Oct. 21, 1958 B. A. ROCKWELL ET AL 2,856,924

AUTOMATIC HYPODERMIC SYRINGE

Filed Nov. 9, 1954

Fig. 1.

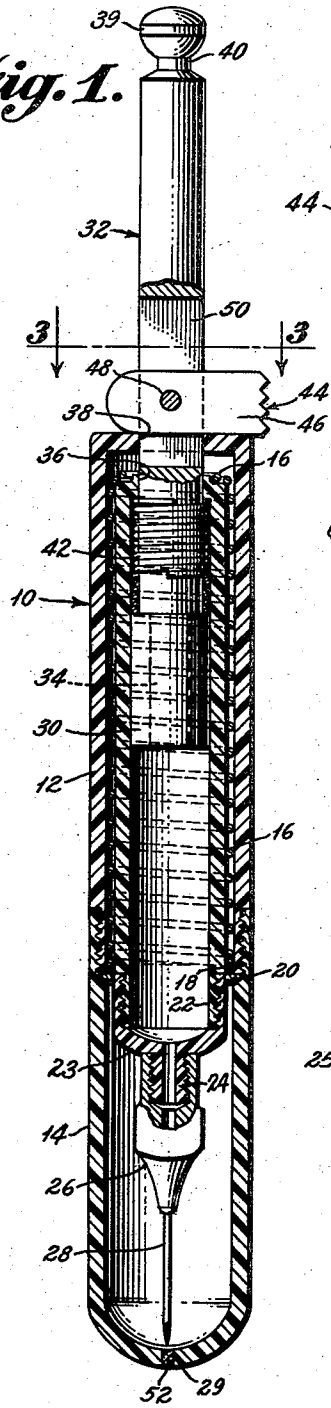


Fig. 3.

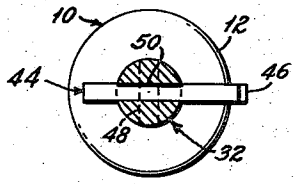


Fig. 4.

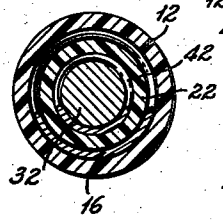


Fig. 5.

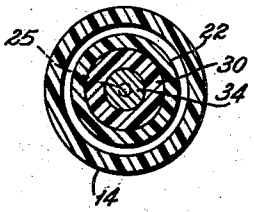
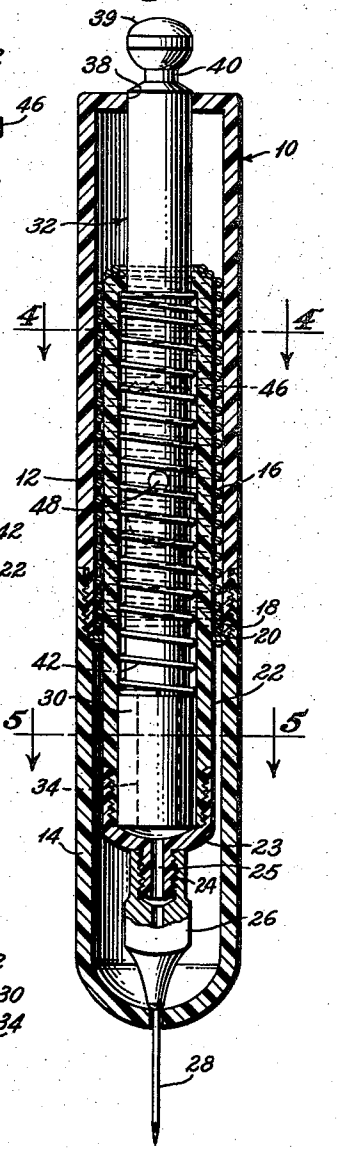


Fig. 2.



INVENTORS

Franklin W. Daugherty

and Burt A. Rockwell

BY Mead, Browne, Schuyler & Beveridge

ATTORNEYS

United States Patent Office 2,856,924 Patented Oct. 21, 1958

2,856,924

AUTOMATIC HYPODERMIC SYRINGE

Burt A. Rockwell, Hershey, and Franklin W. Daugherty, Dallas, Pa., assignors to Daugherty and Rockwell, Hershey, Pa., a partnership

Application November 9, 1954, Serial No. 467,735

10 Claims. (Cl. 128—218)

This invention relates to hypodermic syringes and more particularly to a hypodermic syringe in which the projection of the needle into the flesh of the person receiving the injection, and also the ejection of the liquid from the syringe, are both accomplished automatically.

There is a great need in both the military and civilian fields for a compact and easily operated hypodermic syringe adapted to be carried on the person and which will permit rapid hypodermic injections particularly under emergency conditions. One of the uses of such a device would be to permit the self-administration in time of emergency of therapeutic agents to counteract the lethal effects of poison gases or atomic radiation. For example, there is danger in time of war that both the military forces and the civilian population might be subjected to attacks of so-called "nerve gas" which, when inhaled, causes unconsciousness in about four minutes and death in from fifteen to twenty minutes. The effects of this nerve gas may be counteracted by the injection into the muscular tissue of the leg of a few milligrams of properly diluted atropine sulphate ($C_{17}H_{23}NO_3$). A hypodermic syringe filled with the proper dose of atropine sulphate and carried on the person by military personnel or by civilians could be used immediately to counteract the effect of nerve gas. Furthermore, in the event of an enemy attack by atomic or hydrogen bombs, individuals for enough from the center of the explosion to survive the immediate effects of the explosion are still subject to the effects of radioactive particles in the atmosphere which may result in the gradual destruction of corpuscles. Efforts are being made to develop chemicals to counteract the effect on the individual of atomic radiation shock. Several of these counteracting materials which offer some hope are, for example, ethylin diamintetra acetic acid and Iriloysin. If a suitable chemical compound should be developed which serves as a satisfactory agent to prevent or retard the destruction of blood corpuscles or which aids in the rapid development of white corpuscles, a hypodermic syringe which permits intermuscular hypodermic injections rapidly and automatically would have intestimable value in saving human lives.

Another field in which an automatically operated preloaded hypodermic syringe would have great utility is for use in mass inoculations, such as inoculations with gamma globulin to prevent poliomyelitis. A "one-shot" automatically operated hypodermic syringe filled at the factory and sealed against contamination when manufactured would greatly expedite and facilitate such mass inoculations. The use of a one-shot preloaded hypodermic syringe for this purpose would eliminate the necessity of needle sterilization and refilling after each use.

Accordingly, it is an object of this invention to provide a hypodermic syringe which is automatic in its operation and is thus suitable for use in emergency situations.

It is another object of this invention to provide a hypodermic syringe which is suitable for automatic self-administration of hypodermic injections, particularly under emergency conditions.

It is still another object of this invention to provide a self-contained automatic hypodermic syringe to be carried on the person by military personnel or by civilians in readiness for emergency use.

It is a further object of this invention to provide a compact hypodermic syringe adapted to be carried on the person in a loaded condition in readiness for use, and constantly maintained in a sealed sterile condition.

It is a still further object of the invention to provide a preloaded hypodermic syringe which may be used as a "one-shot" disposable unit, and hence is suitable for use in emergencies, in mass inoculations, and similar situtions.

It is still another object of this invention to provide a hypodermic syringe in which the projection of the needle into the skin of the user and also the ejection of the liquid from the barrel of the syringe are both accomplished automatically.

Further objects and advantages of the invention may best be understood by reference to the following description taken in conjunction with the accompanying drawing in which:

Fig. 1 is a view in vertical section of a hypodermic syringe in accordance with the invention, showing the syringe in latched position with the needle retracted inside the casing;

Fig. 2 is a view in vertical section showing the syringe of Fig. 1 after the latching means has been released;

Fig. 3 is a view in horizontal section along line 3—3 of Fig. 1;

Fig. 4 is a view in horizontal section along line 4—4 of Fig. 2; and

Fig. 5 is a view in horizontal section along line 5—5 of Fig. 2.

Referring now to the drawing, there is shown an automatic hypodermic syringe comprising an outer casing generally indicated at **10** which may be made of any suitable material such as appropriate plastic or metal. In the illustrated embodiment, the casing **10** is made of an appropriate plastic material. The casing may be made of Plexiglas, for example, or aluminum, or other noncorrosive metal alloy. The selection of a suitable material is determined by such factors as the strength and weight required and efficiency and economy of production.

The casing **10** includes upper and lower casing sections **12** and **14**, respectively, which in the embodiment shown are of the same outer diameter and in screw-threaded engagement with each other. A spiral expansion spring member **16** is anchored in any suitable manner at its lower end (with respect to the view shown in the drawing) to the inner surface of the upper casing section. In the illustrated embodiment, which includes a plastic outer casing, the lower end **18** of the spring is welded or otherwise suitably secured to a washer member **20** which is held in a groove in the inner surface of casing section **12** adjacent the mouth of the casing section. If casing section **12** were made of metal, the end **18** of the spring could be spot-welded directly to the inner surface of the casing section.

A hypodermic syringe is disposed within the interior of casing **10**. The hypodermic syringe includes a generally cylindrical barrel member **22** which may be formed of the same material as the casing. Spring **16** is coaxially disposed about the outer surface of barrel member **22**, the upper end of the spring bearing on and moving with the upper end surface of the barrel. Thus spring **16** normally biases barrel **22** downwardly (with respect to the view shown in the drawing). A detachable end portion **23** is in screw-threaded engagement with the lower end of barrel member **22**. The detachable end portion **23** is provided with a neck portion **24** which is externally screw-threaded to receive an internally screw-threaded

needle holder 26. A hypodermic needle 28 is carried by needle holder 26. A passage 25 in neck portion 24 permits liquid flow from barrel 22 to needle holder 26 and thence to needle 28. The lower end of casing section 14 is provided with an aperture 29 through which needle 28 is adapted to pass. Aperture 29 is normally sealed by a suitable sealing material 52 which maintains the contents of the casing in a sterile condition, but which may be easily penetrated by needle 28 when the tension on expansion spring 16 is released.

Disposed within barrel 22 and axially movable therein is a plunger member 30 made of a suitable material which is not subject to corrosion by the liquid contents of the barrel. Plunger 30 is secured in any suitable manner to the reduced end portion 34 of a rod member generally indicated at 32. Rod 32 extends through an aperture 36 in the upper end of the barrel 22 and outwardly through an aperture 38 in the upper end of casing section 12. At its outer end rod 32 is provided with a small knob-like member 39 which is joined to the rod by a reduced neck portion 40. A compression spring 42 is disposed within barrel 22 between the upper end of plunger 30 and the inner surface of the upper end of the barrel adjacent the opening 36. Compression spring 42 biases plunger 34 toward a liquid-ejecting position. Compression spring 42 is weaker than expansion spring 16.

A latch means generally indicated at 44 is provided and comprises a flat arm member 46 pivotally secured within a recess 50 provided in rod 32 intermediate the length thereof. Latching arm 46 is adapted to be swung about its pivot point 48 to the position shown in Fig. 1 in which it is substantially perpendicular to the longitudinal axis of rod 32, in which position rod 32 is latched in the extended position shown in Fig. 1. Alternately, arm 46 may be swung about its pivot point in such manner as to be completely received within recess 50.

The hypodermic syringe is preferably filled in the following manner: With casing sections 12 and 14 detached from each other, and with the end portion 23, needle carrier 26 and needle 28 detached from barrel 22, barrel 22 and plunger 30 are actuated to the positions shown in Fig. 1. This is done by drawing rod 32 axially outwardly through aperture 38 in casing section 12 from the position shown in Fig. 2 to the position shown in Fig. 1 and moving latch arm 46 about its pivotal axis 48 into latching position. In the latched position, expansion spring 16 is tensioned and compression spring 42 is under compression.

After the barrel 22 and plunger 30 have been latched in the position shown in Fig. 1, the assembly is held in inverted position for filling. The liquid with which the syringe is to be filled is poured through the open mouth of barrel 22 until the barrel 22 has been filled to the proper level. To insure a complete filling without any air space, the rod 32 may be drawn a short distance beyond the latching point to thereby displace plunger 30 slightly beyond its normal latched position while filling is taking place. After the barrel has been filled, the end cap 23 is screwed onto the end of barrel 22, needle holder 26 and needle 28 being properly positioned on the end cap. The casing section 14, with aperture 29 properly sealed, is then screwed onto the end of casing section 12. The hypodermic syringe is then ready for use.

To use the hypodermic syringe of the invention hereinbefore described, the latch arm 46 is swung about its pivotal support 48 in a counterclockwise direction with respect to the view shown in Fig. 1, to cause arm 46 to move into axial alignment with rod 32. As soon as the latch arm 46 is no longer in abutting relation to the upper surface of casing section 12, the tension on expansion spring 16 is suddenly released, causing barrel 22 to be moved rapidly downwardly in the casing. This causes needle 28 to penetrate the sealing material in aperture 29 at the lower end of the casing section 14, and to be projected outwardly into the position shown in Fig. 2. During this rapid outward movement of needle 28, it penetrates the skin of the person receiving the hypodermic injection. Substantially simultaneously with the release of spring 16, the compression force on the spring 42 disposed within barrel 22 is released and plunger 30 is moved rapidly within the barrel 22 to eject the liquid from barrel 22 and through the needle into the person receiving the injection. Due to the fact that expansion spring 16 is stronger than compression spring 42, barrell 22 begins to move downwardly in casing 10 slightly before plunger 30 begins to move downwardly in barrel 22. Therefore, a slight lag occurs between the outward movement of needle 28 and the flow of liquid through the needle sufficient to permit needle 28 to penetrate the skin before liquid begins to flow through the needle.

It can be seen from the foregoing that there is provided in accordance with this invention a compact automatic hydopermic syringe which has great utility in the administration of hypodermic injections. In accordance with the invention a hypodermic syringe is provided which may be preloaded or filled at the factory with the desired dosage and subsequently maintained in a sealed sterile condition until needed. The hypodermic syringe has a dual automatic spring action. One spring serves to project the needle of the hypodermic syringe outwardly through the casing and into the flesh of the person receiving the injection, while the other spring serves to eject the liquid from the barrel of the syringe and through the needle into the flesh of the person receiving the injection. Both spring actions are subject to control and release by the same easily operated latching means to provide automatic operation of the syringe. The device may be used as a disposable "one-shot" hypodermic syringe which may be carried on the person by military personnel or by civilians for use in an emergency. The hypodermic syringe hereinbefore described would also have great utility in expediting the administration of mass inoculations when used as a preloaded "one-shot" syringe since it would dispense with the requirements for refilling and sterilization of the needle after each injection.

While there has been shown and described a particular embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and, therefore, it is aimed to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What we claim as our invention is:

1. A hypodermic syringe comprising an outer casing, a hollow liquid-receiving barrel member disposed within said casing and axially movable therein, a hypodermic needle carried by said barrel member and in communication with the interior of said barrel member, a first means for moving said barrel member axially in said casing to a position in which said needle is projected through said casing, a plunger means for ejecting liquid from said barrel member through said needle, and a single latch means engaging said plunger means, release of said latch means rendering said first means and said plunger means respectively effective to project said needle through said casing, and to eject liquid from said barrel member through said needle.

2. A hypodermic syringe comprising an outer casing, a hollow liquid-receiving barrel member disposed within said casing and axially movable therein, a hypodermic needle carried by said barrel member and in communication with the interior of said barrel member, a first biasing means for biasing said barrel member axially in said casing toward a position in which said needle is projected through said casing, a liquid-ejecting means disposed within said barrel member, a second biasing means for biasing said liquid-ejecting means toward a liquid-ejecting position, and a single latch means engaging said liquid-ejecting means, release of said latch means rendering said first and second biasing means effective to respectively move said

barrel member to project said needle through said casing, and to cause said liquid-ejecting means to eject liquid from said barrel member.

3. A hypodermic syringe comprising an outer casing, a hollow liquid-receiving barrel member disposed within said casing and axially movable therein, a hypodermic needle carried by said barrel member and in communication with the interior of said casing, a first biasing means for biasing said barrel member axially in said casing toward a position in which said needle is projected through said casing, liquid-ejecting means disposed within said barrel member, a second biasing means for biasing said liquid-ejecting means toward a liquid-ejecting position, and a single latch means engaging said liquid-ejecting means to render said first and second biasing means respectively ineffective to project said needle through said casing and to eject liquid from said barrel member.

4. A hypodermic syringe comprising an outer casing, a hollow liquid-receiving barrel member disposed within said casing and axially movable therein, a hypodermic needle carried by said barrel member and in communication with the interior thereof, spring means disposed within said casing and engageable with said barrel member for moving said barrel member axially in said casing whereby said needle is projected through said casing, a plunger member movable within said barrel member for ejecting liquid from said barrel member, a second spring means disposed within said barrel member and engaging said plunger member, and latch means carried by said plunger member and engaging said casing to render said plunger member ineffective to eject liquid from said barrel member and to hold said barrel member in a retracted position within said casing.

5. A hypodermic syringe comprising an outer casing, a hollow liquid-receiving barrel member disposed within said casing and axially movable therein, a hypodermic needle carried by said barrel member and in communication with the interior thereof, first spring means disposed within said casing and engageable with said barrel member for moving said barrel member axially in said casing whereby said needle is projected through said casing, a plunger member movable within said barrel member for ejecting liquid from said barrel member, a second spring means engaging said plunger member, and a single latch means for holding said barrel member and said plunger member in predetermined positions in which said first spring member is tensioned and said second spring member is compressed.

6. A hypodermic syringe comprising an outer casing, a hollow liquid-receiving barrel member disposed within said casing and axially movable therein, a hypodermic needle carried by said barrel member and in communication with the interior thereof, a first spring means disposed within said casing and engageable with said barrel member for axially moving said barrel member in said casing whereby said needle is projected through said casing, a plunger member disposed in said barrel member for ejecting liquid from said barrel member, a second spring means disposed in said barrel member for moving said plunger member whereby liquid is ejected from said barrel member, and a single latch means engaging said plunger member for holding said barrel member and said plunger member in predetermined positions against the force of said first and second spring means.

7. A hypodermic syringe comprising an outer casing, a hollow liquid-receiving barrel member disposed within said casing and axially movable therein, a hypodermic needle carried by said barrel member and in communication with the interior thereof, a first spring means disposed within said casing and engageable with said barrel member for axially moving said barrel member in said casing whereby said needle is projected through said casing, plunger means disposed in said barrel member for ejecting liquid from said barrel member, a second spring means disposed within said barrel member for moving said plunger member whereby liquid is ejected from said barrel member, and a single latch means engaging said plunger means for holding said barrel member and said plunger means in predetermined positions against the force of said first and second spring means.

8. A hypodermic syringe comprising an outer casing, a hollow liquid-receiving barrel member disposed within said casing, a hypodermic needle carried by said barrel member and in communication with the interior thereof, an expansion spring means disposed within the interior of said casing and anchored thereto, said barrel member being axially movable in said casing against the force of said expansion spring to retract said needle entirely within said casing, a plunger member disposed within said barrel member, a compression spring disposed within said barrel member, said plunger member being movable in said barrel member against the force of said compression spring, and latch means for holding said barrel member and said plunger member in predetermined positions against the force of said springs.

9. A hypodermic syringe comprising an outer casing, a hollow liquid-receiving barrel member disposed within said casing and axially movable therein, a hypodermic needle carried by said barrel member and in communication with the interior of said barrel member, a first spring disposed within said casing and engaging an outer surface of said barrel member, a plunger member disposed within said barrel member and axially movable therein, a second spring disposed within said barrel member and engageable with said plunger member, a rod member connected to said plunger member and extending through said barrel member and through said casing to the exterior of said casing, said rod member being movable to store energy in said spring members, and means for latching said rod member in a predetermined position in which said first spring is tensioned and said second spring is compressed.

10. A hypodermic syringe comprising an outer casing, a hollow barrel member disposed within said casing, a hypodermic needle carried by an outer end of said barrel member and in communication with the interior of said barrel member, an expansion spring means anchored at one of its ends to said casing and disposed about the outer surface of said barrel member, a plunger member disposed within said barrel member and axially movable therein, a compression spring disposed within said barrel member between a surface of said plunger member and a surface of said barrel, a rod member connected to said plunger member, said rod member passing through an aperture in said barrel member and through an aperture in said casing to the exterior of said casing, said rod member being movable to compress said compression spring and to tension said expansion spring, and latch means for retaining said rod member in a position in which said compression spring is compressed and said expansion spring is expanded.

References Cited in the file of this patent

UNITED STATES PATENTS

159,192	Leiter	Jan. 26, 1875
1,845,036	Busher	Feb. 16, 1932
2,472,116	Maynes	June 7, 1949

FOREIGN PATENTS

539,092	France	Mar. 28, 1922
1,014,881	France	Aug. 25, 1952