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H. R. JOHNSON
HYPODERMIC SYRINGE WITH MAGNETICALLY
ACTUATED PISTON AND NEEDLE
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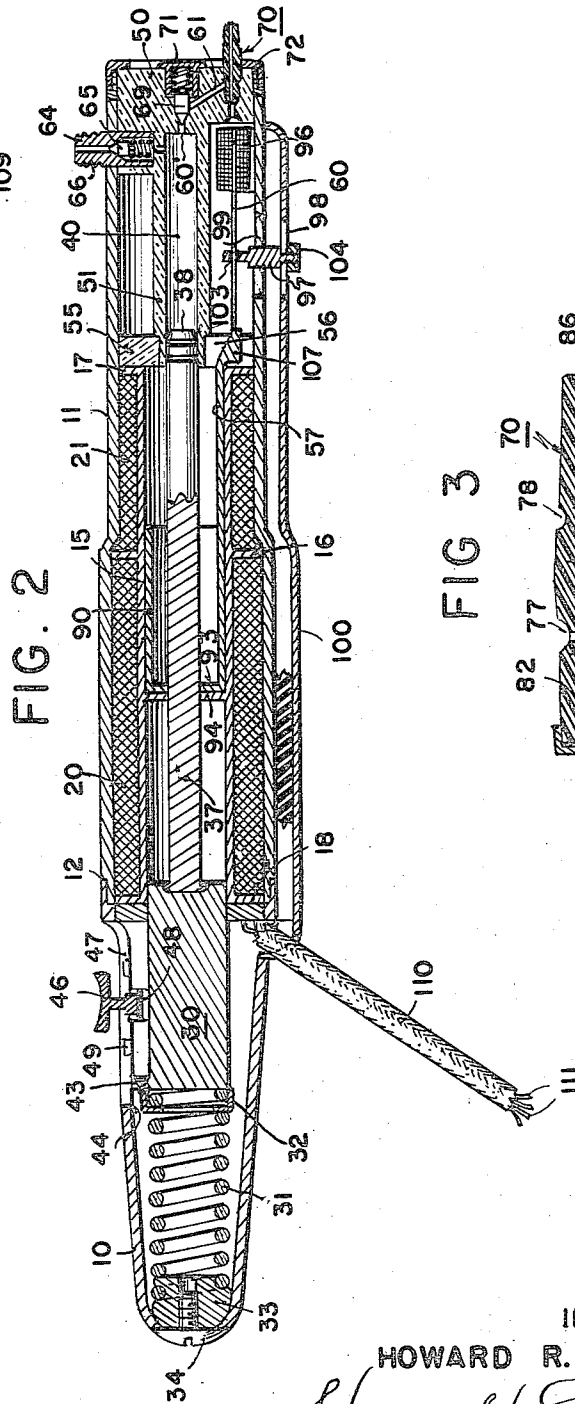
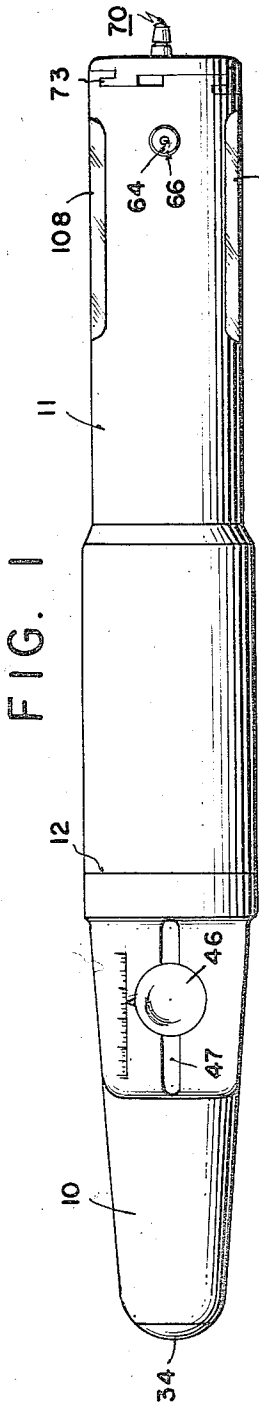
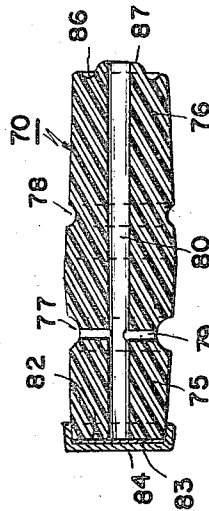


FIG. 3



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HYPODERMIC SYRINGE WITH MAGNETICALLY ACTUATED PISTON AND NEEDLE

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This invention relates to hypodermic syringes and has for its principal object the provision of such an instrument in which the needle is solid and is withdrawn before the medicine or other fluid is injected.

An important feature of the present invention is to provide a small, light weight hypodermic syringe electrically operated preferably, though not necessarily, by a foot switch.

A further object of the invention is to provide a hypodermic syringe in which the capsule is readily removable either after each operation or when the same capsule is used for a number of injections, a tip can be used for a single injection and then disposed of.

The invention contemplates a generally cylindrical body having therein at least one and preferably two solenoids for operating the plunger of the syringe in one or both directions and for operating a penetrating needle in one or both directions, the preference being that closing a single switch will advance the needle, instantly withdrawing it, and while withdrawing the needle advance the plunger in the cylinder of the capsule to discharge the fluid, at the same time operating a sterilizing device inside of the body which may be kept energized after the plunger has been returned to initial position.

In the drawings:

Figure 1 is a top plan view;

Figure 2 is a central vertical section;

Figure 3 is an enlarged sectional view of the disposable tip.

The casing is composed of a rear section 10 and forward section 11 joined as at 12 by threading or any other connection. Centrally within the casing is a bobbin 15 providing what might be called a double spool having a central flange 16, a forward flange 17 and a rear flange 18. The larger and rearward portion of the spool houses a solenoid 20 which is the coil for the plunger while the smaller and forward portion of the spool houses a solenoid 21 which is the operating means for the hypodermic needle which differs from other syringes in that this needle is solid and is withdrawn into the housing prior to the administration of the fluid medicament. The armature 30 for the coil 20 is positioned axially in the casing and is held in inoperative position by a tension spring 31 fast to the armature 30 as by the clamp 32 and secured to a retainer 33, held at the rear of the syringe by a screw 34.

At the front of the armature 30 there is an elongated plunger piston 37 having the usual head or seal 38 fitting snugly in the cylinder 40 of the capsule. The axial movement of the core or armature 30 is limited by a stop member 43 which at the close of its return journey strikes an abutment 44 on the casing 10. The front limit of travel is formed by a button 46 sliding in a slot 47 and being held by a leaf-spring 48 in any one of the grooves 49. In previous models I have provided that the button 46 can be positioned with extreme accuracy anywhere in its travel but find that the four places are ample for all but very exceptional work.

The capsule is preferably of glass having a large head 50 integral with a tubular extension 51, the interior of which forms the cylinder or piston chamber 40, the end of the tube fitting snugly into a relatively heavy ring 55 which is slotted at its bottom as at 56 to provide a passage for the elongated arm 57 which carries the needle 60. The capsule frequently would be for one or a few uses and in such case would generally be closed except for the axial passageway 62 and the communicating passageway 61 but where, as illustrated, the chamber 40 receives fluid from a large reservoir I provide an intake nipple 64 having a spring-pressed valve 65 and being threaded as at 66 to receive a fairly large jar or a tube leading from such reservoir. I may also provide a spring-pressed valve 69 in the passageway 62, the spring of the valve being housed in a small cup 71 in the cap shell 72 which closes the discharge end of the syringe and preferably has a bayonet slot joint 73 with the front portion 11 of the syringe.

The disposable tip 70 is illustrated in detail in Fig. 3 and consists of a quite small cylinder preferably of plastic being about 1/2" long and 1/8 of an inch in diameter. The two ends 75 and 76 are each tapered from the proximate face at about 2° to a groove 77 or 78, the former having bores 79 at right angles to each other and communicating with the axial bore 80 of the disposable tip. The rear face 82 of the tip is closed by a membrane 83 which may be held by a metal clip 84 but preferably is merely affixed to the tip by adhesive. The membrane 83 is of any suitable quick-seal material so that when the extremely thin needle penetrates the membrane and is withdrawn liquid may not follow the needle being stopped by the membrane. It is my preference to provide an annular groove 86 in the front face 87 of the tip in order to secure a somewhat more firm contact with the tissue to be penetrated.

The core or armature 90 which carries the needle 60 is preferably in the form of a hollow thimble, the base 93 of which in normal position rests against a central stop 94 integral with the spool or bobbin 15. The arm 57 is integral with the thimble. A sterilizing element 96, preferably in the form of a coil of resistance wire, is mounted on the casing 11 below the tubular wall 51 of the cylinder 40. A stop member 97 is adjustable in slots 98 and 99 in an electrical conduit cover 100 and in the bottom of the housing 11, respectively. The stop 97 has a hole 103 therethrough to support and guide the fine needle 60. A nut 104 secures the stop which engages the head 107 of the arm 57. It has been found convenient to provide transparent windows 108 and 109 on each side of the forward portion 11 of the casing to observe the mechanism, the capsule itself being transparent and preferably of glass.

The electrical connections to the device are indicated diagrammatically, the cable 110 carrying a number of wires 111, either four or six in number preferably, and leading to the main coil 20, the auxiliary coil 21, and to the sterilizer 96. These members are energized preferably by a foot control switch which may have three separate elements, one for each coil and one for the sterilizer, but in my preferred models has a single switch which first energizes the coil 21 thus driving the needle 60 through the tip 70 to an extent governed by the stop 97. This action through a relay energizes main coil 20 so that the plunger operates instantaneously upon withdrawal of the needle and this is followed in turn by closing the current to the sterilizer. The armature 30, which is the head of the plunger, is withdrawn either manually or by the tension spring 31. While the core or plunger head 30 in delivering a maximum charge of medicine would come substantially in contact with the annular wall 94, I prefer that this wall shall not act as a stop

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member for the plunger, preferring that the stop member 43 shall always strike the button 46.

What I claim is:

1. In a hypodermic syringe, a casing, a solenoid therein, an armature coaxial with said solenoid, an elongated needle carried by the armature and adapted to be projected beyond the casing upon energization of said solenoid, and a magnetic device for returning the armature to its initial position with the needle inside of the casing when the solenoid is de-energized.

2. The syringe of claim 1 with means for de-energizing the solenoid as the point of the needle is projected beyond the casing, and means for adjustably limiting the forward penetrating movement of the needle.

3. The syringe of claim 1 with a sterilizer within the casing and surrounding the point of the needle when the needle is in inoperative position within the casing.

4. The syringe of claim 3 in which the sterilizer comprises a coil of resistance wire guiding the needle between the means limiting movement and the forward end of the casing.

5. In combination a casing, a capsule having a spring-pressed discharge valve in the casing, a plunger cooperating with the capsule to discharge liquid from the capsule, and means including a magnet and its armature for moving the plunger forward in the capsule.

6. A hypodermic syringe including a casing having a capsule forming a cylinder having a discharge orifice, a piston plunger operating in the cylinder to discharge fluid thru said orifice, a penetrating needle housed within the casing and movable parallel to the axis of the cylinder, a hollow disposable tip carried by the casing in the path of movement of the needle, means for moving the piston plunger and the needle independently of each other whereby the needle may form a temporary passageway outside of the casing for the fluid in the cylinder and the plunger may drive the fluid into such passageway, and means within the casing for sterilizing the needle after each use, said sterilizing means being positioned coaxially of the disposable tip and in proximity thereto.

7. In an ejecting device, a casing, two axially spaced electro-magnets within the casing, a first armature axially movable in the casing, a second armature coaxial thereto, a cylinder, a plunger within the cylinder and operably connected to the first armature, a needle movable with the second armature and adapted to be projected beyond the discharge end of the casing, a disposable hollow tip in the casing axially aligned with the travel of the needle, a valved passageway in the casing connecting the discharge end of the cylinder with the hollow of the disposable tip, and means for successively energizing the magnets, said second armature being positioned to move in one direction under urge of one magnet and to be re-

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turned to initial position when the other magnet is energized.

8. A hypodermic syringe comprising a generally cylindrical casing, a cap for the discharge end of the casing having therein a discharge passage, a portion of which is coaxial with the casing, a spring-pressed valve in said portion of the passageway, a disposable tip in said cap communicating with the discharge passageway, a needle movable in a path passing thru said disposable tip, electrical means for ejecting the needle through the discharge end of the device, for sterilizing the needle and for returning the needle to initial position.

9. In a hypodermic syringe, a generally cylindrical casing, a disposable tip therein, a plurality of electro-magnetic devices spaced axially in said cylinder, a capsule having an intake valve and a discharge valve, said casing having a passage therein connecting the cylinder with the disposable tip, a plunger proximate one of said electro-magnets having a piston connected thereto to discharge fluid in said cylinder through said disposable tip, and a receptacle secured to the intake valve of the cylinder to form a reservoir for fluid to be drawn into the cylinder upon reverse movement of the piston.

10. In a hypodermic syringe, a pair of axially positioned electro-magnets within the casing, an armature coaxial with the casing and positioned between the two electro-magnets, a needle carried by said armature and means for successively energizing the two electro-magnets whereby one magnet will move the armature forward to project the needle beyond the casing and the second magnet will withdraw the armature to initial position with the point of the needle within the casing.

11. A plastic disposal tip for a hypodermic syringe comprising a generally cylindrical body having an axial bore therethrough, an annular groove proximate one end of the tip and a bore connecting the groove with the axial bore, and a quick seal membrane covering the face proximate the groove.

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