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(54) HYPODERMIC SYRINGE

(71) We, N. V. PHILIPS' GLOEILAMPENFABRIEKEN, a limited liability Company, organized and established under the laws of the Kingdom of the Netherlands, of Emmasingel 29, Eindhoven, Holland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a hypodermic syringe of the kind comprising a substantially cylindrical housing within which is accommodated a liquid-container having a needle connected thereto at one end, the other end of the container being bounded by a piston fitting within it, wherein at the end adjacent the needle the housing is bounded by a wall through which the needle can pass but the liquid container cannot pass, the syringe also comprising an operating mechanism to exert a force on the piston.

A hypodermic syringe of the above-described type is known from the French Patent Specification 1,342,358. In this known hypodermic syringe a pressure is exerted on the piston, after unlocking the operating mechanism by means of a pre-tensioned spring. As a result of this, the assembly of liquid-container and needle is moved to the outside, while at the same time a stopper diaphragm which separates the liquid from the needle can be broken by the liquid under pressure so that the liquid starts flowing out.

A drawback of this known hypodermic syringe is that the liquid can discharge out of the liquid-container before the needle has penetrated sufficiently far into the part of the body to be treated.

It is the object of this invention to mitigate this drawback and to provide a hypodermic syringe in which the instant at which the discharge of the liquid out of the liquid-container begins is determined by the construction of the syringe.

According to this invention there is provided a hypodermic syringe of the kind defined above, the syringe also comprising one or more blocking elements which can block the operating mechanism or the piston against movement relative to the liquid-container and which can be moved radially to unblock the said operating mechanism or piston, and wherein at least over part of its circumference the wall of the housing has a diameter transition spaced from the upper edge of the liquid-container by a distance not greater than the length of the needle, so that in passing the transition, the blocking elements move radially and unblock the operating mechanism or piston, after which the operating mechanism can push the piston into the liquid-container and force the liquid out through the needle.

Upon exerting a force by the operating mechanism, first the assembly of liquid container and needle is moved over such a distance that the needle has reached the desirable depth of penetration, after which, when the transition edge provided in the housing is passed, the blocking is removed and the piston discharges the liquid out of the liquid-container. In this manner the instant of discharge of the liquid is fully determined by the design of the housing.

The blocking elements may have a variety of constructions; for example they may be constituted by pawl segments incorporated in a groove of the piston or a pressure member co-operating therewith, said pawl segments being forced by springs against the wall of the housing, their configuration being such that upon passing the diameter transition they are forced inwards over such a distance that they become located inside the wall of the liquid container.

In one embodiment the blocking elements are formed by part-annular segments bearing individually on the upper edge of the liquid-container and engaging with their outer annular surface the wall of the housing, the inner

annular surface of said segments being at least partly bevelled and having a minimum diameter smaller than the inside diameter of the liquid container, the piston and a pressure member, respectively, co-operating therewith, of the pressure member comprising a bevelled surface which bears against the bevelled surface of the annular segments, the diameter of the housing at the position of the said diameter transition becoming larger so that the annular segments can move outwards and are released from the piston and the pressure member, respectively, when the assembly of the liquid container and needle are moved along the housing.

In a further embodiment the blocking elements are constituted by outwardly springing lugs which are connected to a pressure member of the operating mechanism and which face the liquid container with their free end and in the uncompressed condition have a larger diameter than the wall of the liquid container, the piston having space for receiving said lugs when they are compressed, wherein the free end of each lug bears on the edge of the liquid container and is formed with a segment which projects within the liquid container and wherein each lug is formed with a bevel on its side facing the inner wall of the housing, the diameter of the housing at the position of the said diameter transition becoming smaller so that when the liquid-container and needle assembly moves along it the lugs are forced inwards.

In another embodiment the blocking elements are formed by outwardly-springing lugs connected to the piston and the free ends of which are remote from the liquid-container and which lugs, in the uncompressed condition, have a larger diameter than the wall of the liquid container, the pressure member having a space for receiving said lugs when they are compressed, each lug having a surface which bears on the edge of the liquid container, the part of each lug situated between said surface and its free end being bevelled on the side facing the wall of the housing, the diameter of the housing at the position of the said diameter transition becoming smaller so that when the liquid-container and needle assembly moves along it the lugs are forced inwards.

In the two last-mentioned embodiments the pressure member and the piston and the lugs connected thereto, respectively, may be formed as one assembly, for example, of a synthetic resin.

In order that this invention may be readily carried into effect, it will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:

Figure 1 diagrammatically shows a hypodermic syringe comprising a pressure member provided with blocking lugs.

Figure 2 diagrammatically shows a hypodermic syringe in which the piston is provided with blocking lugs which with their free ends are remote from the liquid container.

Figure 3 diagrammatically shows a hypodermic syringe which comprises separate blocking segments which can be moved radially.

Reference numeral 1 in Figure 1 denotes a housing which is constructed of two parts 2 and 3. An assembly of liquid-container 4 and needle 5 connected thereto is arranged in said housing so as to be movable. The lower side of the liquid-container 4 is closed by a stopper diaphragm 6 which bursts when the liquid comes under pressure. The upper side of the liquid-container is closed by a piston 7. A pressure member 8 constructed as a cup spring co-operates with the piston 7. A compression spring 9 is present between the pressure member 8 and the upper side of the part 3 of the housing. The pressure member 8 is locked against movement by means of a locking member 10 which is connected thereto and which is formed with fingers 11 on its upper end as viewed in the figure. The fingers 11 extend through a bore in the upper end of the housing and terminate in bevelled lugs 12. Beneath the outer levelled surface of each lug 12 is a substantially par-annular surface 13 which engages the upper circular edge of the bore in the housing 3.

A slidable sleeve 14 which comprises a partially-conical bore 15 which can co-operate with the bevelled lugs 12 of the fingers 11 is situated around the part 3 of the housing. In order to prevent an unintentional actuation of the syringe a pin 16 projects into the space between the fingers 11 in such manner that the fingers cannot be compressed. The pin 16 has a cap 17 with which the pin can be removed.

The pressure member 8 is formed with resilient lugs 20 the free ends 21 of which bear on the upper edge of the liquid-container 4. Each free end 21 is formed with a segment 22 which projects a short distance within the liquid-container, and each free end 21 also is formed with a bevelled surface 23 facing the wall of the housing part 3. The surface of this wall of the housing part 3 is formed with axial grooves in which the lugs 20 can slide and these grooves extend to the position 24 where they change to a smaller diameter *via* a bevel.

The operation of this hypodermic syringe is as follows: First of all the cap 17 with pin 16 is removed. The slidable sleeve 14 is then moved downwards relative to the part 3 of the housing, the bevelled lugs 12 being squeezed by the conical part of bore 15 so that the edges 13 are released and the member 10 with pressure member 8 is forced downwards by the spring 9. Since the pressure member 8 presses on the liquid-container 4 by means of the lugs 20, the liquid-container is

also moved downwards, the needle 5 penetrating the wall of the housing. At the position where the needle has substantially left the housing, the lugs 20 pass the diameter transition 24. Said lugs 20 are forced inwards so that they are released from the edge of the liquid-container 4, and the pressure member forces the piston 7 downwards and the liquid is pressed out of the liquid-container. During the lowering of the liquid-container 4 by means of the pressure member 8, the lugs 20 exert no extra frictional force on the wall of the part 3 of the housing because the segments 22 engage behind the edge of the liquid-container 4 so that the lugs 20 cannot move outwards.

In this manner a hypodermic syringe is obtained in which the instant at which the discharge of liquid begins is determined by the position of the diameter transition 24.

A seal 25 is present between the liquid container 4 and the part 2 of the housing, so that prior to use the compartment 26 in which the needle 5 is present is fully closed so that the needle can be stored in a sterile atmosphere.

Figure 2 shows a hypodermic syringe which corresponds in general with the syringe shown in Figure 1 and in which therefore corresponding components are referred to by the same reference numerals. The difference from the syringe shown in Figure 1 is that the piston 7 is provided with lugs 30 which are remote from the liquid-container with their free end. A surface 31 of said lugs 30 bears on the edge of the liquid-container 4, while from said surface the lugs 30 extend upwards at an angle over a part 32. Again the pressure member 8 is constructed so that it bears against the piston 7 and again the part 3 is formed with axial grooves in which the lugs 30 can slide. When the operating mechanism is actuated, the whole assembly of liquid-container 4 and needle 5 is moved. When the ends 24 of the grooves are passed, the lugs 30 are pressed inwards so that the piston 7 in the liquid-container starts moving and the liquid is pressed out.

Figure 3 shows again a hypodermic syringe as is shown in Figures 1 and 2 in which the blocking elements are formed by separate part-annular segments 40, the part-annular undersurfaces 41 of which bear on the edge of the liquid-container 4. The outer part-cylindrical surface of the segments bear against the inner wall of the part 3 of the housing, while each inner part-cylindrical surface is provided with an inclined part 42 so that the segments form an annulus the lower end of which has a smaller diameter than the inside diameter of the liquid container. The pressure member 8 has a diameter which is slightly smaller than that of the liquid container and, with a bevelled surface 43, engages the surface part 42 of the annular segments. At the area 24 the part 3 of the housing changes into the part 2 of the housing which has a slightly larger diameter. When actuating the operating mechanism of this syringe, first the liquid container and the needle are moved by means of the pressure member because the annular segments lock the pressure member and the liquid container. When the annular segments 40 pass the edge 24 they are forced outwards as a result of the forces exerted on the inclined surface 41 so that they are released from the pressure member. The pressure member then presses on the piston so that the liquid starts flowing out.

From the above it is clear that this invention provides a hypodermic syringe in which the sequence of movement of the liquid-container with needle and piston is entirely determined by the design of the housing and blocking elements co-operating therewith.

WHAT WE CLAIM IS:—

1. A hypodermic syringe comprising a substantially cylindrical housing within which is accommodated an assembly of a liquid-container having a needle connected thereto at one end, the other end of the container being bounded by a piston fitting within it, wherein at the end adjacent the needle the housing is bounded by a wall through which the needle can pass but the liquid container cannot pass, the syringe also comprising an operating mechanism to exert a force on the piston, one or more blocking elements which can block the operating mechanism or the piston against movement relative to the liquid-container and which can be moved radially to unblock the said operating mechanism or piston, and wherein at least over part of its circumference the wall of the housing has a diameter transition spaced from the upper edge of the liquid-container by a distance not greater than the length of the needle, so that in passing the transition, the blocking elements move radially and unblock the operating mechanism or piston, after which the operating mechanism can push the piston into the liquid-container and force the liquid out through the needle.

2. A hypodermic syringe as claimed in Claim 1, wherein the blocking elements are constituted by part-annular segments which bear individually on the upper edge of the liquid-container and which engage the wall of the housing with their outer annular surface, the inner annular surface of said segments being partly bevelled and having a minimum diameter smaller than the inside diameter of the liquid container, the piston and a pressure member, respectively, of the operating mechanism co-operating therewith, the pressure member comprising a bevelled surface which bears against the bevelled surface of the annular segments, the diameter of the housing at the position of the said diameter transition becoming larger so that the annular segments can move outwards and are released from the piston and the pressure

also moved downwards, the needle 5 penetrating the wall of the housing. At the position where the needle has substantially left the housing, the lugs 20 pass the diameter transition 24. Said lugs 20 are forced inwards so that they are released from the edge of the liquid-container 4, and the pressure member forces the piston 7 downwards and the liquid is pressed out of the liquid-container. During the lowering of the liquid-container 4 by means of the pressure member 8, the lugs 20 exert no extra frictional force on the wall of the part 3 of the housing because the segments 22 engage behind the edge of the liquid-container 4 so that the lugs 20 cannot move outwards.

In this manner a hypodermic syringe is obtained in which the instant at which the discharge of liquid begins is determined by the position of the diameter transition 24.

A seal 25 is present between the liquid container 4 and the part 2 of the housing, so that prior to use the compartment 26 in which the needle 5 is present is fully closed so that the needle can be stored in a sterile atmosphere.

Figure 2 shows a hypodermic syringe which corresponds in general with the syringe shown in Figure 1 and in which therefore corresponding components are referred to by the same reference numerals. The difference from the syringe shown in Figure 1 is that the piston 7 is provided with lugs 30 which are remote from the liquid-container with their free end. A surface 31 of said lugs 30 bears on the edge of the liquid-container 4, while from said surface the lugs 30 extend upwards at an angle over a part 32. Again the pressure member 8 is constructed so that it bears against the piston 7 and again the part 3 is formed with axial grooves in which the lugs 30 can slide. When the operating mechanism is actuated, the whole assembly of liquid-container 4 and needle 5 is moved. When the ends 24 of the grooves are passed, the lugs 30 are pressed inwards so that the piston 7 in the liquid-container starts moving and the liquid is pressed out.

Figure 3 shows again a hypodermic syringe as is shown in Figures 1 and 2 in which the blocking elements are formed by separate part-annular segments 40, the part-annular undersurfaces 41 of which bear on the edge of the liquid-container 4. The outer part-cylindrical surface of the segments bear against the inner wall of the part 3 of the housing, while each inner part-cylindrical surface is provided with an inclined part 42 so that the segments form an annulus the lower end of which has a smaller diameter than the inside diameter of the liquid container. The pressure member 8 has a diameter which is slightly smaller than that of the liquid container and, with a bevelled surface 43, engages the surface part 42 of the annular segments. At the area 24 the part 3 of the housing changes into the part 2 of the housing which has a slightly larger diameter. When actuating the operating mechanism of this syringe, first the liquid container and the needle are moved by means of the pressure member because the annular segments lock the pressure member and the liquid container. When the annular segments 40 pass the edge 24 they are forced outwards as a result of the forces exerted on the inclined surface 41 so that they are released from the pressure member. The pressure member then presses on the piston so that the liquid starts flowing out.

From the above it is clear that this invention provides a hypodermic syringe in which the sequence of movement of the liquid-container with needle and piston is entirely determined by the design of the housing and blocking elements co-operating therewith.

WHAT WE CLAIM IS:—

1. A hypodermic syringe comprising a substantially cylindrical housing within which is accommodated an assembly of a liquid-container having a needle connected thereto at one end, the other end of the container being bounded by a piston fitting within it, wherein at the end adjacent the needle the housing is bounded by a wall through which the needle can pass but the liquid container cannot pass, the syringe also comprising an operating mechanism to exert a force on the piston, one or more blocking elements which can block the operating mechanism or the piston against movement relative to the liquid-container and which can be moved radially to unblock the said operating mechanism or piston, and wherein at least over part of its circumference the wall of the housing has a diameter transition spaced from the upper edge of the liquid-container by a distance not greater than the length of the needle, so that in passing the transition, the blocking elements move radially and unblock the operating mechanism or piston, after which the operating mechanism can push the piston into the liquid-container and force the liquid out through the needle.

2. A hypodermic syringe as claimed in Claim 1, wherein the blocking elements are constituted by part-annular segments which bear individually on the upper edge of the liquid-container and which engage the wall of the housing with their outer annular surface, the inner annular surface of said segments being partly bevelled and having a minimum diameter smaller than the inside diameter of the liquid container, the piston and a pressure member, respectively, of the operating mechanism co-operating therewith, the pressure member comprising a bevelled surface which bears against the bevelled surface of the annular segments, the diameter of the housing at the position of the said diameter transition becoming larger so that the annular segments can move outwards and are released from the piston and the pressure

member, respectively, when the assembly of the liquid-container and needle are moved along the housing.

3. A hypodermic syringe as claimed in Claim 1, wherein the blocking elements are formed by outwardly springing lugs connected to a pressure member of the operating mechanism and facing the liquid container with their free end, and in the uncompressed condition have a larger diameter than the wall of the liquid container, the piston having a space, for receiving said lugs when they are compressed, wherein the free end of each lug bears on the edge of the liquid container and is formed with a segment which projects within the liquid container and wherein each lug is formed with a bevel on its side facing the wall of the housing, the diameter of the housing at the position of the said diameter transition becoming smaller so that when the liquid-container and needle assembly moves along it the lugs are forced inwards.

4. A hypodermic syringe as claimed in Claim 1, wherein the blocking elements are formed by outwardly-springing lugs connected to the piston and the free ends of which are remote from the liquid-container and which lugs have a larger diameter, in the uncompressed condition, than the wall of the liquid container, the pressure member having a space for receiving said lugs when they are compressed, each lug having a surface which bears on the edge of the liquid container, the part of each lug situated between said surface and its free end being bevelled on the side facing the wall of the housing, the diameter of the housing at the position of the said diameter transition becoming smaller so that when the liquid-container and needle assembly moves along it the lugs are forced inwards.

5. A hypodermic syringe substantially as herein described with reference to the accompanying drawings.

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