Oct. 31, 1944. S. J. EVERETT 2,361,617

HYPODERMIC SYRINGE

Filed May 21, 1941

Fig. 1.

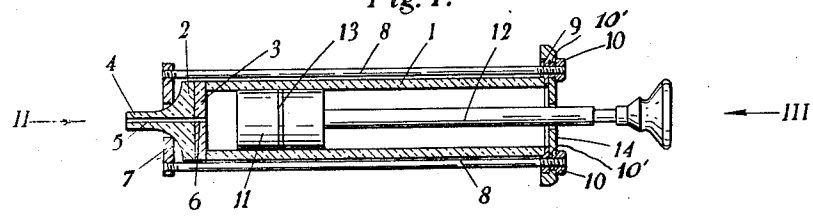


Fig. 2.

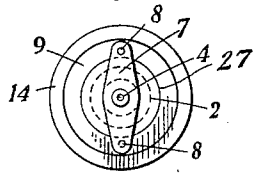


Fig. 3

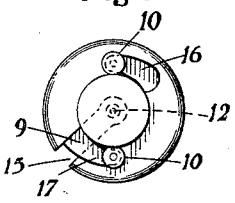


Fig. 4.

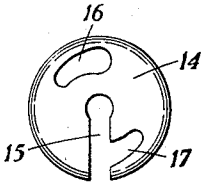


Fig. 5

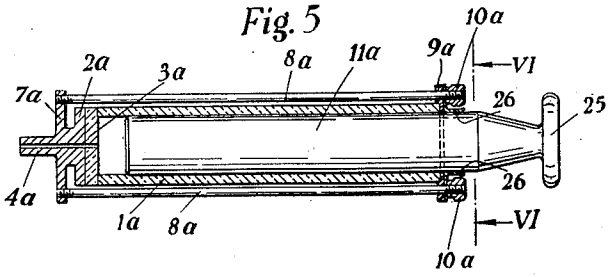


Fig. 6.

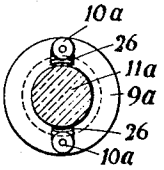


Fig. 7.

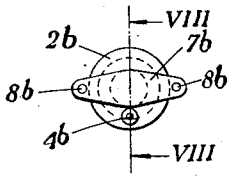
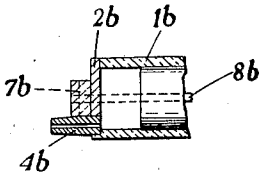


Fig. 8.



INVENTOR.
S. J. EVERETT,
BY
ATTORNEYS

Patented Oct. 31, 1944

2,361,617

UNITED STATES PATENT OFFICE

2,361,617

HYPODERMIC SYRINGE

Samuel James Everett, Thornton Heath, England

Application May 21, 1941, Serial No. 394,547
In Great Britain June 1, 1940

7 Claims. (Cl. 128—215)

When a hypodermic syringe is subjected, as sometimes happens, to rapid and substantial temperature changes, for example when the syringe is plunged into boiling water or when a hot syringe is plunged into cold liquid, undesirable expansion or contraction of the parts of the syringe is liable to occur. Volumetric changes in the barrel can be avoided by manufacturing this from a low-expansion glass, such as the glass sold under the registered trade-mark "Pyrex." However, the arrangement of the metal parts of the syringe, so that they can readily adapt themselves to temperature changes, presents a problem, particularly because low-expansion metals corrode too readily to allow them to be used in hypodermic syringes, whereas brass which expands and contracts considerably with temperature changes is a very convenient metal for the purpose.

One aim of the present invention, therefore, is to provide a hypodermic syringe which is constructed so that the parts can readily accommodate themselves to temperature changes. This aim is achieved, according to the invention, by providing the syringe with a frame which acts resiliently on the center of a front closure member, to secure the latter to the barrel, and reacts against the opposite end of the barrel, the frame comprising radial arms lying beyond the front closure member and connected by tension members to an element that acts on the rear end of the barrel. Thus, the resilience in the frame ensures that, if there is a differential expansion of the parts, they remain properly assembled and undesirable distortions and changes in stress do not occur. Such differential expansion arises, for instance, when the barrel is made of low-expansion glass and other parts are of brass. The resilience incorporated in the frame then compensates for a change in the length of the frame relatively to the barrel and the frame can be arranged so that the front closure member can expand relatively to the barrel without any undesired effects.

The necessary resilience may be provided in any convenient manner; for example, a resilient element can be interposed between the frame and the rear end of the barrel, but advantageously the resilience may be provided by a flexible yoke, which incorporates the said radial arms and which bears upon, or is integral with, the front closure member. The frame may consist of the yoke, a ring bearing against the opposite end of the barrel, and two tie rods lying in a plane containing the axis of the barrel and connecting the ends of the yoke respectively with the ring. In all cases, the pressure exerted by the yoke is at, or near, the centre of the closure member so that an even pressure is distributed round the periphery of the closure member. The front closure member may consist of a glass disc with an integral nozzle held in position by a resilient yoke as aforesaid. A lapped joint is provided between the closure member and the adjacent end of the barrel, or, if a glass plate formed with a port is interposed between the barrel and the closure member, the lapped joint is provided between the plate and the barrel.

In order that the invention may be clearly understood and readily carried into effect, constructions in accordance therewith will now be described, by way of example, with reference to the accompanying drawing, in which:

Figure 1 is a sectional elevation of a hypodermic syringe,

Figure 2 is a plan of the syringe in Fig. 1 as viewed in the direction of the arrow II,

Figure 3 is a plan of the syringe in Fig. 1 as viewed in the direction of the arrow III,

Figure 4 is a plan of a detail of the syringe in Fig. 1,

Figure 5 is a sectional elevation of a modified form of hypodermic syringe,

Figure 6 is a section on the line VI—VI in Fig. 5.

Figure 7 is a plan of one end of a third form of syringe, and

Figure 8 is a section on the line VIII—VIII in Fig. 7.

Referring to the syringe shown in Fig. 1, this comprises a glass barrel 1 to which a frame serves to secure a glass front closure member 2, a glass plate 3 being interposed between the barrel 1 and the closure member 2. The latter comprises a disc 27 formed with a central nozzle 4 having a fine central passage 5 which registers with a corresponding port 6 in the plate 3.

The frame comprises a resilient yoke 7 which bears upon the front closure member 2 and is formed with a central aperture through which the nozzle 4 extends. When the syringe is in use a hollow cap, carrying a hypodermic needle, is fitted over the nozzle 4 in the manner well known in the art. The frame also includes tie rods 8 lying in a plane passing through the axis of the barrel and screwed at their ends into tapped holes at the ends of the yoke 7. At their outer ends the tie rods pass through holes in a ring 9 that bears against the remote end of the barrel 1. Beyond the ring 9 the tie rods 8 are threaded to receive nuts 10. The latter which bear against

the ring 9 are tightened until the desired strain exists in the resilient yoke 7, and the barrel 1 and plate 3 are securely held between the front closure member 2 and the ring 9. It will be seen that the ring 9 is formed with a central opening large enough to permit the insertion of a piston 11 carried by a comparatively thin piston rod 12. The piston 11 is formed so as to receive a piston ring 13.

To prevent the inadvertent withdrawal of the piston 11 from the barrel 1, a readily detachable plate 14 is provided upon the ring 9. This plate, which is shown by itself in Fig. 4, is formed with a radial slot 15 and arcuate slots 16 and 17 which are tapered in the circumferential direction. When the detachable plate 14 is to be secured, the piston rod 12 is passed radially along the slot 15 to the centre of the plate 14 which is then moved towards the barrel with the wider end of the slot 16 in alignment with one of the nuts 10. The latter will then project through the slot 16 while the other nut projects through the radial slot 15 until the heads of the nuts 10 lie beyond the plate 14 and undercut parts 10' of the nuts lie within the slots. The plate 14 can then be turned about the axis of the barrel so that the arcuate slots 16 and 17 pass circumferentially along the undercut parts 10' of the nuts 10 to the position shown in Fig. 3 in which the plate 14 is locked to the frame by the heads of the nuts 10 overlapping the narrow ends of the slots 16 and 17.

One way in which the syringe shown in Figures 5 and 6 differs from that of Fig. 1 is that a metal closure member 2*a* is formed integrally with a nozzle 4*a* as well as a resilient yoke 7*a*. The yoke 7*a*, the rods 8*a* and a ring 9*a* provide the frame which secures the front closure member 2*a* to the barrel 1*a*. A glass disc 3*a* is again interposed between these members. The piston 11*a* in this construction is made entirely of glass and consists of a plunger of uniform cross section formed at its outer end with a thumb button 25. To prevent the plunger 11*a* from sliding too freely in the barrel, friction devices 26 are arranged to bear against the surface of the plunger. These friction devices are small angle pieces, through which the rods 8*a* pass and which are secured between the ring 9*a* and the nuts 10*a* carried by the rods 8*a*.

The modification shown in Figures 7 and 8 comprises a closure member 2*b* which bears directly against the glass barrel 1*b* and is integral with a resilient yoke 7*b* forming part of a frame similar to that appearing in Fig. 5 and including rods 8*b*. The nozzle 4*b* in this construction is eccentrically disposed in relation to the barrel.

In a further modification the nozzle is separate from the front closure member and is formed with a conical external surface that fits in a conical mouth formed in the port in the closure member. The nozzle projects through an aperture in the centre of the resilient yoke and the latter bears on a shoulder on the nozzle so as to hold the nozzle in engagement with the closure member as well as the closure member in engagement with the barrel or with the glass disc interposed between the barrel and the closure member.

In assembling a syringe constructed as shown in the drawing, the frame is first assembled with the ring 9 or 9*a* and the front closure member 2, 2*a* or 2*b* substantially in the relative positions they are ultimately to occupy but with the ring slightly more separated from the front closure member. Then the barrel 1, 1*a* or 1*b* and any glass disc 3 or 3*a* are inserted laterally into the frame and put in the positions they are to occupy with respect to the ring and front closure member. Next, the nuts 10 or 10*a* are tightened so that the parts are clamped together between the resilient yoke 7, 7*a* or 7*b* and the ring 9 or 9*a*. Then the piston is inserted. Finally any plate, such as the plate 14, is secured in position in the manner described above. The degree to which the nuts 10 are tightened is such that the parts remain tight in engagement with each other in spite of any differential expansion or contraction that may occur on account of temperature changes, such expansion or contraction being accommodated by the bending of the arms of the yoke.

I claim:

1. A hypodermic syringe comprising, in combination, a barrel, a piston slidable within said barrel, a front closure member, including a disc and a nozzle extending forward from said disc, and a frame adapted to secure said front closure member to said barrel, said frame including a resilient yoke acting substantially centrally on said front closure member, a reaction member arranged to react against the rear end of said barrel and tension means extending longitudinally beside and spaced from said barrel and connecting said reaction member to said yoke, the latter including arms radiating from said nozzle and spaced from said disc.

2. A hypodermic syringe comprising, in combination, a barrel, a piston slidable within said barrel, a front closure member comprising a disc with a projecting nozzle, a resilient yoke bearing centrally on said closure member to secure the latter to said barrel, a reaction member bearing on the rear end of said barrel, and ties spaced from said barrel connecting said reaction member and the extremities of said yoke, the latter consisting of arms spaced from said disc and radiating from the centre of said disc.

3. A hypodermic syringe comprising, in combination, a barrel, a piston slidable within said barrel, a front closure member comprising a disc with a nozzle extending axially therefrom, resilient arms extending radially from said nozzle and spaced from said disc, a reaction member adapted to bear upon the rear end of said barrel, and ties spaced from said barrel connecting the outer ends of said resilient arms to said reaction member.

4. A hypodermic syringe comprising, in combination, a barrel, a piston slidable within said barrel, a front closure member comprising a disc with a nozzle extending therefrom parallel to but to one side of the axis of said barrel, resilient arms radiating from the centre of said disc, a reaction member arranged to react against the rear end of said barrel, and ties connecting the outer ends of said resilient arms to said reaction member.

5. A hypodermic syringe comprising, in combination, a barrel, a piston slidable within said barrel, a front closure member, a central nozzle on said member, a yoke formed with a central aperture to receive said nozzle and with resilient radial arms, a reaction member resting on the rear edge of said barrel, and tie rods connecting the outer extremities of said arms to said reaction member.

6. A hypodermic syringe comprising, in combination, a barrel, a piston slidable within said barrel, a front closure member, a nozzle projecting forwardly from said front closure member, and a frame arranged to act resiliently on said

front closure member to maintain same in position with respect to said barrel, said frame including a ring resting on the rear edge of said barrel, and formed with an aperture through which said piston can be removed, a pair of diametrically opposed radial resilient arms lying on the side of said closure member remote from said barrel, two tie rods connecting the ends of said arms respectively to said ring, and means for adjusting said tie rods to vary the distance between said ring and said ends of said arms.

7. A hypodermic syringe comprising, in combination, a barrel, a piston assembly including a piston rod and a piston slidable in said barrel, a front closure member, a nozzle projecting forwardly from said closure member, radial resilient arms projecting from said nozzle, a ring resting on the edge of said barrel remote from said closure member and formed with a central aperture through which said piston can pass and with small lateral apertures, tie rods fixed to said arms and passing through said small apertures, heads on said tie rods bearing on the face of said ring remote from said barrel, and a detachable plate formed with a radial slot through which said piston rod passes and with arcuate slots cooperating with said heads to hold said plate in position.

SAMUEL JAMES EVERETT.