United States Patent

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[54] FLUID-POWERED APPLICATOR FOR MEDICAMENTS

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[51] **Int. Cl.** **A61m 5/00**

[58] **Field of Search** ..... 128/218 A, 218 G, 218 C, 218 OA, 128/173 H, 215, 218 F, 218 D, 223; 222/80, 320, 321, 326

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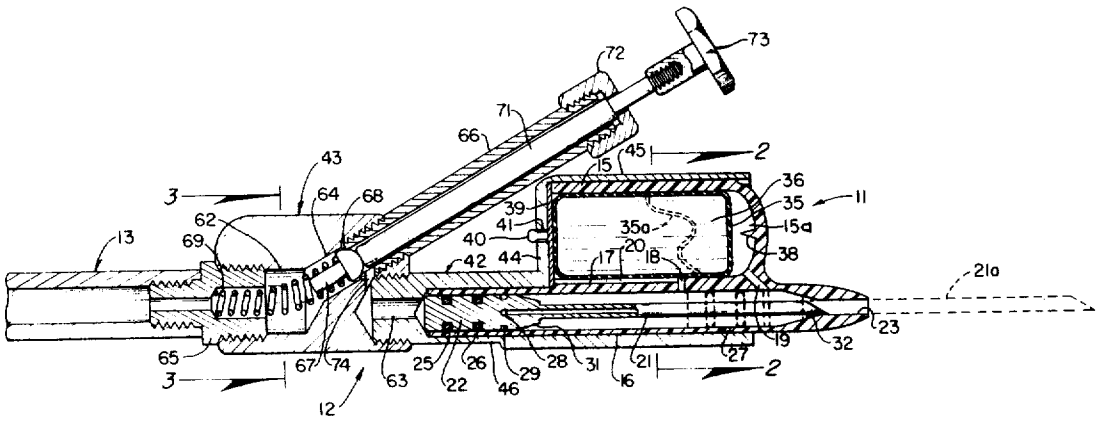
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[57] **ABSTRACT**

A power-actuated medicament applicator device includes a pressure cylinder and an injection needle or like applicator tool with a piston portion worked by pressure in the cylinder to drive the needle into the skin and then force a quantity of medicament carried in an accompanying container through the piston. The piston is carried in a normally retracted position in the cylinder and will extend through a restricted opening in an end wall thereof. The container for the medicament is located adjacent the cylinder and is carried in a rupturable ampule made of a flexible material. Flow passages between the pressure cylinder and container are arranged so that once the piston has moved to its extended position the container is pressurized to compress the ampule and medicament is forced from the container and through the needle or other applicator tool.

14 Claims, 3 Drawing Figures



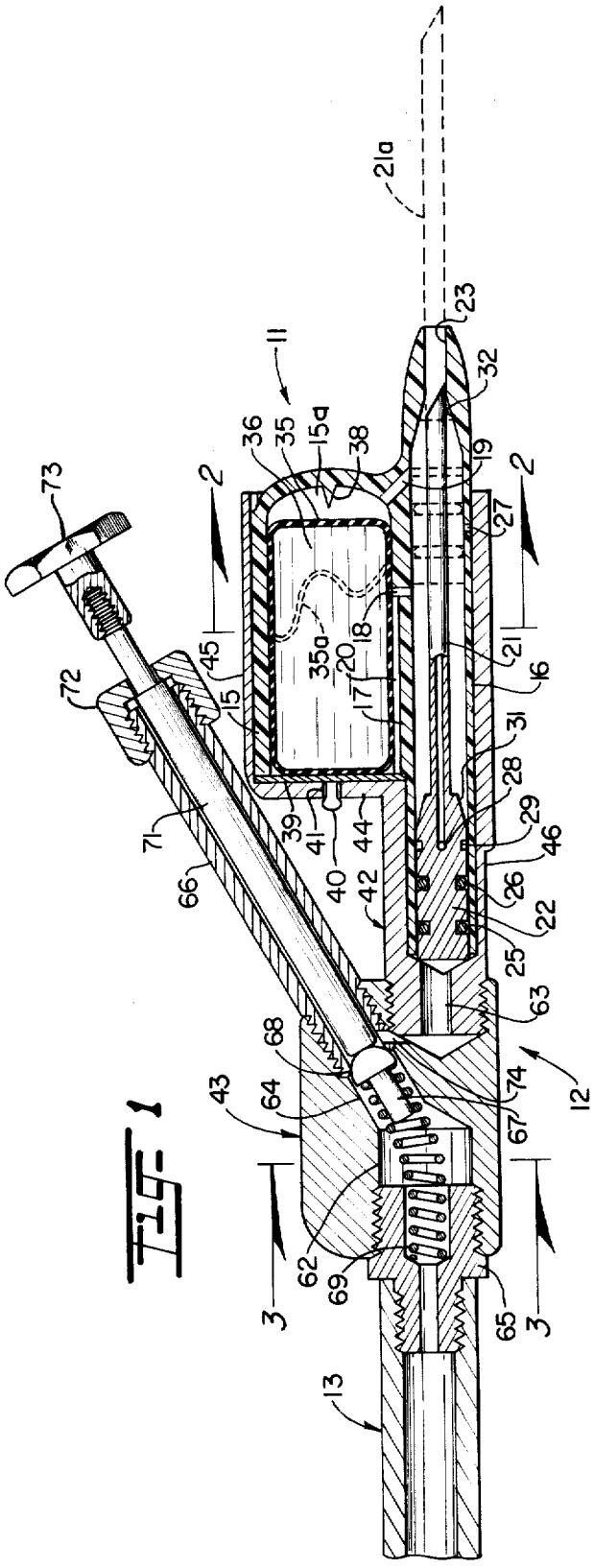


FIG. 1

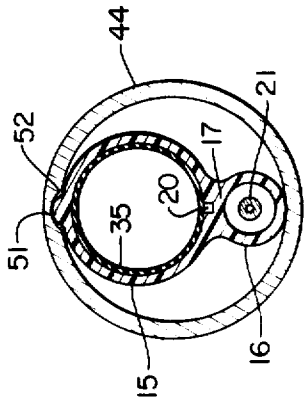


FIG. 2

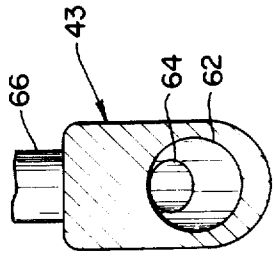


FIG. 3

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FLUID-POWERED APPLICATOR FOR MEDICAMENTS

This invention relates to medicament applicators and more particularly to fluid-powered applicator apparatus for the controlled application of medicaments.

Hypodermic needles and various forms of applicator apparatus have heretofore been used for applying medicaments. Previously known injection devices for the most part have been manually actuated and generally comprised a cylindrical housing, a barrel having a needle mounted at one end and a hand-actuated piston to force the medicament therein through the needle. Hermetically sealed ampules containing medicaments have been used to preserve strength and avoid contamination. The hand or manually operated syringes are satisfactory for some applications but, as will be appreciated from the foregoing, a fluid-powered injection apparatus for projecting the needle and forcing the medicament lends itself to faster and more effective injections.

Accordingly, it is an object of this invention to provide a simple, durable and efficient fluid-powered applicator apparatus for injecting a variety of medicaments into the body or for the application of same to the skin.

Another object of this invention is to provide novel and improved fluid-powered injection apparatus with a replaceable injection unit including a sterilized needle and a measured amount of medicament in a sealed ampule to be injected.

A further object of this invention is to provide an improved power-operated injection device characterized by successively driving the needle into the skin and then positively forcing the medicament from an ampule into the body through the needle.

In accordance with the present invention, a preferred form of an injection device has been constructed which includes a medicament container with a rupturable ampule of medicament and a pressure cylinder containing an injection needle with a piston portion arranged to be driven through the end of the cylinder into the skin. Flow passages at particular locations couple the interior of the medicament container to the interior of the cylinder so that the pressure in the cylinder may be used to force the medicament through the needle. The medicament container, cylinder, ampule and needle are constructed as a replaceable or disposable unit which is arranged for releasable coupling to a control valve unit which may be permanently connected to a source of fluid under pressure.

Other objects, advantages and capabilities of the present invention will become more apparent as the description proceeds taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a vertical sectional view through injection apparatus embodying features of the present invention;

FIG. 2 is a sectional view taken along lines 2—2 of FIG. 1; and

FIG. 3 is a sectional view taken along lines 3—3 of FIG. 1.

Referring now to the drawings, the injection apparatus shown broadly stated comprises an injection unit **11** which is supported by and releasably coupled to a control valve tool or unit **12** for regulating the fluid pressure into the injection unit **11** from a supply line **13** which, for example, leads from a compressed air source or other source of fluid under pressure, not shown. The injection unit **11** is constructed to be used as a replaceable unit which is to be used only once and then replaced. The apparatus described herein is particularly suited for air pressure actuation. Unit **11** comprises a cylindrical medicament container **15** and a pressure cylinder **16** joined together in a juxtaposed relation with a common wall **17**. A pressure passage **18** and a return passage **19** are provided in the wall **17** at the forward end of the container so as to transfer the fluid pressure from the cylinder into the container and to pass medicament from the container in the sequence of operation as described more fully hereinafter. A longitudinal groove **20** is provided in the wall of the container to pass air from passage **18** along one side of the ampule. The term "medicament" as used herein refers to medicinal materials in a liquid or gas form including nitrogen, narcotics and the like which may be injected.

A hollow injection needle **21** having a piston portion **22** at one end is carried in the cylinder **16** for movement from the retracted position wholly within the cylinder, as shown in full, through a restricted opening **23** in the discharge end of the cylinder to an extended position in which it will penetrate the skin, as shown in dashed lines **21***a*, under the influence of the fluid pressure applied to the cylinder **16**. The discharge end of the cylinder may be adapted for attachment of fittings commonly used for application of the medicament, such as, for use in skin treatment. The piston portion **22** has a pair of axially spaced annular seal members or **0**-rings **25** and **26**, and a radial passage **27** in the cylinder **16** is aligned between the rings in the extended position of the needle to vent any fluid under pressure which may leak past the inner seal **25**. This avoids introducing fluid under pressure into the body. The piston portion **22** also includes a passage defined by a radial bore **28** which communicates with the hollow interior of the needle from an external annular groove **29** at its upper end to permit the medicament to flow into the interior of the needle regardless of the circumferential position of the needle relative to the cylinder. The forward or outer end portion **31** of the piston is tapered so as to seal against a complementary tapered portion **32** within the cylinder in its extended position so as to provide a stop for the needle and, as will be observed with the dashed lines, the annular groove **29** aligns with the discharge passage **19** so that the medicament will be discharged from the container into the needle.

The container **15** is formed to receive a flexible ampule **35** and has a concave bottom portion **15***a*. The ampule **35** is made of a plastic or like material containing a medicament **36** to be injected into the body by the needle. The bottom of the ampule terminates above the concave portion to provide a space therebetween and the forward end of the container is welded to the inner surfaces of the container. To rupture the ampule as required, a sharp pin **38** is mounted in the concave bottom portion **15***a* so that when fluid under pressure is applied to the interior of the container it is forced into the concave portion and punctured by the pin **38**. A cap **39** is secured across the rear end of the container **15** after the ampule has been inserted and is held in place by means of electronic welding or the like.

The control valve unit **12** includes an open cylindrical housing **42** at one end of a valve body **43**, and the supply line **13** is connected to the opposite end of the body **43**. The housing **42** defines an enlarged cylindrical shroud **45** projecting forwardly from a base portion **44** and which forms an extension of a hollow sleeve **46**, the latter being offset from the center of the base and threaded at one end into the end of the valve body **43**. The sleeve is in communication with the interior of the housing **42** for slidable insertion of the end of the pressure cylinder **16** into sealed relation to a shoulder surface at the forward end of a reduced axial bore **63** which is provided in the threaded end.

To releasably hold unit **11** in the housing **42**, a nipple **40** made of a flexible material such as rubber and having an enlarged head is provided on the outer surface of the end cap **39**. Nipple **40** forcibly inserts into an aperture **41** in the center of base **44** when units **11** and **12** are brought together and removal of unit **11** is accomplished by forcing the nipple back through the aperture **41**. An alignment key **51** on the container slides into a complementary groove **52** in the shroud portion to properly align the container and piston with respect to the housing **42**.

The valve body **43** includes a central bore **62** with an inclined intermediate passage **64** opening through a side of the valve body. A hollow fitting **65** is threaded into the end of the bore **62**, and an elongated cylinder **66** is threaded into the intermediate passage so as to be inclined forwardly on an angle with the valve. This forward inclination permits the unit to be held in the palm of the hand of the user and the plunger to be readily depressed a selected amount by use of the thumb or forefinger for controlled application of medicaments.

A valve element 67 is disposed in the inclined passage 64 and is normally held against a tapered valve seat 68 at the end of the cylinder 66 by a spring member 69 which abuts against a seat within the fitting 65 and against the enlarged head of the valve element so as to bias the valve to a normally closed position. A plunger 71 is slidable through the cylinder 66 to engage the head of the valve element 67, and a cap 72 is threaded onto the end of the cylinder 66 to retain the plunger therein. A reduced end of the plunger extends through an aperture in the cap and is provided with a flat head 73 to depress the plunger downwardly against the valve element 67 to open the valve against the urging of the spring 69. Fluid under pressure is then free to flow past the valve element through a narrow aperture 74 in the cylinder 66 into the outlet passage 63 which will then pass the fluid under pressure into the cylinder against the inner end of the piston. In rapid succession the needle is driven through the discharge end of the cylinder into the skin until the piston has cleared the port 18, after which the fluid is passed into the container along groove 20 to act across the end of the ampule adjacent to the base 44. The ampule is compressed, as shown in dashed lines 35*a*, whereby to force the ampule against pin 38 to penetrate same and the medicament is then forced through passage 19 and through the needle.

Thus once the valve plunger has been depressed the unit will sequentially drive the needle and automatically inject the medicament into the body. Close regulation of the amount and duration of injection is possible by the pressure applied to the plunger 71 via cap 73.

Once unit 11 has been used it is removed from unit 12 and replaced with another unit 11 with the required medicament. One particular advantage of this arrangement is that the medicament can be dispensed in a desired quantity so as to eliminate the possibility of unauthorized use of a portion of the unused medicament. Another advantage is that the device is readily adaptable for use in dispensing medicaments from the ampule into a hollow applicator tool positioned at the discharge end of the cylinder in place of an injection needle. For example, in the treatment of skin cancer, the tool may be pressed against the skin and liquid nitrogen selectively released from the ampule in the manner described by driving the piston forwardly to pass fluid under pressure into the container so that the medicament can be forced through the needle into the interior of the tool.

While there has been shown and described a preferred form of the present invention as well as adaptations thereof to different uses, it is to be understood that various modifications and changes may be resorted to without departing from the spirit and scope of the present invention as defined in the appended claims.

What is claimed is:

1. In a medicament applicator operated by a source of fluid under pressure, the combination of

a container having a medicament to be delivered,

a pressure cylinder coupled to the medicament container including a pressure inlet end and an applicator end, with an inlet flow passage between said container and cylinder arranged to admit fluid under pressure from the cylinder into the medicament container and an outlet flow passage between the container and cylinder, means separating the medicament from the pressurized fluid and preventing the medicament from flowing through the outlet passage until the pressure is applied and

a piston member movable through said pressure cylinder in response to fluid under pressure delivered into said pressure inlet, said piston member being movable from a retracted position closing said inlet flow passage to an extended position opening said inlet flow passage and said outlet passage into said cylinder via said piston member, the pressure in the cylinder positively forcing the medicament from the container via said inlet and outlet flow passages whereby to discharge the medicament from the container through the applicator end of said pressure cylinder.

2. In a medicament applicator as set forth in claim 1 wherein said medicament container and pressure cylinder are a part of a single body and have a common wall portion.

3. In a medicament applicator as set forth in claim 2 wherein said inlet flow passage comprises an opening through said common wall portion disposed rearwardly of the piston member when moved to its extended position to pressurize the container.

4. In a medicament applicator as set forth in claim 3 further including an injection needle located at the leading end of said piston member movable through the applicator end of said cylinder, and said outlet flow passage comprises an opening through said common wall portion which aligns with a passage in the side of the piston member opening to the interior of said needle.

5. In a medicament applicator as set forth in claim 1 wherein said means separating the medicament from the pressurized fluid comprises a rupturable ampule made of a flexible material in said container enclosing said medicament.

6. In a medicament applicator as set forth in claim 5 including means in the container against which the ampule is forced to rupture said ampule.

7. In a medicament applicator as set forth in claim 5 wherein said container and cylinder are preloaded with said ampule and needle to provide a disposable injection unit.

8. In a medicament applicator as set forth in claim 1 wherein said piston member has spaced sealing rings to seal against pressure loss in the cylinder.

9. In a medicament applicator as set forth in claim 8 including a passage in the cylinder between said sealing rings in their extended position to vent the pressure in the cylinder to the atmosphere if one of the rings should fail.

10. In a fluid powered applicator tool having a source of fluid under pressure, the combination of a cartridge including a medicament container having a rupturable ampule of medicament to be injected and a fluid pressure cylinder with a common wall joining said container and cylinder, said cylinder having a pressure inlet, an inlet flow passage in said common wall to admit fluid under pressure from the cylinder into the interior of the container and an outlet flow passage for the flow of medicament from the medicament container through the cylinder, the pressure in the cylinder positively forcing the medicament from the ampule and container via said inlet and outlet flow passages,

a hollow injection needle having a piston portion in the pressure cylinder movable in response to fluid under pressure delivered into said pressure inlet, said piston portion being movable from a retracted to an extended position and after being extended to open said inlet flow passage and said outlet flow passage into said cylinder and position an inlet of the needle in communication with the container for said ampule, and

a flow-control valve releasably coupled to the cartridge to selectively admit fluid under pressure from the source into the pressure cylinder into said pressure inlet whereby to successively drive the needle to penetrate the skin of a body and regulate the application of the medicament through the needle into the body.

11. In a fluid-powered applicator tool as set forth in claim 10 including a housing extending beyond one end of the valve into which the cartridge is releasably inserted.

12. In a fluid-powered applicator tool as set forth in claim 11 wherein said medicament container has an end cap having a flexible nipple adapted to be forced through an aperture at the base of the housing to releasably secure the cartridge to the housing.

13. In a fluid-powered applicator tool as set forth in claim 11 wherein said housing has an enlarged bore sized to slidably receive an end of the cylinder.

14. A pneumatic-powered injection device having a source of fluid under pressure comprising

a disposable injection cartridge unit including a medicament container with a rupturable ampule of medicament to be injected and a pressure cylinder having a pressure

inlet with a hollow injection needle having a piston portion, said container and cylinder being a part of a single body joined by a common wall having an inlet pressure passage to pressurize the container from the cylinder and an outlet flow passage to pass medicament from the container into the pressure cylinder, said piston portion being movable from a retracted position to an extended position to open said inlet flow passage and said outlet flow passage, said piston portion having a passage to pass medicament from the outlet flow passage into the needle when advanced by fluid under pressure in the cylinder to said extended position, said unit including means to selectively rupture said ampule at said outlet passage, and

a flow-control valve assembly coupled to the cartridge unit having a housing at one end for releasable insertion of the cartridge unit to selectively admit air under pressure into said cylinder via said pressure inlet whereby to successively drive the needle to the extended position and open the inlet and outlet flow passages to force medicament through the needle under the regulation of the control valve.

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