

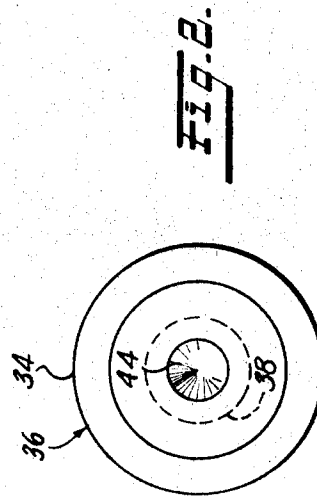
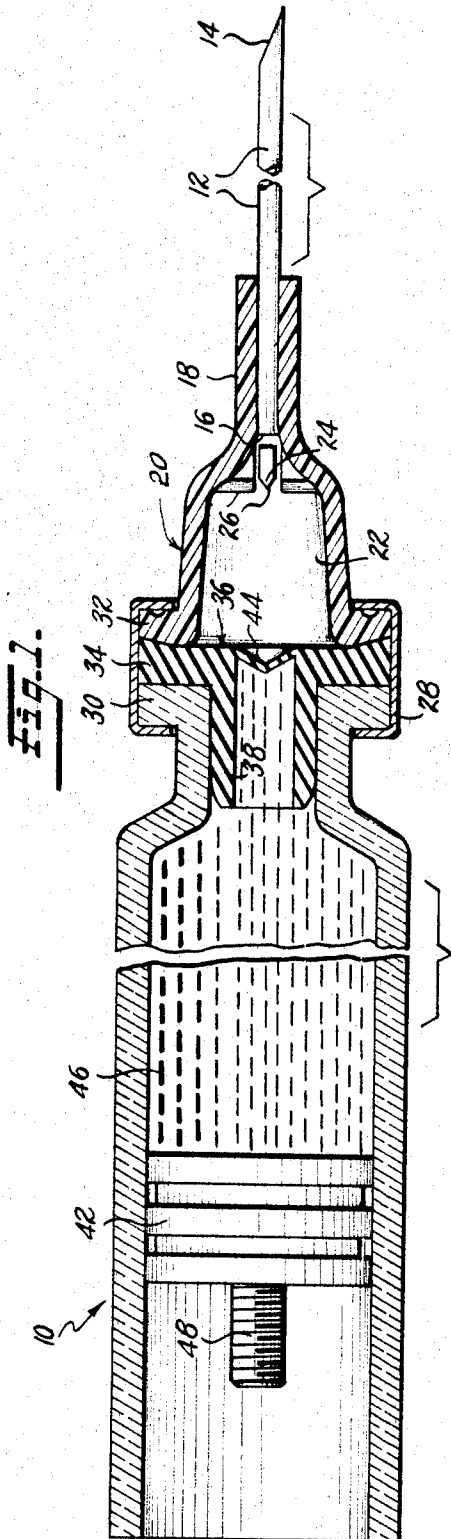
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CARTRIDGE WITH REFLEXED BURSTABLE DIAPHRAGM

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CARTRIDGE WITH REFLEXED BURSTABLE DIAPHRAGM

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ABSTRACT OF THE DISCLOSURE

A cartridge containing a medicament is provided with a plunger at one end and a thin walled resilient stopper at the other end, said stopper having a portion normally reflexed toward the plunger. Upon pressure being applied to the plunger, the medicament causes the reflexed portion to evert, the pressure further ballooning the resilient stopper portion until it bursts and the medicament is expelled through the ruptured portion of the stopper and through a hollow needle attached to the cartridge.

This invention relates to cartridges such as are utilized in syringes for administering fluid medication to a subject. In particular, the invention relates to a cartridge or syringe wherein the cartridge or syringe may contain a medicament which it is desired to maintain normally sealed and away from a cannula carried by the cartridge or the syringe in order to prevent deleterious interaction between the medicament and the cannula or the passage to the cannula. Still more particularly, the invention relates to a novel form of burstable diaphragm within the cartridge which effects the sealing relationship between the medicament and the cannula.

Where a medicament is contained in the cartridge, it has been known in the prior art, as in Pittinger 1,288,174, Kabnick 1,943,120, Cohen et al. 2,847,996 or in Sarnoff applications Ser. No. 408,423, filed Nov. 2, 1964 and Ser. No. 447,741, filed Apr. 13, 1965, to effect the seal referred to above by means of a membrane which, when it is desired to use the contents of the cartridge, is either pierced by movement of the hypodermic needle relative to the cartridge or by forcing or stretching the membrane into contact with the needle so that the needle may puncture the membrane. It has also been known, in the prior art, where a medicament is contained in the cartridge, as in Gould 1,455,047 and in the referred to Sarnoff disclosures, to effect communication between a fluid container and the needle by bursting a flexible diaphragm, the bursting being effected by reason of fluid pressure applied to the diaphragm to cause it to distend and finally burst because of wall weakness or, as in the case of the Sarnoff disclosures, by engaging puncturing projections in the path of movement by the ballooning diaphragm. In most instances, prior to medication injection into a patient and in order to determine whether the point of the needle, after skin penetration, has entered the proper area, the administrator of the medicament will perform an aspirating or backward movement of the plunger of the syringe, in order to draw and inspect a specimen of the fluid with which the point of the needle is in contact, this necessitating unrestricted fluid movement past the burst diaphragm. However, prior to this invention, the diaphragms were so formed that, upon aspirating movement, the fragmentary portions remaining on the diaphragm tended to move to an obstructing position. This would be particularly so when the ballooning of the diaphragm caused a stretching action of the diaphragm and imparted a more or less permanent set thereto, whereby upon release from pressure the parts of the ruptured diaphragm would overlap to prevent aspiration of fluid from the patient into the syringe.

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It is therefore an object of this invention to provide a diaphragm construction such that an obstruction of fluid movement due to diaphragm action will be obviated and resistance to aspiration effects is reduced.

For a fuller understanding of the invention, attention is directed to the following specification and the accompanying drawing in which:

FIG. 1 is a longitudinal sectional view of a cartridge and needle illustrating an embodiment of the invention; and,

FIG. 2 is a plan view of the diaphragm in its normal condition.

Now referring to the drawings in greater detail, there is illustrated in FIG. 1 a cartridge comprising a vial or container 10 and its associated portions, and a hollow needle 12 and its associated portions. The needle is pointed at its forward end, as indicated at 14, for body penetration and need not be pointed at the rear end 16. As illustrated, the needle end 16 is blunt and lies within the neck portion 18 of a needle holder or shield 20 and is fastened thereto in any conventional fashion. The holder is formed with a large chamber as indicated at 22 within which are located diaphragm rupturing devices 24. In the form disclosed, these devices are projections integral with the hollow holder, the holder being of plastic, rubber or like material. Preferably, the holder is made of a transparent plastic material, such as nylon, so that it may be observed within the holder what diaphragm action occurs within the holder and so that the aspirated fluid may be viewed in the holder rather than in the medication containing portion of the cartridge. The latter viewing obviously would require a greater degree of aspiration than the viewing in the holder. The projections 24 are formed with bevelled edges forming ridges or knife edges 26, adapted to cut into an expanding diaphragm, as will be explained.

The needle holder 20 is clamped to the vial in any convenient fashion, as by spinning an aluminum collar 28 over the shoulder of a terminal portion 30 of the vial and over an annular flange 32 integral with the holder. The needle holder is clamped to the vial with the flange 34 of a stopper 36, preferably of soft rubber, the stopper flange being compressed between the open mouth of the holder and the terminal portion of the vial.

The flange of the stopper is integral with a channeled cylinder 38 compressed in the neck of the vial 10. The forward end of the channel is sealed off by an expandable wall section or diaphragm, sufficiently thin so that when a fluid in the vial is operated by a piston, as piston 42, the fluid is forced through the channel in the cylinder 38 against the diaphragm. The diaphragm is reflexed as indicated at 44. That is to say, the diaphragm normally has a shape such that it is concave toward the needle end of the syringe and convex toward the medicament end of the syringe. The diaphragm may be normally arcuate in cross section. Preferably the diaphragm, as illustrated in the drawings, is conical in form. Upon pressure being applied to the medicament in the vial, the diaphragm will pop to a reverse condition, with the concavity forming a convexity and will balloon out and either burst by reason of the walls of the diaphragm becoming too thin to resist the applied pressure or by reason of contacting the knife edges 26 of the projections. Then, by reason of the resiliency of the rubber and the forces inherent in the rubber, the remnants of the diaphragm will move back more or less to the normal reflex position. Thus, subsequent aspiration would tend to open any existing aperture rather than to obstruct such aperture.

In the use of the cartridge, the vial is filled with a medicament, as a liquid medicament 46, and placed within a cartridge holder, not shown, provided with a plunger

rod for coupling with the piston 42, as through the intermediary of the screw 48 embedded within the piston. The plunger rod is then operated to force the piston 42 toward the forward end of the cartridge. The liquid within the cartridge is forced through the channel in the stopper 38 and will cause the diaphragm 40 to balloon out into the chamber 22 of the needle holder 20 until either the diaphragm ruptures because of internal stresses within the diaphragm or until the diaphragm ruptures by reason of engagement of the thinned diaphragm balloon wall with the projections 24. The sharp edge 26 of the projections ensure the rupturing of the balloon. Thus, free passage is now afforded for the medicament from the vial and out of the needle. Aspirating can be effected by performing a withdrawing action on the plunger rod immediately after diaphragm rupture and which rupture can be observed through the transparent holder 20. Because of the normal reflexed condition of the diaphragm, aspiration is performed much more readily since blockage of flow of blood from a patient by reason of diaphragm fragments overlapping or contacting is obviated, aspiration tending to open the burst diaphragm passage rather than closing it. Blocking of the passage of the needle is obviated because the tension on the thin ballooned wall of the diaphragm when it is burst will immediately draw all fragments of the wall away from the needle. It should be noted that by reason of the cutting members 24, the back end of the needle need not be sharpened, thus saving expense in the cost of manufacture of the needle, and the positioning of the rear end of the needle is not critical.

Having thus described the invention, what is claimed is:

1. A cartridge comprising a container, a stopper at the forward end of the container, a fluid within the container, said stopper having a resilient wall section which presents a convex face toward the fluid in the container,

when the pressures are equalized on both sides of said wall section, said wall section being adapted to be flexed in an opposite direction so as to present a substantially concave face toward the fluid, ballooned, and eventually burst on application of pressure to the fluid, said cartridge being further provided with a shield in advance of the stopper, said shield being hollow and free of obstructions for a substantial distance beyond the stopper to enable such ballooning action of the wall section to occur within the shield.

2. The cartridge of claim 1 wherein the cartridge has a neck and the diaphragm has a channeled cylinder fitted in the neck, the wall section lying in said channeled cylinder.

3. The cartridge of claim 1 wherein the shield functions as a holder, a needle fixed in said holder, said stopper having a flange positioned between the neck end portion of the vial and the holder, and means for clamping together the vial, flange of the stopper and holder

4. The cartridge of claim 3 wherein the holder is provided, internally thereof, with knife edges remote from the stopper in the path of movement of a ballooning wall section.

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