

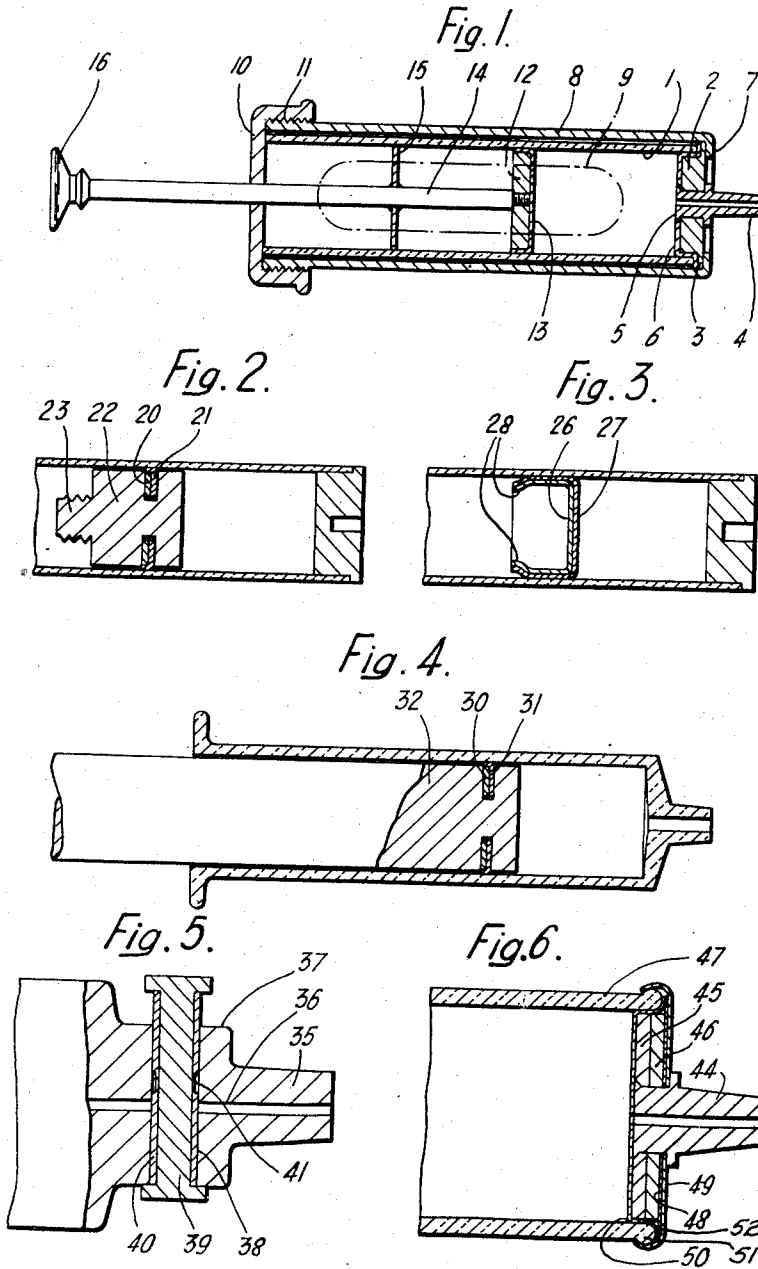
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HYPODERMIC SYRINGES

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HYPODERMIC SYRINGES

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One of the difficulties in manufacturing hypodermic syringes and similar apparatus is in providing joints between the various parts of the apparatus which are leak-proof and yet can be easily dismantled and which do not present difficulties in sterilisation. In certain circumstances also joints require a certain amount of lubrication and also must not deteriorate with changes in temperature.

The present invention provides a simple and improved form of joint which can be easily dismantled, which is self-lubricating, which gives very satisfactory sealing, and which withstands sterilisation without deterioration while enabling a hypodermic syringe to be made with all these advantages by a very simple and economical construction.

According to the invention, a sealing surface is formed by a sealing layer of halogenated ethylene such as polytetrafluoroethylene known as Fluon or polymonochlorotrifluoroethylene known as Hostaflon on a rigid supporting member preferably formed of material which has a similar coefficient of expansion as the material of the member with which the sealing surfaces engages. Thus in a syringe having a glass barrel, the piston and front cap may be of a nickel alloy known as Nilo 36 which contains 36% nickel and 64% iron and which has a similar coefficient of expansion to that of glass and which is coated with Fluon or Hostaflon. Generally Fluon is preferable to Hostaflon.

Various examples of sealing joints according to the invention are shown in the accompanying drawings in which:

Figure 1 shows in longitudinal part section a hypodermic syringe having a piston and front cap according to the invention;

Figure 2 shows a form of piston particularly for a disposable ampoule;

Figure 3 shows another form of piston for a disposable ampoule;

Figure 4 shows a plunger for a hypodermic syringe;

Figure 5 shows a stop-cock for a hypodermic syringe according to the invention; and

Figure 6 shows another form of hypodermic syringe.

In Figure 1, the syringe comprises a glass barrel 1 open at both ends, and a front cap consisting of a disc 2 of Nilo 36 flanged at 3 and having a tapered central spigot 4 riveted into the disc 2 to form a flange 5. A fluid-tight seal between the barrel 1 and disc 2 is formed by a "hat shaped" Fluon washer 6 which is applied to the disc 3 and held by the flange 5. The barrel 1 and disc 2 are held together in a tubular syringe body 8, cut away at 9 to enable the piston and the scale on the barrel to be observed, and having an inwardly projecting flange 7 at the front end. A rear cap 10 is screwed on to threads 11 on the rear end of the body 8 so as to engage the rear end of the barrel 1 pressing the front end of the barrel firmly on to the Fluon washer 6 on the disc 2 which is seated against the flange 7.

The piston comprises a Nilo disc 12 coated on its front

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face and periphery with Fluon 13 making linear contact of about $\frac{1}{8}$ of an inch with the bore of the barrel 1. The Fluon coating is .010 of an inch thick. The disc is secured to a piston rod 14 which carries a guide disc 15 preferably of Nilo a distance of between one and two diameters of the disc behind the disc. The rear end of the piston rod 14 has a finger piece 16. Linear contact of about $\frac{1}{8}$ of an inch gives a satisfactory permanent seal in bores of up to $1\frac{1}{2}$ inches diameter.

In Figure 2, a piston for a disposable ampoule of .010 of an inch thick phial is shown, which consists of a Nilo disc 20 and Fluon cup washer 21. The disc 20 maintains the shape and size of the Fluon washer 21 during and after sterilisation. The disc 20 and washer 21 are carried by a nylon piston 22 which passes through the central hole of the disc 20 and washer 21 and also has a threaded projection 23 from the rear face which can be engaged by a plunger. In a disposable ampoule, a linear contact of about .010 of an inch is satisfactory.

In Figure 3, the piston comprises a cup 26 of thin Nilo coated on its outer surfaces by spraying with Fluon 27 and having a pair of inwardly projecting dimples 28 which can be engaged by a bayonet attachment on a plunger. The Fluon coated cup 26 may be formed by drawing a flat disc of coated Nilo.

Figure 4 shows a similar construction of sealing washer to Figure 2 consisting of a Nilo disc 30 and Fluon cup washer 31 mounted in a nylon plunger 32 of a hypodermic syringe.

Figure 5 shows a stop-cock according to the invention, formed in the nozzle of a syringe. The nozzle 35, tapered to take a hypodermic needle, has a central bore 36 and a large central boss 37 through which is a transverse bore 38 of accurate cylindrical form and of a diameter substantially greater than the bore 36. The valve member consists of a plug 39 of a material of a similar coefficient of expansion to that of the body 37 and having a diameter slightly less than the diameter of the transverse hole 38 by an amount of, say, 0.016 of an inch.

The plug is surrounded by a tube 40 of Fluon which fits precisely in the bore 38. Slightly to one side of the centre of the plug, a groove 41 is turned in the outer surface of the Fluon tube so that the tube is reduced in thickness to a few thousandths of an inch. The parallel portion of the tube of full diameter, completely prevents the passage of fluid through the bore 36, but when the plug is pressed sideways so that the groove 41 registers with the bore 36, the fluid can flow. The groove in the tube may have varying shapes so as to give a gradual or abrupt cut-off. In an alternative form the groove may be formed in the plug itself into which the Fluon is moulded.

Figure 6 shows a syringe in which the front cap comprises a central nozzle 44 riveted into two Nilo discs 45, 46 forming a spigot of a diameter less than the bore of the barrel 47 by .016 of an inch, and a further stiffening disc 48 which forms a flange between the disc 46 and a thin metal disc 49 of larger diameter than the disc 48. The discs 45, 46 are surrounded by a hat-shaped Fluon disc washer 50 about .010 of an inch thick. The parts are heated to 230° C. and assembled, so that the Fluon washer is squeezed tightly between the barrel and cap. The front cap is then held in place by spinning the flange of the disc 49 over a ridge or beading 51 surrounding the end of the barrel 47. The seal is formed at 52, and it may be desirable in some cases to cut away the front of the disc.

Apart from Nilo, other rigid materials which are particularly suitable as backings or supports for use in conjunction with the Fluon or Hostaflon which forms the self-lubricating sealing member are glass, stainless steel,

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and stainless iron. Preferably any such combination of sealing member and backing should withstand sterilising at 160 degrees centigrade.

The Nilo alloy referred to is particularly suitable for use in conjunction with a Fluon sealing surface fitting against glass having a low coefficient of expansion or known by the registered trademark Pyrex. Stainless iron is particularly suitable for use with glass having a coefficient of expansion of about 10.5×10^{-6} .

I claim:

1. A hypodermic syringe comprising a barrel, an end cap formed of a material having a coefficient of expansion substantially equal to that of said barrel, said end cap comprising a first portion slightly less in diameter than the internal diameter of said barrel and extending into said barrel, a nozzle secured to said end cap, a sealing member formed by a relatively thin layer of a halogenated ethylene of the class consisting of polytetrafluoroethylene and polymonochlorotrifluoroethylene interposed between the adjacent surfaces of said barrel and said end cap, and means for securing said end cap to said barrel.

2. A hypodermic syringe according to claim 1, in which said end cap comprises a second portion having a diameter greater than the internal diameter of said barrel and extending over the end of said barrel between said sealing member and said securing means.

3. A hypodermic syringe according to claim 2, in which said second portion is a flange formed on said portion inserted into the barrel.

4. A hypodermic syringe according to claim 2 in which said second portion is a separate disc.

5. A hypodermic syringe according to claim 2 in which said securing means comprises an outwardly extending bead on said barrel and a third portion in contact with said second portion and having its periphery spun over said bead.

6. A hypodermic syringe according to claim 1 in which said holding means comprises a tubular syringe body encompassing said barrel, an inwardly extending flange por-

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tion at one end of said body in contact with said second portion, and a threaded cap engaging threads on the other end of said body screwed to bear upon the rear end of said barrel and thus to press the front end of said barrel firmly onto said sealing layer.

7. A hypodermic syringe according to claim 1 in which said sealing member is hat-shaped and wherein the crown extends over the inside face of said first portion of said end cap.

8. A hypodermic syringe according to claim 1 wherein said end cap material is a nickel alloy comprising nickel and iron.

9. A hypodermic syringe according to claim 1 wherein said sealing member is secured to said end cap by a rivet.

10. A hypodermic syringe comprising a barrel, an end cap and nozzle combination over one end of said barrel, a piston member slidable within said barrel and of a diameter slightly less than the internal diameter of the barrel, said piston comprising an annular groove, a thin supporting metal washer of a diameter slightly less than the internal diameter of the barrel, located within said groove, and formed of a material having a coefficient of expansion substantially equal to that of said barrel and a sealing layer of a halogenated ethylene of the class consisting of polytetrafluoroethylene and polymonochlorotrifluoroethylene adjacent to said washer in said groove and extending over the periphery of said washer.

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