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PROJECTILE HYPODERMIC SYRINGES

Filed Nov. 10, 1964

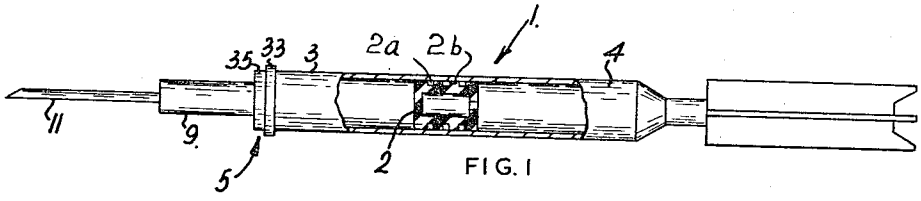


FIG. 1

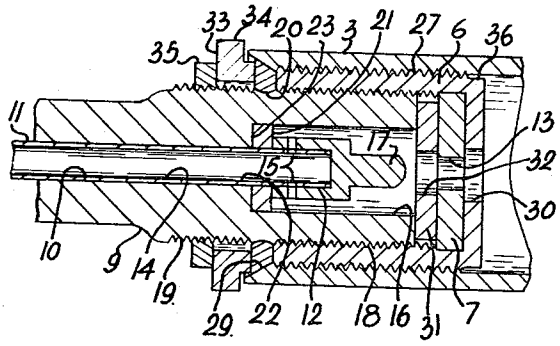


FIG. 4

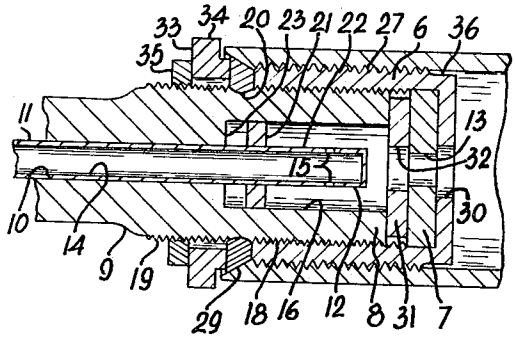


FIG. 2

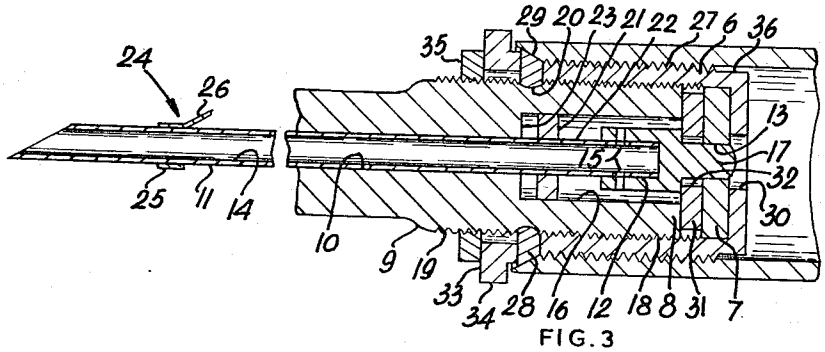


FIG. 3

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PROJECTILE HYPODERMIC SYRINGES

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ABSTRACT OF THE DISCLOSURE

A projectile for injecting liquid medicines and the like into animals in which the body is divided into anterior and posterior portions for receiving a liquid medicine and actuating means, respectively by a piston of resilient material. A closure for the end of the anterior portion is provided with an axial bore having a hollow needle positioned therein for axial movement. A valve means functions to close the bore for preventing communication between the anterior portion and the interior of the hollow needle, and the actuating means within the posterior portion normally urging the piston in the direction of the closure and maintaining the anterior portion under pressure.

This invention relates to projectile hypodermic syringes and more particularly to valve means for the controlling of the injection of liquid drugs or medicines or the like from such a projectile into an animal to be treated.

In describing this invention the valve means will be described as being in association with a projectile as described in my copending application Serial No. 238,448, now Patent No. 3,205,157 dated September 21, 1965, which, inter alia discloses a body of a hollow cylindrical formation, a piston dividing the body into anterior and posterior portions, and a valve means.

The preferred form of the actuating means for the piston is a gas compressed within the posterior portion of the body urging the piston towards the end of the anterior portion of the body but any form of the actuating means described in my beforementioned application may be utilized.

In the preferred form of the valve means disclosed in and claimed in claim 22 (as per the amendment filed at the United States Patent Office on February 6, 1964) of my said application Serial No. 238,448, now Patent No. 3,205,157 dated September 21, 1965, the valve means is actuated upon the rearward movement of the needle which penetrates the rubber disc by way of the slit and allows the passage of the liquid contents of the anterior portion through the bore of the needle.

While this method of operation of the valve means has proved perfectly satisfactory when the projectile is projected in the lower speed range it has been found that when such a projectile has been projected in the higher speed range, the high initial acceleration of the projectile caused the needle to move rearwardly of the projectile and open the valve means thus allowing the egress of the liquid contents of the anterior portion of the projectile during its flight.

It is therefore an object of this invention to provide a projectile hypodermic syringe with a valve means constructed and arranged to operate so as to overcome the problems reiterated above.

It is a further object of this invention to provide a projectile with a valve means which has a positive action and is capable of being opened only after impact with the animal desired to be treated.

It is a further object of this invention to provide a projectile with a valving means of simple construction

and capable of being easily disassembled for the purpose of replacing or renewing any worn or damaged parts.

To fulfill the objects of this invention the valve means includes a valve and a hypodermic needle which needle is capable of axial movement, the needle and the valve co-operating so that the valve is closed upon the rearward movement of the needle and opened upon the forward movement of the needle.

According to this invention the projectile adapted to inject liquid medicines, drugs and the like into animals, comprises a hollow body, a piston of resilient material within said body capable of axial movement therein and dividing the body into anterior and posterior portions, closure means for the end of said anterior portion provided with a bore extending axially thereof, a hollow needle positioned in said bore for axial movement therein, valve means closing said bore for preventing communication between the anterior portion and the interior of said needle, said anterior portion being adapted to be filled with liquid medicine, actuating means within said posterior portion normally urging said piston in the direction of said closure means and maintaining said anterior portion under pressure and means on said needle to close the valve means when the needle is moved rearwardly of the projectile and open the valve means when the needle is moved forwardly of the projectile effective immediately subsequent to the penetration of the hollow needle into the animal by the residual momentum of said needle which causes it to be displaced axially and forwardly of said bore thereby opening said valve means for providing communication between said anterior portion and the interior of said needle so that said actuating means forces said piston toward the closure means thus expelling the liquid contents of the anterior portion through the hollow needle.

The valve means for use with the projectile of this invention will now be further described with reference to the accompanying drawing in which:

FIGURE 1 is a view, partly in elevation and partly in cross section of the projectile of this invention.

FIGURE 2 is a fragmentary sectional view of one form of the valve means.

FIGURE 3 is a fragmentary sectional view of another form of the invention with the valve closed.

FIGURE 4 is a fragmentary sectional view of the form of the valve means of FIGURE 3 showing the valve open.

Referring to FIGURE 1 of the drawings the projectile includes a body generally denoted **1** of a hollow cylindrical formation, a piston **2** capable of axial movement therein and dividing the body **1** into anterior and posterior portions **3** and **4** respectively. The valve means is denoted generally at **5**. The anterior portion contains a liquid medicine or drug and the posterior portion and actuating means for the piston such as compressed gas. The piston **2** as shown in my above mentioned application is of circular cross section and of a resilient material. The piston is provided with annular grooves **2***a* defining peripheral upstanding projections **2***b* adapted to bear against the inner surface of the body **1** to seal the portion **3** from the portion **4**. The piston is hollow and its interior is open to the rear thereof for communication with the posterior portion **4**.

In a preferred form of the valve means **5** as shown in FIGURE 2 there is provided a valve housing **6** receivable and securable within the anterior portion **3**, a valve **7** receivable within the valve housing **6** and adapted to be secured and retained therein by the butt end **8** of a closure means **9** which is receivable and securable within the valve housing **6** and extends beyond the anterior portion **3**. The closure means **9** is provided with an axial bore **10** therethrough capable of slidably receiving a hy-

podermic needle 11 the butt end 12 of which is closed and receivable through a hole 13 provided in the valve 7, the sliding action of which needle 11 may operate the valve means 5 by its butt end 12 alternately stopping and opening the hole 13.

Access to the bore 14 of the needle 11 may be effected by passages 15 provided through the wall thereof.

The axial bore 10 may be divided into two portions, a forward portion and a rearward portion 16, the forward portion having a diameter such as to provide sliding clearances only with the needle 11, and the rearward portion 16 having a substantially greater diameter than the external diameter of the needle 11.

In a further form of this invention as shown in FIGURES 3 and 4 the butt end 12 is provided with a nipple 17 which is capable of being received within the hole 13 and when thus received, closing the valve 7. Upon the forward movement of the needle 11 the nipple 17 is withdrawn from the hole 13 thereby permitting the egress of the liquid content of the anterior portion 3 through the hole 13 into the rearward portion 16, and, by way of passages 15 through the bore 14. The passages 15 are preferably situated immediately beyond or in association with the nipple 17.

The valve 7 may be constructed from any resilient material such as rubber and may be of such dimensions as to ensure that a sealing fit is obtained between itself, the nipple 17, and the interior of the valve housing 6.

The closure means 9 is provided with external screw threading at 18 and at 19, the two resulting screw threaded portions 18 and 19 being separated by a waisted formation or annular depression 20. The closure means 9 extends beyond the second threaded portion 19 for the purpose of ensuring that adequate support is given to the needle 11 when situated within the bore 10 as aforesaid.

To ensure that the drug or medicine when being expelled through the valve 7 and into the bore 14 does not escape between the needle 11 and the forward portion of the axial bore 10 there is provided a resilient sealing washer 21 which may be of such dimensions that a sealing fit is ensured between such washer 21 and the external surface 22 of the needle 11 and the rearward portion 16 of the axial bore 10.

The nipple 17 may be of such dimensions so as to ensure that the drug may pass between it and the wall of the rearward portion 16 to gain access to the bore 14 through the passages 15 and to ensure that the needle 11 cannot be withdrawn from the closure means 9 by virtue of the fact that the nipple 17 will strike the abutment 23 formed at the junction of the rearward portion 16 and the forward portion of the axial bore 10.

Thus by this construction as described the initial acceleration when imparted to the projectile ensures that the valve means 5 will not open in that the inertia of the needle 11 keeps the nipple 17 in position within hole 13. Upon the impact of the projectile with the animal to which the drug is to be administered the needle 11 penetrates the flesh of the animal until the closure means 9 strikes the flesh of the animal thus halting the movement of the projectile, the momentum of the needle 11 then carries the needle 11 on into the flash of the animal giving a forward movement of the needle 11 relative to the projectile thus opening the hole 13 in the valve 7 and permitting the injection of the liquid content of the anterior portion 3 through the needle 11 into the flesh of the animal. Also the fact that the needle 11 is in its rearmost position during the flight of the projectile with the minimum length of needle 11 projecting from the closure means 9 aids the true flight of the projectile and minimises damage caused thereto by impact with the animal to be dosed.

Assisting the momentum of the needle 11 to open the valve means is the fact that upon the impact of the projectile with the animal, that part of the flesh thereof subjected to the impact is compressed and after the impact the flesh expands to resume its original shape thus pulling the body 1 of the projectile away from the needle 11 which is embedded in the flesh.

It is a feature of this invention whereby the closure means 9 may be screwed further into the valve housing 6 thus compressing and distorting the valve 7 to a greater extent which compression or distortion has the effect of reducing the diameter of the hole 13 thus increasing the pressure of the valve 7 against the nipple 17 and accordingly increasing the resistance of the nipple 17 to movement through the hole 13. By being able to vary the resistance of the passage of the nipple 17 through the valve 7 the operator of the projectile is able to vary the resistance of the needle 11 to axial movement. Thus, when it is desired to project the syringe at a low velocity and when the needle has a correspondingly low momentum the positive opening of the valve means may be ensured by reducing the resistance to the passage of the nipple through the valve as previously described.

Barb or barbs (generally denoted 24 in FIGURE 3) may be attached to the needle 11 for the purpose of ensuring that the projectile is securely embedded in the animal during the injection of the drug. The barbs 24 may be formed from pieces of tube 25 whose internal diameter is substantially identical with the external diameter of the needle 11 part of the piece of tube 25 being cut away so that a barb portion 26 extends from the tube 25 so that the latter may be easily fixed over the needle 11 and also may be removed if so desired.

In the assembly of the preferred form of the valve means the valve housing 6 may be secured as by screw threading at 27 within the anterior portion 3 of the body member 1 leaving sufficient space between the forward end of the valve housing 6 and the forward end of the anterior portion 3 for a further sealing washer 28 to be placed within and flush with the end of the anterior portion 3. The space so provided may be bevelled internally at 29 and devoid of any screw threading.

The needle 11 may have its sealing washer 21 placed in position thereover and then inserted through the bore 10. The barb 24 may then, if so desired, be placed and fixed over the needle 11.

The valve 7 is then so placed within the valve housing 6 so as to have its hole 13 over an axial bore 30 of a slightly larger diameter than that of the nipple 17, provided in the rearward part of the valving housing 6 connecting the anterior portion 3 with the interior of the valve housing 6. A rigid washer 31 having a hole 32 therethrough of similar dimensions to said bore 30 may then be placed over the valve 7 and the closure means 9 may then be screwed into the valve housing 6 so as to have its butt end 8 secure the valve 7 at its periphery between the washer 31 and the bottom of the valve housing 6.

The internal screw threading at 18 of the valve housing 6 may terminate short of the bottom of the interior thereof to ensure that a sealing fit is provided between the wall of the interior of the valve housing 6 and the valve 7.

The sealing washer 28 may then be placed over the closure means 9 so that the internal surface of the washer 28 seats in the annular depression 20 and the peripheral surface bears against the bevelled edge 29.

A gas sealing washer 33 constructed of a suitable resilient material may then be placed over the closure means 9 the periphery 34 of which washer 33 overlies the body member 1 for the purpose of sealing the projectile against the bore of the barrel of a projecting device, such as that described in my co-pending United State application Serial No. 238,412. A nut 35 may then be threaded onto the forward threaded portion 19 to press the gas sealing washer 33 onto the washer 28 to compress and so extrude said washer 28 against the annular depression 20 and the bevelled edge 29.

In order to ensure that the piston 2 does not come in contact with the internal thread provided at 27, the rear

end of the valve housing **6** is formed with a rearwardly extending threadless portion **36** of a reduced diameter against which the piston **2** may abut when there is liquid contained with the anterior portion **3**.

There is a further advantage in the provision of a valve housing as previously described in that it retains the piston within the body of the syringe when the valve means is assembled or disassembled.

As previously described the projectile hypodermic syringe may contain any desired quantity, (not exceeding the maximum capacity of the syringe) of drug or medicine to be injected and this desired quantity of drug may be loaded into anterior portion **3** by opening the valve means effected by the forward movement of the needle **11** and connecting the needle **11** to a normal type of hypodermic syringe filled with the drug or medicine where upon the operation of said syringe, the drug or mediicne is transferred therefrom into the anterior potion **3**. When the desired quantity of drug or medicine has been transferred into the anterior portion **3** the valve means may then be closed by the rearward movement of the needle **11** and the normal syringe disconnected therefrom. By this method of filling the accuracy of the dose of drug or medicine to be administered to the animal to be treated is ensured.

This invention is not to be confined to any strict conformity to the showings in the drawings but changes or modifications may be made therein so long as such changes or modifications mark no material departure from the spirit and scope of the appended claims.

What I do claim and desire to obtain by Letters Patent of the United States of America is:

1. A projectile adapted to inject liquid medicines, drugs and the like into animals, comprising a hollow body, a piston of resilient material within said body capable of axial movement therein and dividing the body into anterior and posterior portions, closure means for the end of said anterior portion provided with a bore extending axially thereof, a hollow needle positioned in said bore for axial movement therein, valve means closing said bore for preventing communication between the anterior portion and the interior of said needle, said anterior portion being adapted to be filled with the liquid medicine, actuating means within said posterior portion normally urging said piston in the direction of said closure means and maintaining said anterior portion under pressure, said valve means including two co-acting components, one of said components being provided at the rear end of said bore and the other adjacent the rear end of said needle cooperable with said one component for closing said valve means when the needle is moved rearwardly respecting the body and for opening the valve means when the needle is moved forward effective immediately subsequent to the penetration of the needle into the animal by the residual momentum of the needle causing the needle to be displaced axially and forwardly of the bore so that the actuating means forces the piston towards the closure thereby expelling the contents of the anterior portion through the hollow needle.

2. A projectile adapted to inject liquid medicines, drugs and the like into animals, comprising a hollow cylindrical body, a piston of resilient material within said body capable of axial movement therein and dividing the body into anterior and posterior portions, closure means for the end of said anterior portion provided with a bore extending axially thereof, a hollow needle positioned in said bore for axial movement therein, valve means closing said bore for preventing communication between said anterior portion and the interior of said needle, said anterior portion being adapted to be filled with liquid medicines, drugs and the like, a gas compressed in said posterior portion constituting an actuating means for moving said piston in the direction of said closure means and for maintaining said anterior portion under pressure when the valve means closes the bore, said piston having annular grooves around the periphery thereof for forming upstanding peripheral projections, said piston being hollow and open to said posterior portion whereby the pressure of said gas presses said peripheral projections against the inner surface of said body thereby providing a seal between said anterior and posterior portions, and means on said needle to close the valve means when the needle is moved rearwardly of the projectile and to open the valve means when the needle is moved forwardly of the projectile effective immediately subsequent to the penetration of the hollow needle into the animal by the residual momentum of said needle which causes it to be displaced axially and forwardly of said bore thereby opening said valve means for providing communication between said anterior portion and the interior of said needle so that said actuating means forces said piston toward the closure means thus expelling the liquid contents of the anterior portion through the hollow needle.

3. A projectile adapted to inject liquid medicines, drugs and the like into animals, comprising a hollow cylindrical body, a piston of resilient material within said body capable of axial movement therein and dividing the body into anterior and posterior portions, means for closing the end of said anterior portion, said closure means being formed as a nipple extending forwardly of the end of said anterior portion and provided with a bore extending axially therethrough, a hollow needle having a closed rear end positioned in said bore for axial sliding movement therein, said closure means having a butt end, a valve housing secured within said anterior portion having an axial hole therein capable of receiving the rear end of the needle, a valve within said valve housing adapted to be secured and retained therein by said butt end of said closure means the sliding movement of said needle operating the valve by having its rear end alternately stopping and opening said hole, said anterior portion being adapted to be filled with liquid medicines, drugs and the like, a gas compressed in said posterior portion constituting an actuating means for moving said piston in the direction of said closure means and for maintaining said anterior portion under pressure when said valve closes said bore in said nipple, said piston having annular grooves around the periphery thereof for forming upstanding peripheral projections, said piston being hollow and open to said posterior portion whereby the pressure of said gas presses said peripheral projections against the inner surface of said body thereby providing a seal between said anterior and posterior portions, and means on said needle to close the valve when the needle is moved rearwardly of the projectile and to open the valve when the needle is moved forwardly of the projectile effective immediately subsequent to the penetration of the hollow needle into the animal by the residual momentum of said needle which causes it to be displaced axially and forwardly of said bore thereby opening said valve for providing communication between said anterior portion and the interior of said needle so that said actuating means forces said piston toward the closure means thus expelling the liquid contents of the anterior portion through the hollow needle.

4. The projectile as claimed in claim **3** in which said valve is defined by a rubber disc having a centrally disposed hole therein allowing the passage therethrough of the closed rear end of said needle to prevent the passage therethrough of the liquid contents of said anterior portion when the rear end of said needle is moved axially into the hole in said disc.

5. A projectile adapted to inject liquid medicines, drugs and the like into animals, comprising a hollow body, a piston of resilient material within said body capable of axial movement therein and dividing the body into anterior and posterior portions, closure means for the end of said anterior portion provided with a bore extending axially therethrough, a hollow needle located in at least a part of said axially extending bore, valve means for closing said bore for preventing communication between

said anterior portion and the interior of said hollow needle, said anterior portion being adapted to be filled with liquid medicines, drugs and the like, actuating means within said posterior portion normally urging said piston in the direction of said closure means and maintaining said anterior portion under pressure, and means on said needle to close the valve means when the needle is moved rearwardly of the projectile and to open the valve means when the needle is moved forwardly of the projectile effective immediately subsequent to the penetration of the hollow needle into the animal by the residual momentum of said needle which causes it to be displaced axially and forwardly of said bore thereby opening said valve means for providing communication between said anterior portion and the interior of said needle so that said actuating means forces said piston toward the closure means thus expelling the liquid contents of the anterior portion through the hollow needle.

6. A projectile adapted to inject liquid medicines, drugs and the like into animals comprising a hollow body, a piston of resilient material within said body capable of axial movement therein and dividing the body into anterior and posterior portions, closure means for the end of said anterior portion provided with a bore extending axially therethrough, a hollow needle located in at least a part of said axially extending bore, valve means for closing said bore for preventing communication between said anterior portion and the interior of said hollow needle, said anterior portion being adapted to be filled with liquid medicines, drugs and the like, a gas compressed in said posterior portion constituting an actuating means for moving said piston in the direction of said closure means and means on said needle to close the valve means when the needle is moved rearwardly of the projectile and to open the valve means when the needle is moved forwardly of the projectile effective immediately subsequent to the penetration of the hollow needle into the animal by the residual momentum of said needle which causes it to be displaced axially and forwardly of said bore thereby opening said valve means for providing communication between said anterior portion and the interior of said needle so that said actuating means forces said piston toward the closure means thus expelling the liquid contents of the anterior portion through the hollow needle.

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