

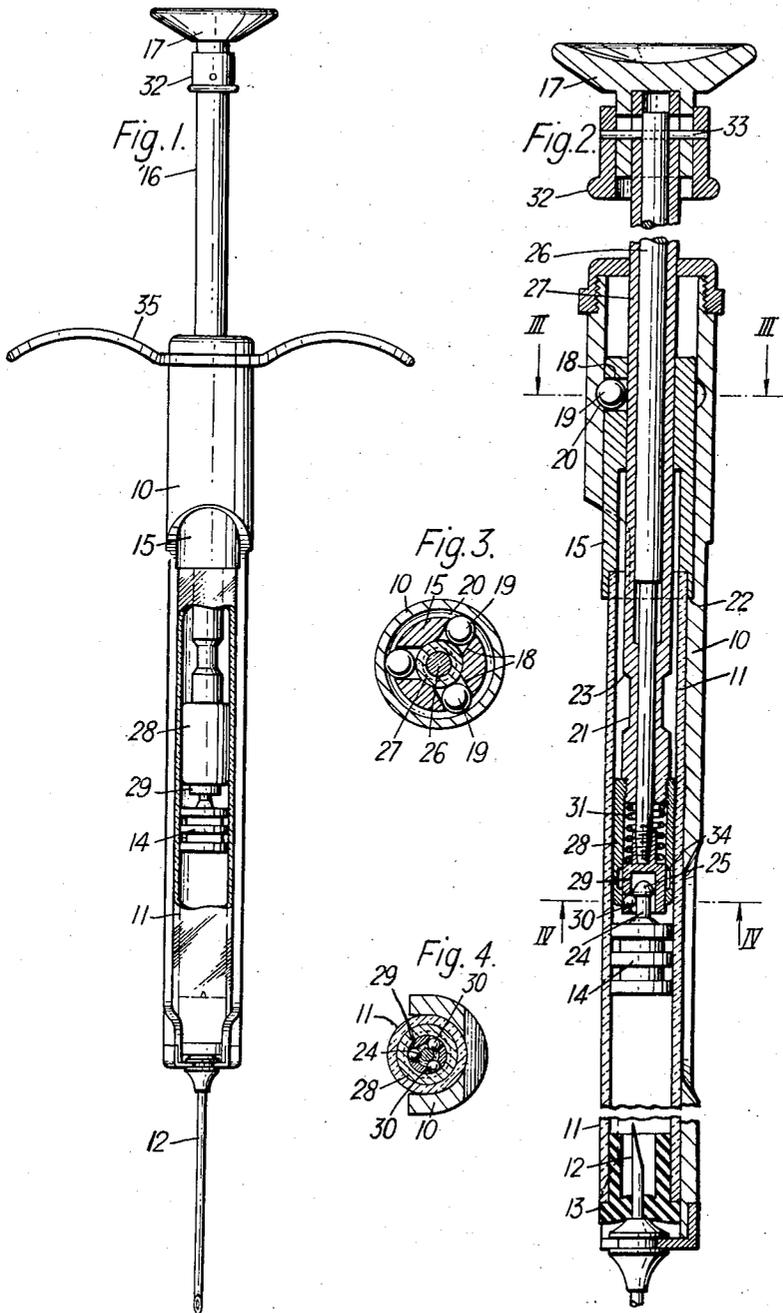
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LOCKING DEVICES

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## LOCKING DEVICES

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5 Claims. (Cl. 128—218)

The invention relates to a cartridge hypodermic syringe, for the medical injection of liquids, that is to say a hypodermic syringe adapted to receive a cartridge containing the liquid for injection, the contents of a cartridge in the syringe being expelled through a needle by means of a plunger.

It is an object of the present invention to provide a locking mechanism to hold the cartridge in place, and a further object is to provide a syringe in which the action of locking the cartridge in place is combined with the action required to advance the plunger rod into the cartridge and in which the withdrawal of the plunger rod from the cartridge releases the latter to enable its removal from the syringe. This object is achieved by the provision, between an outer casing and the plunger rod, of a sleeve which is axially movable to lock over the end of the cartridge, and one or more radially movable members, for example radially movable balls, which pass through apertures defined in the said walls of the sleeve and project either into a recess defined in the inner wall of the casing (in the position in which the sleeve locks over the end of the cartridge) or into a recess defined in the plunger rod, the radially movable member or members being moved from one of the said recesses to the other when the recesses come into register during the movement of the plunger rod. During the movement of the latter into a cartridge the sleeve is moved by the plunger to the first position and is then automatically locked to the casing, the plunger rod continuing its movement alone, and during the withdrawal of the plunger rod the sleeve is automatically released when the rod reaches the first position and is then withdrawn to the second position by further movement of the plunger rod.

It is an inherent disadvantage of cartridge syringes hitherto used that they cannot be used for withdrawing fluids as well as for injection. This arises from two causes; firstly, the plunger generally acts to push a pellet or stopper, e.g. of rubber, down the cartridge, the said pellet being unattached to the plunger and therefore not withdrawn when the plunger is withdrawn; secondly, if the plunger is attached, as by screwing, to the pellet, withdrawal of the plunger will bring about removal of the whole cartridge from the conventional container, but will not withdraw the pellet from the cartridge. Furthermore the methods so far used for securing the pellet to the plunger have not been mechanically sound and were liable to fail in operation.

In a preferred form of a hypodermic cartridge syringe according to the invention, the ball locking principle is used to cause the end of the plunger to grip the rear pellet or piston of the cartridge.

An example of a locking device according to the invention will now be described with reference to the accompanying drawings. This example shows the application of the invention to a hypodermic cartridge syringe. In the drawings:

Figure 1 is a plan view of the syringe fitted with a

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cartridge, part of the cartridge being broken away to show details of the plunger head and piston;

Figure 2 is an axial sectional view in elevation of the syringe and cartridge;

Figure 3 is a cross-section on the line III—III of Figure 2; and

Figure 4 is a cross-sectional view on line IV—IV of Figure 2.

The cartridge syringe shown in the drawings includes a casing 10, one side of which is cut away to enable a cartridge 11 to be loaded into the casing from the side. Once in the casing, the cartridge is moved axially on to a double-ended needle 12, the rear end of which pierces the diaphragm of a front pellet 13 of the cartridge and places the needle in communication with the contents of the cartridge. These contents are housed between the front pellet 13 and a rear pellet or piston 14. A cap 15 moves axially on to the cartridge and is locked in this position in a manner to be described later, and a plunger 16 provided with a thumb stop 17 passes through the cap and engages the piston 14. As the plunger is pushed into the casing, the movement of the piston causes the contents of the cartridge to be expelled through the needle.

The manner in which the cap is locked over the end of the cartridge will now be described. The cap contains three apertures 18 in its side wall (Figures 2 and 3) in each of which is housed a ball 19 having a diameter greater than the thickness of the wall. In the position shown in Figures 2 and 3, the balls 19 project from the apertures 18 into a groove 20 in the wall of the casing 10. In this position, therefore, the cap is locked in position within the casing and the cartridge is firmly held.

It will be seen from the drawings that the plunger has a portion 21 of reduced diameter. When the plunger is withdrawn it tends to withdraw the cap but is at first prevented from doing so by the locking action of the balls 19 in the groove 20. A point will be reached, however, at which the waist portion 21 will be opposite the balls 19. At this point, the plunger rod is no longer holding the balls 19 in their locking position, and further withdrawal of the plunger causes the balls to be forced out of the groove 20 in the casing into the groove round the waist portion 21 of the plunger, and the sleeve thereafter moves with the plunger until it reaches the end of the casing. This movement of the cap releases the rear end of the cartridge and enables its removal.

To lock a new cartridge in position, the plunger is moved forward, taking with it the cap, until the cap reaches a stop or shoulder 22 in the casing, beyond which it cannot move. At this point, the forward end of the cap encloses the rear end of the cartridge, and the balls 19 are in register with both the groove 20 in the casing and the groove round the waist portion 21 of the plunger. Further movement of the plunger into the casing causes the balls 19 to ride up the cam surface 23 at the side of the waist portion 21 and to enter the groove 20. The cap is now locked in position and cannot be moved in either direction, until the plunger is withdrawn.

It will be seen that, when the plunger is moved forward, it takes the cap with it until the cap reaches its locking position, at which point the cap locks to the casing and the plunger continues its movement alone. When the plunger is withdrawn, it releases the lock at a given point in its travel and then takes the cap to the rear of the casing.

A device similar to the ball lock which has been described for the breech mechanism is used to enable the plunger head to grip the piston, so that the latter can be drawn back in the cartridge. The piston is provided with a pin-head projection, formed for example from a metal insert, having a narrow neck portion 24 and an

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enlarged head 25. The plunger rod includes an axial rod 26 within a tubular member 27. A cylinder 28 is screwed on to the end of the tubular member 27, and a hollow cup-shaped member 29 is mounted on the end of the rod 26 and slides within the cylinder 28. Three balls 30 are housed in three apertures formed in the side wall of the cup-shaped member 29 (see Figures 2 and 4). A spring 31 between the end of the tubular member and the rear of the cup-shaped member tends to hold the latter and the cylinder 28 in the relative position shown in the drawings, in which the inner wall of the cylinder makes contact with the outer wall of the cup-shaped member so that the balls 30 are caused to project inwardly and to grip the neck portion 24 of the piston end. To release the piston, a sleeve 32 which surrounds the plunger rod and which is connected by a diametral pin 33 to the rod 26, is drawn back, against the spring 31, towards the thumb stop. The effect of this is to cause the rod 26 and the member 29, to move backwards with respect to the cylinder 28 to the position in which the balls 30 are opposite a groove 34 in the inner wall of the cylinder 28. Owing to the resistance to movement of the piston, withdrawal of the plunger now causes the balls to be forced over the head 25 of the piston into the groove 34, thus releasing the piston from the plunger.

The sleeve 32 and the thumb stop 17 are brought together in a similar manner when it is desired to pass the balls 30 over the head 25 of the piston to enable them to grip the neck portion 24.

The movement of the plunger is brought about by manipulating the thumb stop in association with the finger rests 35.

The invention is not restricted to the use of the ball locking system described above for connecting the plunger head to the piston, as other forms of connection, for example a screw or bayonet fastening, can be used. Moreover, if a ball locking system is used for connecting the plunger head to the piston the balls can be expanded into an undercut recess in the piston or bung instead of the arrangement described above.

It will be clear that the syringe which has been described has the advantage that the complete operation of the syringe, for injection and withdrawal of fluid and the holding and release of the cartridge, is dependent substantially entirely on pushing and pulling movements of a kind normal in syringe technique, the action being to a large extent automatic.

The ball lock gives more positive and secure action than devices which have been used hitherto for connecting the plunger head to the piston, is not readily susceptible to wear and tear, and is relatively simple to manufacture.

I claim:

1. A hypodermic syringe or the like comprising a tubular casing having a lateral aperture through which a cartridge may be loaded into the syringe, a closure member at one end of said casing, a plunger rod axially movable within said casing and passing through said closure member, a sleeve in said casing surrounding said plunger rod and axially slidable between a first position where it locks over one end of said cartridge and a second position where it is withdrawn to the rear of said casing to permit insertion and removal of cartridges, said sleeve having apertures in the side wall thereof, a radially movable member which passes through said sleeve apertures and projects into a recess defined in the inner wall of said casing when said sleeve is in the first position and at other times projects into a recess defined in said plunger rod, said radially movable member being moved from one of said recesses to the other when the recesses come into register during the movement of the plunger rod, and a stop within said casing which prevents movement of said sleeve beyond the position at which the radially movable members are in register with the recess in the casing.

2. A syringe according to claim 1, in which said stop consists of a portion of the casing of smaller internal

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diameter than that in which the sleeve slides, the said portion serving to support a cartridge in the syringe, the rear end of the cartridge extending beyond the end of said portion so that when the sleeve abuts against said portion it encloses the end of the cartridge.

3. A syringe according to claim 1 in which said plunger rod has formed thereon a cam surface adjacent said recess in the latter, said cam surface moving the radially movable member into the recess in the casing when the movement of the plunger rod is continued after the engagement of said sleeve with the stop.

4. A hypodermic syringe or the like comprising a tubular casing having a lateral aperture through which a cartridge may be loaded into the syringe, a hypodermic needle mounted and projecting through one end of said casing, a closure member at the other end of said casing, a plunger rod axially movable within said casing and passing through said closure member, a sleeve in said casing surrounding said plunger rod and axially slidable between a first position where it locks over that end of the cartridge remote from said needle and a second position where it is withdrawn to the rear of said casing to permit insertion and removal of cartridges, said sleeve having apertures in the side wall thereof, a radially movable member which passes through said sleeve apertures and which projects into a recess defined in the inner wall of said casing when said sleeve is in the first position and at other times projects into a recess defined in said plunger rod, said radially movable member being moved from one of said recesses to the other when the recesses come into register during the movement of the plunger rod, said casing having a portion of smaller internal diameter than that in which said sleeve slides which serves to support a cartridge, the arrangement being such that the rear end of a cartridge extends beyond the end of said smaller portion whereby when said sleeve is in said first position it abuts said smaller portion and encloses the end of said cartridge.

5. A hypodermic syringe or the like comprising a tubular casing, a cartridge within said casing, a hypodermic needle mounted in and projecting through one end of said casing, a closure member at the other end of said casing, a plunger rod axially movable within said casing and passing through said closure member, a sleeve in said casing surrounding said plunger rod and axially slidable between a first position where it locks over that end of said cartridge remote from said needle and a second position where it is withdrawn to the rear of said casing to permit removal of said cartridge, said sleeve having apertures in the side wall thereof, a radially movable member which passes through said sleeve apertures and which projects into a recess defined in the inner wall of said casing when said sleeve is in the first position and at other times projects into a recess defined in said plunger rod, said radially movable member being moved from one of said recesses to the other when the recesses come into register during the movement of the plunger rod, said casing having a portion of smaller internal diameter than that in which said sleeve slides which serves to support said cartridge, the arrangement being such that the rear end of said cartridge extends beyond the end of said smaller portion whereby when said sleeve is in said first position it abuts said smaller portion and encloses the end of said cartridge, a piston within said cartridge, said piston having projecting therefrom a narrow neck terminating in an enlarged head, a plunger head connected to said plunger rod and slidable within said cartridge, said plunger head including an inner cylinder and an outer cylinder slidable relative to each other, said outer cylinder having a recess formed in its inner wall and said inner cylinder having apertures in the side wall thereof, and a radially movable member which passes through said apertures in said inner cylinder and projects into said recess in said outer cylinder when said cylinders are in one relative position, said

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radially movable member moving from said recess to grip the neck of said piston beyond said enlarged head when said cylinders are moved relative to one another to another position.

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