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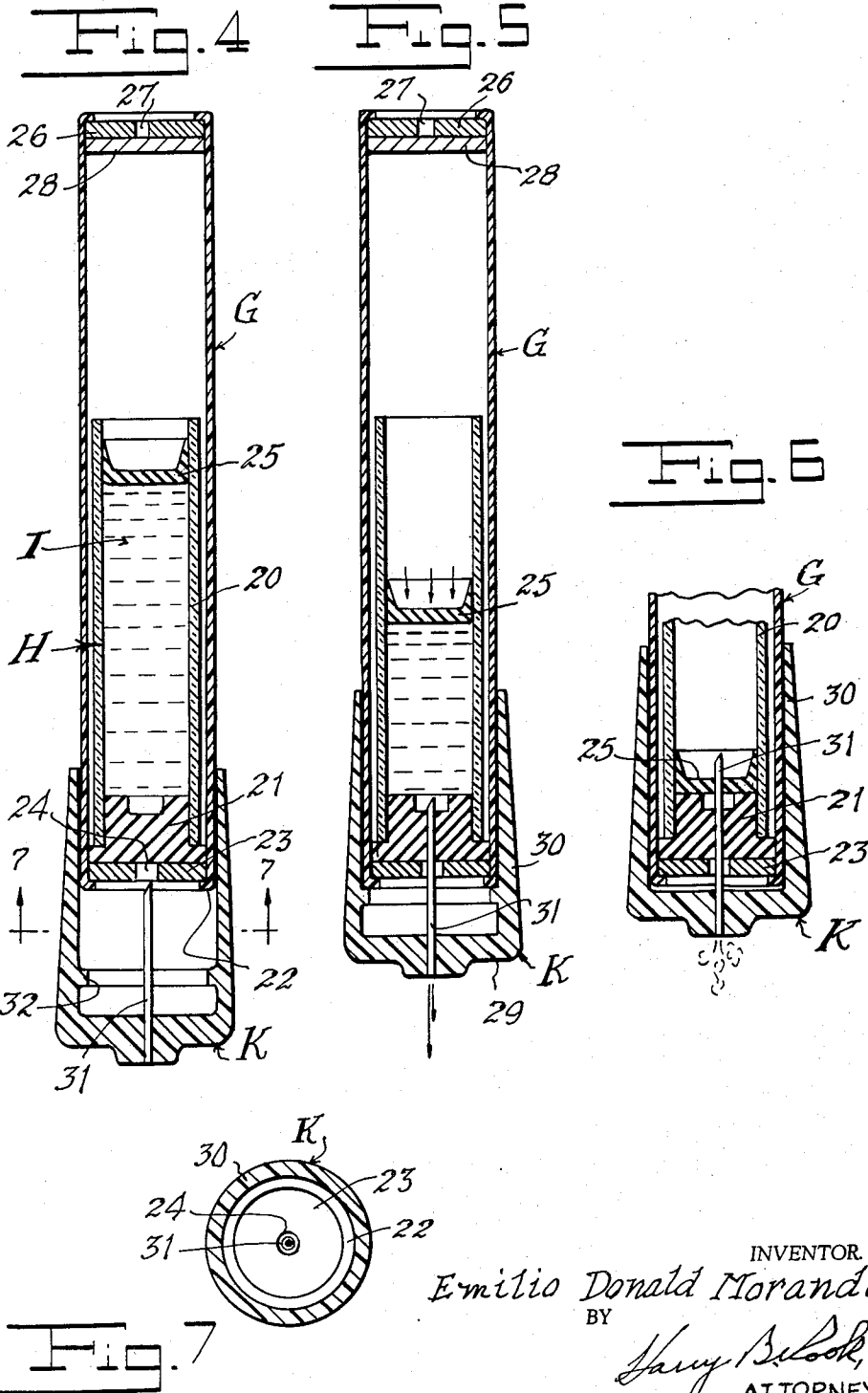
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NEEDLELESS PREFILLED DISPOSABLE HYPODERMIC INJECTOR

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NEEDLELESS PREFILLED DISPOSABLE HYPODERMIC INJECTOR

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9 Claims. (Cl. 128—173)

This invention relates to a hypodermic injection device of the type wherein the injections of medicament are made without the piercing of the body tissues with a needle; and more particularly the invention contemplates a hypodermic injection device of this character wherein the medicament is expelled from an ampule or cartridge through an orifice at high velocity under pressure of a gas.

An important object of the invention is to provide an hypodermic injection device of this character which shall embody novel and improved features of construction whereby the medicament is released from the ampule or cartridge automatically upon pressure of a part of the device bearing the orifice against the surface, for example, the skin of a human body, through which the injection is to be made.

Another object is to provide such an injection device which shall include a novel and improved combination of a casing, a glass cartridge or ampule and a chamber within said casing for gas under pressure wherein at all times the pressure inside and outside the cartridge shall be maintained substantially equal to reduce the possibility of breaking of the cartridge during handling and operation of the device.

Still another object of the invention is to provide a hypodermic injection device which includes a novel and improved construction and combination of a casing having a chamber therein for gas under pressure, a medicament containing cartridge or ampule having a puncturable end wall, and means associated with the casing for automatically puncturing said wall to permit the release of the medicament from the cartridge or ampule upon simple pressure of a portion of the casing against the surface through which an injection is to be made.

It is another object of the invention to provide in a hypodermic injection device operable by gas under pressure, novel and improved means to prevent injury to the device or to the operator thereof from excessive pressure within the device, such as might be caused, for example, by excessive heating of the device after filling of the gas-containing chamber.

Other objects, advantages and results of the invention will be brought out by the following description in conjunction with the accompanying drawings in which

FIGURE 1 is a longitudinal sectional view through a hypodermic injection device embodying one form of the invention, showing the parts in normal position and condition ready for use;

FIGURE 2 is a similar view showing the operation of the parts during use of the device;

FIGURE 3 is a horizontal sectional view on the plane of the line 3—3 of FIGURE 1;

FIGURE 4 is a view similar to FIGURE 1 showing a modification of the device;

FIGURE 5 is a view similar to FIGURE 2 showing the modification of FIGURE 4 in use;

FIGURE 6 is a fragmentary view similar to FIGURE 5 but showing the operation of the device for releasing the gas pressure after an injection has been made; and

FIGURE 7 is a horizontal sectional view on the plane of the line 7—7 of FIGURE 4.

Specifically describing the embodiment of the invention shown in FIGURES 1 through 3 the reference character A designates a cylindrical, tubular casing formed of suitable material in which is mounted a cylindrical, prefer-

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ably glass, ampule or cartridge B which includes a tube 1, preferably of glass, which contains a liquid medicament C between a rubber stopper 2 that closes one end of the glass tube, and a rubber piston 3 which is slidable in the glass tube in liquid-tight contact with the walls thereof, said piston being actuable by gas under pressure from a capsule D disposed within the casing, for ejecting the liquid medicament from the cartridge through a cannula 4 and a trigger-contactor E when the latter is pressed against a surface through which injection is to be made, such as the skin of a person that is indicated by the dot-and-dash lines and designated F in FIGURE 2. Preferably, as shown, the stopper 2 tightly fits into the end of the glass tube 1 and has a perimetral flange 6 at one end thereof abutting the end of the glass tube and itself abutted by a rigid disc 7 over the edge of which the end portion of the casing A is intumed as indicated at 8 for holding the stopper and the cartridge firmly against displacement from the casing.

Normally the trigger-contactor E is shown in the form of a cup having a bottom wall 9 and a cylindrical side wall 10 encircling and longitudinally slidably fitted on the end of the casing outwardly of said stopper 2 and having one end portion of the cannula 4 rigidly secured in the bottom wall thereof providing an orifice terminating in the outer surface of said wall and the other end portion extending into the cup and partially penetrating the rubber stopper 2 as shown in FIGURE 1 with the bottom wall 9 spaced a sufficient distance from the end 8 of the casing to permit the cannula to completely pass through the stopper upon contact of the trigger-contactor with the surface F and exertion of longitudinal pressure on the casing sufficient to cause the casing to slide downwardly into the trigger-contactor from the position shown in FIGURE 1 to the position shown in FIGURE 2. In the latter position, the inner end of the cannula extends into the glass tube 1 so that the liquid in the tube can be ejected through the cannula under pressure and at sufficiently high velocity to cause the liquid to penetrate the skin of a person indicated at F in FIGURE 2.

As hereinbefore indicated, the liquid medicament is ejected under the influence of gas under pressure in the capsule D which may be generally of known construction and normally may be disposed with one end resting on the piston 3 as shown in FIGURE 1 with its other end closed by a plug 11 which may be punctured or pushed into the capsule by a pin 12 which is mounted in the end wall of an internally screw-threaded cap 13 which in turn is screwed on an externally screw-threaded closure plug 14 for the end of the casing A opposite the stopper 2. As shown, the closure plug has a perimetral end flange 15 over which the corresponding end of the casing A is intumed as indicated at 16 to firmly hold the plug from displacement from the casing. The pin 12 is longitudinally loosely slidable in an axial opening 17 in the closure plug and preferably has its inner end pointed to penetrate a rubber safety seal disc 18 that is disposed at the inner end of the closure plug 14 and has a slit 19 in line with the pin 12. The slit 19 is such that the disc will normally seal the gas chamber within the casing under the normal gas pressure to be used in making an injection of the medicament, but will facilitate the penetration of the disc by the pin 12 for the purpose of puncturing or displacing the plug 11 of the capsule D when the cap 13 is rotated to move the pin longitudinally into the casing as shown in FIGURE 2. When the plug 11 has been punctured or displaced, the gas in the capsule quickly flows into the chamber within the casing A and against the piston 3 so as to eject the medicament through the cannula 4, and the rubber disc with the pin seated in the slit will prevent the escape of gas.

However, should the gas pressure in the casing become

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excessive, for example, by overheating of the casing, the slit 19 will permit the gas under the excess pressure to escape and thus prevent damage to the injection device and injury to the persons in the vicinity of the device.

It will also be observed that the glass tube 1 is spaced from the walls of the casing so that when the gas is released from the capsule, the glass tube is supported against cracking or damage by the equal pressures externally and internally of the tube.

The use of the device will be clear from the foregoing, but may be summarized. Assuming that the cartridge B charged with medicament in any known manner and the gas capsule D have been secured in the casing A and the gas-releasing cap 13 and the trigger-contactor E have been arranged in their normal positions as shown in FIGURE 1, when it is decided to make the injection, the gas-releasing cap 13 is screwed onto the plug closure 14 to displace the plug 11 from the gas chamber and release the gas into the casing. Thereupon, the casing is grasped and the trigger-contactor is gently pressed into contact with the surface F through which the injection is to be made, with sufficient pressure applied to the casing to cause the cannula 4 to pass through the stopper 2, whereupon the gas under pressure will force the liquid medicament through the cannula at high velocity and through the surface F. It will be observed that none of the liquid medicament is released from the cartridge until the cannula has penetrated the stopper; thus no liquid enters the cannula until the moment of the injection. The gas may be released from the casing after the injection by manipulation of the cap 13 to withdraw the pin 12 from the slit 19 so that the gas may escape through the slit and through the opening 17 of the closure plug in which the pin 12 is slidable.

A modification of the invention is shown in FIGURES 4 through 7 wherein instead of utilizing a gas filled capsule, the gas under pressure is injected directly into the chamber within the casing, and the trigger-contactor is so associated with the casing that the cannula may provide both a discharge orifice for a medicament in the cartridge and also as a vent for the gas pressure after the injection has been completed.

More particularly, this form of the injection device includes a cylindrical tubular main casing G within which is a medicament cartridge H that may be identical with the cartridge B including a cylindrical glass tube 20 one end of which is closed by a rubber stopper 21 between which and the turned flange 22 of the casing is a rigid disc 23 having an axial opening 24 therein to permit the cannula to penetrate the stopper. A piston 25 is slidable in the glass tube to eject the medicament I from the cartridge under gas pressure.

Gas under pressure from a suitable source is injected into the end of the casing G opposite the stopper 21, and for this purpose, the rigid disc 26 is fixedly secured in the end of the casing and has an opening 27 to which may be connected a hose or conduit for supplying the gas under pressure to the chamber within the casing. After the chamber in the casing has been charged to the desired pressure, the opening 27 is closed, for example, by a disc 28 of fusible metal.

The trigger-contactor K is cup-shaped having a bottom wall 29 and a cylindrical side wall 30 that is slidably mounted on the casing in encircling relation thereto. The trigger-contactor has a cannula 31 secured in an extending through the bottom wall 29 and projecting into the cup. The bottom wall of the cup is normally spaced from the stopper 21 at such a distance that the inner end of the cannula clears the stopper 21 but so that the trigger-contactor can be pushed onto the casing to cause the cannula to puncture the stopper and release the medicament from the cartridge through the cannula as shown in FIGURE 5 of the drawings. The inner surface of the side wall of the trigger-contactor has an inwardly extending projection that is shown in the form

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of a rib 32 to initially abut the end of the casing and limit the movement of the cannula through the stopper as shown in FIGURE 2 during the injection operation, but the rib and the side wall of the trigger-contactor are of such nature that upon further forcing of the trigger-contactor onto the casing, the rib will slip past the end of the casing and permit the trigger-contactor to be pushed further onto the casing with the inner end of the cannula projecting beyond the inner end of the stopper 21. With this construction when the piston 25 reaches the limit of its movement during the liquid-ejecting operation, it will abut the end of the stopper and can be punctured by the cannula so that the cannula will serve as a vent for the gas pressure in the casing and in the cartridge, as best shown in FIGURE 6. It will be understood by those skilled in the art that the side wall of the trigger-contactor can be formed of resilient or slightly elastic material such as polyethylene so that it will slightly yield to permit the projection to slip past the end of the casing or the material of the trigger-contactor might be such as to permit the projection to be sheared off as the trigger-contactor is forcibly pushed onto the casing.

From the foregoing, it will be seen that both forms of the invention constitute hypodermic injectors that are pre-filled with the medicament and gas under pressure, are needleless so that the medicament can be ejected from an injection orifice at high velocity simply by pressing the trigger-contactor into contact with the body to receive the injection, and can be economically manufactured so that they can be used once and then thrown away.

Modifications and changes in the construction of the injection device will occur to those skilled in the art as being within the spirit and scope of the invention.

I claim:

1. A hypodermic injector comprising the combination of a casing having therein a medicament cartridge including a tube and means associated therewith provided with a penetrable stopper closing one end of said casing and the corresponding end of said tube, and a trigger-contactor axially slidably mounted on said casing at said end thereof and provided with a wall disposed outwardly of said stopper to move toward and away therefrom and having a cannula one end portion of which is rigidly secured on said wall providing an orifice terminating in the outer surface of said wall, the other end portion of the cannula projecting inwardly of said wall to penetrate said stopper and provide for discharge of said medicament from said cartridge upon relative movement of said casing and said trigger-contactor incident to pressing the latter against a body to receive an injection, and means to effect such discharge of the medicament at high velocity.

2. A hypodermic injector as defined in claim 1 wherein said cartridge is open at its other end and has a piston therein, and the last-named means includes a chamber containing gas under pressure which urges said piston toward said stopper to eject said liquid.

3. A hypodermic injector as defined in claim 1 wherein said casing has a chamber in which said cartridge is disposed and said cartridge has its other end opening into said chamber and has a piston therein, and the last-named means comprises a normally sealed gas-containing capsule in said chamber, and means at the end of the casing opposite said trigger-contactor for opening said capsule to release gas under pressure into said chamber.

4. A hypodermic injector as defined in claim 1 wherein said casing has a chamber containing gas under a predetermined pressure, and with the addition of safety means operable upon occurrence of excessive pressure in said chamber to vent said gas from the chamber.

5. A hypodermic injector as defined in claim 1 wherein said cartridge is open at its other end and has a piston therein, and the last-named means includes a chamber containing gas under pressure which urges said

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piston toward said stopper to eject said liquid and with the addition of means for releasing gas from said chamber after completion of an injection.

6. A hypodermic injector as defined in claim 1 wherein said cartridge is open at its other end and has a piston therein, and the last-named means includes a chamber containing gas under pressure which urges said piston toward said stopper to eject said liquid and wherein said trigger-contactor is mounted for limited movement in one direction relative to the casing to puncture said stopper but is forcible farther in the same direction to enter said cartridge and puncture said piston after completion of an injection to release the gas from said chamber.

7. A hypodermic injector as defined in claim 1 wherein said cartridge has its other end opening into said chamber and has a piston therein, the last-named means comprises a normally sealed capsule in said chamber containing gas at a predetermined pressure, the end of said chamber opposite said trigger-contactor having a safety sealing disc secured therein normally closing said chamber and formed with a slit and providing for sealing of the chamber against escape of gas under said predetermined normal pressure, said capsule having openable sealing means, and with the addition of means including a pin mounted at the second-mentioned end of the casing and movable longitudinally into the casing through said sealing means for opening said capsule to release gas pressure therefrom into said chamber and coating with said sealing disc to retain said pressure in the chamber, said disc providing for release of gas under excessive pressure from the chamber through said slit in the sealing disc.

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8. A hypodermic injector as defined in claim 1 wherein said cartridge has its other end opening into said chamber and has a piston therein, the end of said chamber opposite said trigger-contactor having a safety sealing device comprising a rigid disc having an opening therein and a disc of material having a low melting point underlying said rigid disc and normally closing said opening, said disc of low melting point being fusible under excessive ambient temperature to release the gas under consequent excessive pressure from said chamber.

9. A hypodermic injector as defined in claim 1 wherein said cartridge is open at its other end and has a piston therein, and the last-named means includes a chamber containing gas under pressure which urges said piston toward said stopper to eject said liquid, and said tube of the cartridge is spaced throughout its length from the wall of the casing so that the gas pressure inside and outside said tube shall be approximately equal to reduce the possibility of breakage of said tube.

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