably substantially flat faces in order to keep the residual volume of injection liquid as small as possible.

Claims

1. An automatic syringe for injecting two or more different injection liquids which may not be in contact with each other for long periods of time, comprising a combination of a discharge mechanism (25), a cartridge holder (13) and a cartridge (12) which is slidably accommodated in the holder and which comprises an ampoule (14), a piston (15) which is movable in the ampoule and seals same, and a hypodermic needle (17) connected to the front of the ampoule and, if desired, covered by a flexible sheath (21) to maintain the needle in a sterile condition; said syringe being characterized in that the needle is connected to the ampoule by means of a needle mount (16), comprising a collar (18) connected to the front of the ampoule in a sealing manner and slidably bearing against the cartridge holder in order to allow forward movement of the cartridge in said holder upon actuation of the syringe, a neck (20) in which the injection needle is connected, and an entirely or substantially circular-cylindrical shaft (19) between collar and neck; said syringe being further characterized in that the ampoule between the piston and the needle mount comprises one or more stoppers (32, 33) which are movable in the ampoule and which, before use of the syringe, keep the injection liquids present in the ampoule separated from each other in that their circumference adjoins the inner wall of the ampoule in a sealing manner; said syringe being still further characterized in that the inner wall of said shaft and the rear face of said neck of the needle holder include a by-pass means (22) through which the injection liquid or liquids present behind the stopper or stoppers can reach the needle past the stopper or stoppers when during use of the syringe the stopper or stoppers is or are moved forward into the shaft of the needle mount, said by-pass means extending longitudinally for a distance slightly greater than the length of the stopper or collection of stoppers.

2. A syringe as claimed in claim 1, characterized in that said by-pass means comprises at least one slot (22) extending from the rear end of the shaft (19) to the rear aperture of the needle (17), said slot being recessed in the inner wall of the shaft and the rear face of the neck (20), said syringe being further characterized in that the room (29) bounded by the inner wall of the shaft and the rear face of the neck, apart from the said slot, has approximately the same diameter as the stopper or stoppers and is slightly longer than the stopper or the collection of stoppers, so that the stopper or the collection of stoppers in the extreme forward position can fill this space substantially entirely but does not cover the end (34) of the said slot or slots adjoining the ampoule.

3. A syringe as claimed in Claim 1, characterized

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in that the front face of the stopper (32) nearest to the needle mount or the rear face of the neck of the needle mount comprises a plurality of spacing supports (37), and that the space bounded by the inner wall of the shaft and the rear face of the neck of the needle mount or the spacing supports on said rear face respectively has a slightly larger circumference than the expanded stopper and is slightly longer than the stopper or the collection of stoppers, including the spacing supports, if present, so that the stopper or the collection of stoppers in the extreme forward position can fill this space substantially entirely but in which an aperture remains around the stopper or stoppers.

4. An automatic syringe for injecting two or more different injection liquids which may not be in contact with each other for long periods of time, comprising a combination of a discharge mechanism (25), a cartridge holder (13) and a cartridge (12) which is slidably accommodated in the holder and which comprises an ampoule (44), a piston (15) which is movable in the ampoule and seals same, and a hypodermic needle connected to the front of the ampoule, preferably by means of a needle mount (43) and, if desired, covered by a flexible sheath (21) to maintain the needle in a sterile condition, wherein the inner surface of the cartridge holder is substantially circular-cylindrical over substantially the entire length travelled by the cartridge upon actuation of the syringe, said syringe being characterized in that the ampoule between the piston and the needle connection comprises one or more stoppers (42) which are movable in the ampoule and which, before use of the syringe, keep the injection liquids present in the ampoule separated from each other in that their circumference adjoins the inner wall of the ampoule in a sealing manner; said syringe being still further characterized in that the cartridge includes a by-pass means, said by-pass means comprising a local deformation of the inner wall of the ampoule between the needle connection and the stopper or foremost stopper, said local deformation comprising at least one radially inward ridge (45) which extends in the longitudinal direction of the ampoule for a distance slightly greater than the length of the stopper or collection of stoppers in such manner that upon actuation of the syringe a by-pass is formed through which the injection liquid or injection liquids present behind the stopper or stoppers can reach the needle past the stopper or stoppers.

Patentansprüche

1. Automatische Spritze zur Injektion von zwei oder mehr verschiedenen Injektionsflüssigkeiten, die für lange Zeitdauern nicht in Kontakt miteinander gelangen dürfen, mit einer Kombination eines Abgabemechanismus (25), eines Patronenhalters (13) und einer Patrone (12), die im Halter verschiebbar aufgenommen ist und eine Ampulle (14), einen Kolben (15), der in der Ampulle bewegbar ist und diese abdichtet, und eine hypodermatische Nadel (17) aufweist, die mit der Vorderseite der Ampulle verbunden und gewünschtenfalls von einer flexiblen Hülle (21) bedeckt ist, um die Nadel in einem sterilen Zustand zu halten, welche Spritze dadurch gekennzeichnet ist, daß die Nadel mit einer Ampulle mit Hilfe einer Nadelhalterung (16) verbunden ist, die einen Kragen (18), der mit der Vorderseite der Ampulle in abdichtender Weise verbunden ist und gegen den Patronenhalter verschiebbar anliegt, um eine Vorwärtsbewegung der Patrone im Halter bei Betätigung der Spritze zu ermöglichen, einen Hals (20), in dem die Injektionsnadel angeschlossen ist, und einen ganz oder im wesentlichen kreiszylindrischen Schaft (19) zwischen Kragen und Hals aufweist, welche Spritze weiter dadurch gekennzeichnet ist, daß die Ampulle zwischen dem Kolben und der Nadelhalterung einen oder mehrere Stopfen (32, 33) aufweist, die in der Ampulle bewegbar sind und vor Gebrauch der Spritze die in der Ampulle vorhandenen Flüssigkeiten voneinander dadurch getrennt halten, daß ihr Umfang an die Innenwand der Ampulle dicht anschließt, welche Spritze noch weiter dadurch gekennzeichnet ist, daß die Innenwand des Schaftes und die Rückseite des Halses des Nadelhalters Umgehungsmittel (22) enthalten, durch die die hinter dem Stopfen oder den Stopfen vorhandene(n) Flüssigkeit(en) die Nadel am Stopfen bzw. an den Stopfen vorbei erreichen kann bzw. können, wenn beim Gebrauch der Spritze der Stopfen oder die Stopfen vorwärts in den Schaft der Nadelhalterung bewegt wird bzw. werden, wobei sich die Umgehungsmittel in Längsrichtung über einen Abstand erstrecken, der etwas größer ist als die Länge des Stopfens oder der Ansammlung der Stopfen.

2. Spritze nach Anspruch 1, dadurch gekennzeichnet, daß die Umgehungsmittel zumindest einem Schlitz (22) umfassen, der sich vom hinteren Ende des Schaftes (19) zur hinteren öffnung der Nadel (17) erstreckt, wobei der Schlitz in der Innenwand des Schaftes und der Rückseite des Halses (20) ausgenommen ist, welche Spritze weiter dadurch gekennzeichnet ist, daß der von der Innenwand des Schaftes und der Rückseite des Halses begrenzte Raum (29), abgesehen vom Schlitz, ungefähr denselben Durchmesser wie der Stopfen oder die Stopfen hat und etwas länger als der Stopfen oder die Ansammlung der Stopfen ist, so daß der Stopfen oder die Ansammlung der Stopfen in der vordersten Position diesen Raum im wesentlichen zur Gänze ausfüllen kann, jedoch nicht das an die Ampulle anschließende Ende (34) des Schlitzes oder der Schlitze bedeckt.

3. Spritze nach Anspruch 1, dadurch gekennzeichnet, daß die Vorderseite des Stopfens (32) zunächst der Nadelhalterung oder die Rückseite des Halses der Nadelhalterung eine Mehrzahl von Distanzhaltern (37) aufweist, und daß der von der Innenwand des Schaftes und der Rückseite des Halses der Nadelhalterung bzw. der Distanzhalter an der Rückseite einen etwas größeren Umfang als der expandierte Stopfen hat und etwas länger als der Stopfen oder die Ansammlung der Stop-

fen, gegebenenfalls einschließlich der Distanzhalter, ist, so daß der Stopfen oder die Ansammlung der Stopfen in der vordersten Position diesen Raum im wesentlichen ganz ausfüllen kann, in ihm jedoch eine öffnung rund um den oder die Stopfen verbleibt.

4. Automatische Spritze zur Injektion von zwei oder mehr verschiedenen Injektionsflüssigkeiten, die für lange Zeitdauern nicht in Kontakt miteinander gelangen dürfen, mit einer Kombination eines Abgabemechanismus (25), eines Patronenhalters (13) und einer Patrone (12), die im Halter verschiebbar aufgenommen ist und eine Ampulle (44), einen Kolben (15), der in der Ampulle bewegbar ist und diese abdichtet, und eine hypodermatische Nadel aufweist, die mit der Vorderseite der Ampulle, vorzugsweise mittels einer Nadelhalterung (43), verbunden und gewünschtenfalls von einer flexiblen Hülle (21) bedeckt ist, um die Nadel in einem sterilen Zustand zu halten, wobei die Innenfläche des Patronenhalters im wesentlichen über die ganze Länge, über die sich die Patrone bei Betätigen der Spritze bewegt, im wesentlichen kreiszylindrisch ist, welche Spritze dadurch gekennzeichnet ist, daß die Ampulle zwischen dem Kolben und dem Nadelanschluß einen oder mehrere Stopfen (42) aufweist, die in der Ampulle bewegbar sind und vor Gebrauch der Spritze die in der Ampulle vorhandenen Flüssigkeiten voneinander dadurch getrennt halten, daß ihr Umfang an die Innenwand der Ampulle dicht anschließt; welche Spritze noch weiter dadurch gekennzeichnet ist, daß die Patrone ein Umgehungsmittel enthält, welches Umgehungsmittel eine lokale Verformung der Innenwand der Ampulle zwischen dem Nadelanschluß und dem Stopfen oder vordersten Stopfen umfaßt, wobei die lokale Verformung zumindest eine radial einwärts ragende Leiste (45) aufweist, die sich in der Längsrichtung der Ampulle über einen Abstand erstreckt, der etwas größer ist als die Länge des Stopfens oder die Ansammlung der Stopfen, so daß bei Betätigung der Spritze ein Umgehungsweg gebildet wird, durch den die hinter dem Stopfen oder den Stopfen vorhandene(n) Flüssigkeit(en) die Nadel am Stopfen bzw. an den Stopfen vorbei erreichen kann bzw. können.

Revendications

1. Seringue automatique servant à injecteur deux ou plusieurs liquides d'injection différents, qui ne peuvent pas être en contact réciproque pendant de longs intervalles de temps, comprenant une combinaison d'un mécanisme de refoulement (25), d'un porte-cartouche (13) et d'une cartouche (12), qui est logée de manière à pouvoir glisser dans le porte-cartouche et comporte une ampoule (14), un piston (15) qui est déplaçable dans l'ampoule et ferme de façon étanche cette dernière, et une aiguille hypodermique (17) raccordée sur l'avant de l'ampoule et recouverte, si cela est souhaité, par une gaine flexible (21) servant à maintenir l'aiguille dans des conditions stériles; ladite seringue étant caractérisée en ce que l'aiguille est raccordée à l'ampoule au moyen d'un support d'aiguille (16) comportant un collet (18) raccordé à l'avant de l'ampoule d'une manière étanche et s'appliquant avec possibilité de glissement contre le porte-cartouche afin de permetre un déplacement de la cartouche vers l'avant à l'intérieur dudit porte-cartouche lors de l'actionnement de la seringue, un goulot (20) dans lequel la seringue d'injection est raccordée, et un tube (19) qui est entièrement ou sensiblement en forme de cylindre circulaire et est disposé entre le collet et le goulot; ladite seringue étant en outre caractérisée en ce que l'ampoule située entre le piston et le support d'aiguille comporte un ou plusieurs bouchons (32, 33) qui sont déplaçables dans l'ampoule et qui, avant l'utilisation de la seringue, maintiennent les liquides d'injection, qui sont présents dans l'ampoule, séparés les uns des autres par le fait que la circonférence de ces bouchons est en contact d'une manière étanche avec la paroi intérieure de l'ampoule; ladite seringue étant en outre caractérisée en ce que la paroi intérieure dudit tube et la face arrière dudit goulot du porte-aiguille comprennent des moyens de dérivation (22), au moyen desquels le ou les liquides d'injection présents en arrière du ou des bouchons peuvent atteindre l'aiguille en franchissant le ou les bouchons lorsque, pendant l'utilisation de la seringue, ce ou ces bouchons sont déplacés vers l'avant à l'intérieur du tube de support d'aiguilles, lesdits moyens de dérivation s'étendant dans la direction longitudinale sur une distance légèrement supérieure à la longueur du bouchon ou de l'ensemble des bouchons.

2. Seringue selon la revendication 1, caractérisée en ce que lesdits moyens de dérivation comprennent au moins une rainure (22) s'étendant depuis l'extrémité arrière du tube (19) jusqu'à l'ouverture arrière de l'aiguille (17), ladite rainure étant en renforcement dans la paroi intérieure du tube et dans la face arrière du goulot (20), ladite seringue étant en outre caractérisée en ce que l'espace (29) délimité par la paroi intérieure du tube et par la face arrière du goulot, en dehors de ladite rainure, possède approximativement le même diamètre que le ou les bouchons et est légèrement plus long que le bouchon ou l'ensemble des bouchons, de sorte que le bouchon ou l'ensemble de bouchons dans la position avant extrême peuvent remplir cet espace sensiblement complètement, mais ne recouvrent pas l'extrémité (34) de la ou desdites rainures contiguës à l'ampoule.

3. Seringue selon la revendication 1, caractérisée en ce que la face avant du bouchon (32), qui est le plus proche du support d'aiguille ou de la face arrière du goulot du support d'aiguille, comporte une pluralité de supports d'enespacement (37), et en ce que l'espace délimité par la paroi intérieure du tube et par la face arrière du goulot du porte-aiguille ou les supports d'espacement situés sur ladite face arrière possède respectivement une circonférence légèrement supérieure au bouchon dilaté et est d'une longueur supérieure au bouchon ou à l'ensemble de bou-

chons, y compris les supports d'espacement s'ils sont présents, de sorte que le bouchon ou l'ensemble des bouchons dans la position avant extrême peuvent remplir sensiblement complètement ces espace, dans lequel une ouverture subsiste autour du ou des bouchons.

4. Seringue automatique servant à injecter deux ou plusieurs liquides d'injection différents, qui ne peuvent pas être en contact réciproque pendant de longs intervalles de temps, comprenant une combinaison d'un mécanisme de refoulement (25), d'un porte-cartouche (13) et d'une cartouche (12), qui est logée de manière à pouvoir glisser dans le porte-cartouche et comporte une ampoule (44), un piston (15) qui est déplaçable dans l'ampoule et ferme de façon étanche cette dernière, et une aiguille hypodermique (17) raccordée sur l'avant de l'ampoule de préférence au moyen d'un support d'aiguille (43) et recouverte, si cela est souhaîté, par une gaine flexible (21) servant à maintenir l'aiguille dans des conditions stériles, et dans laquelle la surface intérieure du porte-cartouche possède sensiblement la forme d'un cylindre circulaire sur sensiblement toute la largeur parcourue par la cartouche lors de l'actionnement de la seringue, ladite seringue étant caractérisée en ce que l'ampoule située entre le piston et le raccordement de l'aiguille comporte un ou plusieurs bouchons (42) qui sont déplaçables à l'intérieur de l'ampoule et qui, avant l'utilisation de la seringue, maintiennent les liquides à injecter, qui sont présents dans l'ampoule, séparés les uns des autres par le fait que leur circonférence est appliquée d'une manière étanche contre la paroi intérieure de l'ampoule; ladite seringue étant en outre caractérisée en ce que la cartouche comporte des moyens de dérivation, lesdits moyens de dérivation comprenant une déformation locale de la paroi intérieure de l'ampoule entre le raccordement de l'aiguille et le bouchon ou le bouchon situé le plus en avant, ladite déformation locale comprenannt au moins une nervure (45) dirigée radialement vers l'intérieur, qui s'étend dans la direction longitudinale de l'ampoule sur une distance légèrement supérieure à la longueur du bouchon ou de l'ensemble de bouchons de telle sorte que, lors de l'actionnement de la seringue, il s'établit une dérivation par laquelle le ou les liquides à injecter présents en arrière du ou des bouchons peuvent atteindre l'aiguille en franchissant le ou les bouchons.