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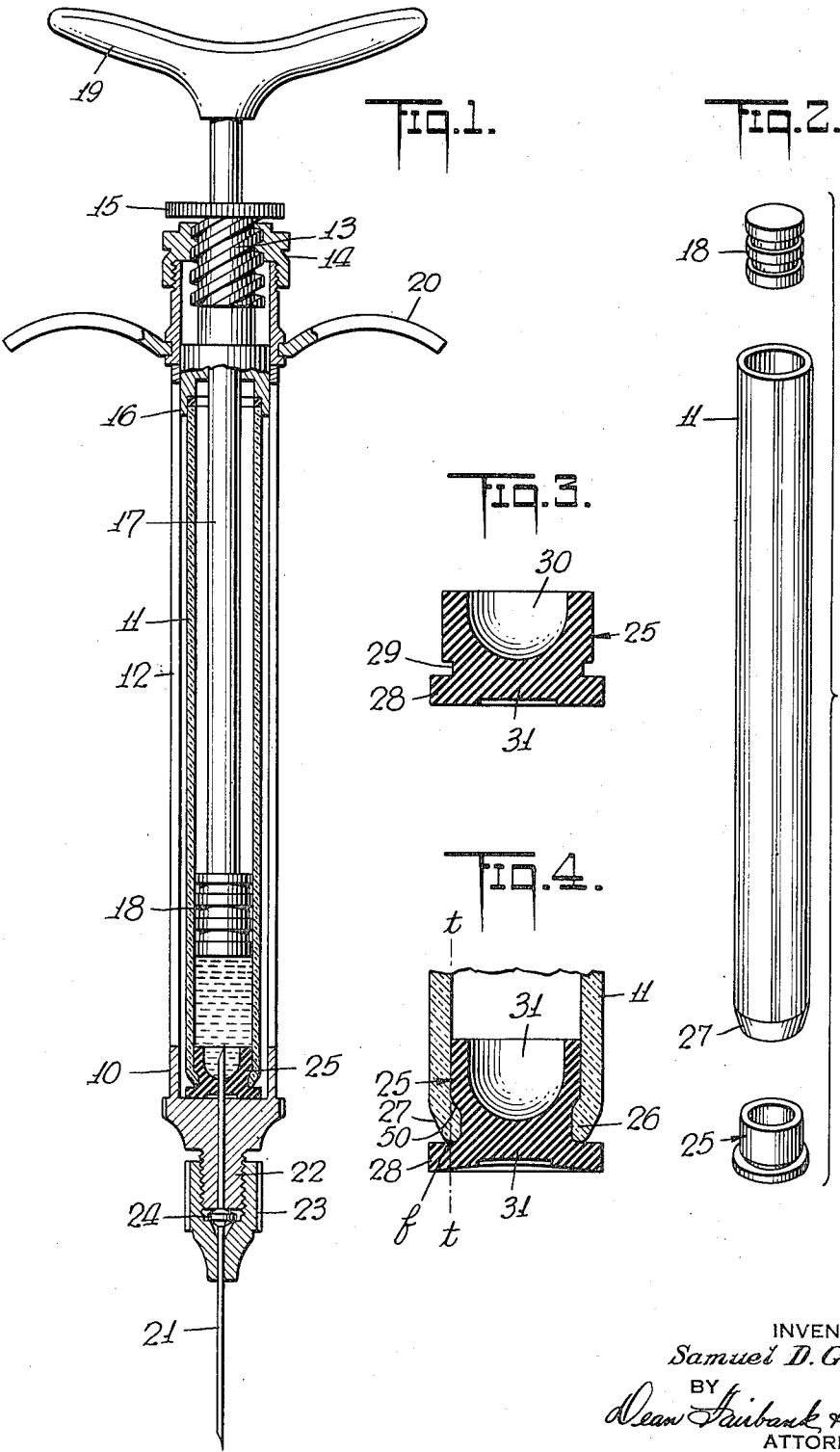
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MEDICAMENT CARTRIDGE OR VIAL

Filed Nov. 1, 1943

2 Sheets-Sheet 1



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FIG. 5.

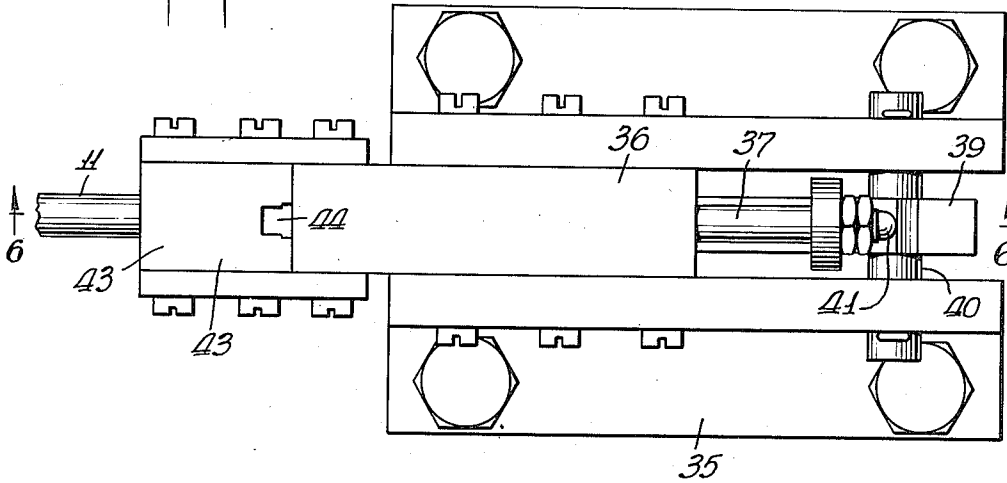
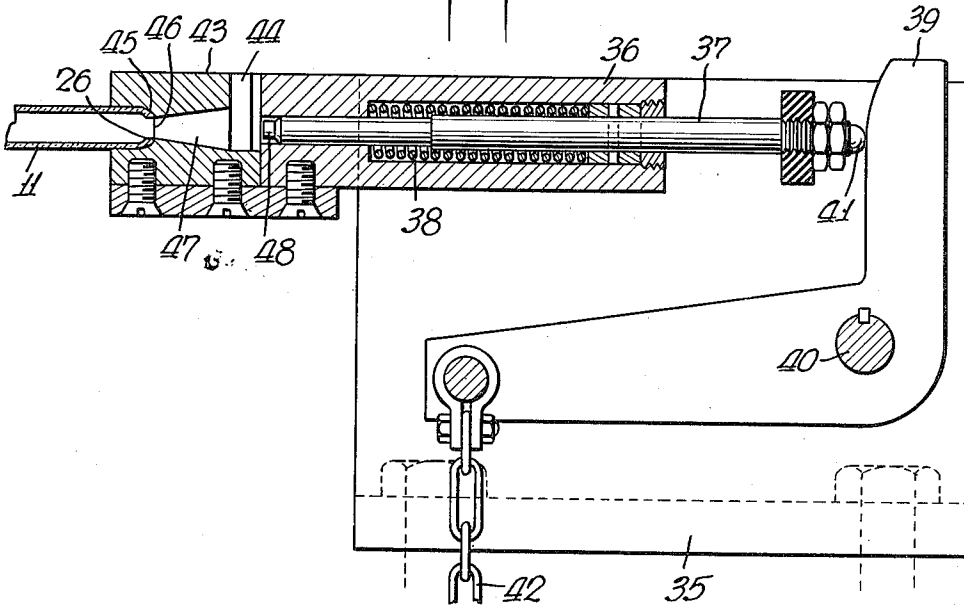


FIG. 6.



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MEDICAMENT CARTRIDGE OR VIAL

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mesne assignments, to Oradent Chemical Co.
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3 Claims. (Cl. 128—272)

1 The present invention is concerned primarily with medicament containers, and while of more general application to serum vials and the like, has an important application to medicament cartridges used in hypodermic syringes such, for instance, as those employed for local anaesthesia in dental surgery.

It is an object of the invention to provide a container, vial or cartridge of the above type with a closure through which the medicament is to be ejected, which closure shall be devoid of metal parts and yet shall be proof against leakage under applied fluid pressure of 1000 lbs. per square inch or more, and which shall even withstand the severe strain of repeated sudden jerking operation of the syringe plunger.

It is among other objects to provide a sealed container, vial or cartridge of the above type, the closure of which is of a unitary homogeneous piece, the sealing effectiveness of which is not impaired by the heat of sterilization to which such containers, vials or cartridges are commonly subjected but which, on the contrary, develops the superlative security of seal as an incident to such sterilization, and which maintains the security of such seal, without deleterious effect upon the medicament, even though the filled cartridge be kept in stock for a long period of time prior to use.

Another object is to provide a sealed cartridge of the above type, the closure of which is not subjected to disintegration as a result of penetration by the cannula in filling, so that there is obviated the loss incurred in the rejection of cartridges with free particles that have been cut from the closure and float in the medicament.

Another object is to provide a cartridge of the above type which dispenses with the need for a plurality of different sizes of calibrated closure plugs, securely to fit each of the various diameters of cartridge rim between the wide limits encountered in the ordinary fabrication of such glass tubes, and by the use of which a plug of a single calibre will securely seal all cartridges even those at the extremes of oversize or of undersize in rim diameter.

In the accompanying drawings, in which is shown one of various possible embodiments of the several features of the invention,

Fig. 1 is a view largely in longitudinal cross-section of a syringe incorporating the cartridge structure of the present invention,

Fig. 2 is a dropped perspective view of the cartridge,

Fig. 3 is a view in longitudinal cross-section on

2 a larger scale of the cartridge closure plug as an article of manufacture,

Fig. 4 is an enlarged fragmentary longitudinal section through the plugged end of the cartridge,

Fig. 5 is a plan view of vial plugging apparatus, and

Fig. 6 is a view in longitudinal cross-section thereof taken on line 6—6 of Fig. 5.

Referring now to the drawings, the syringe shown in Fig. 1 is of generally conventional construction. It includes the holder 10 for the medicament cartridge 11 which may be inserted thereinto through elongated lateral opening 12. A rotatable screw-plug 13 is threaded into the head 14 of the holder. The plug has a knurled rim 15 at the upper end, by manipulation of which it may be screwed inward to bring its depending flange 16 into engagement with the upper end of the cartridge 11. Through the plug 13 extends the plunger shaft 17 which engages the conventional piston 18 that plugs the upper end of the cartridge 11. The plunger shaft mounts the usual hand-grip 19 and the usual finger-grip 20 extends laterally from near the upper end of the holder to assist in forcing the plunger downward by pressure of the hand for forcing the medicament through the cannula 21.

The lower end of the cartridge has a nipple 22 upon which is threaded nut 23 that clamps the button 24 upon the cannula 21 which penetrates the closure 25 of the cartridge preparatory to injection.

The present invention is more especially concerned with the cartridge structure and particularly with the sealing or closure end thereof.

The cartridge 11 is a cylindrical tube of glass, one end of which is closed by the conventional piston plug 18. At the other end, the cartridge rim is intumed, as best shown in the enlarged view of Fig. 4 to an inner diameter somewhat smaller than the bore of the cartridge. To this end the glass cylinder is preferably rolled inward to a taper as at 27, thereby to form an internal rounded annular rib 26 bounded by line *t-t*, which rib is of considerable width axially and of lesser thickness radially of the cartridge. Desirably the axial width of rib 26 is at least as great as the thickness of the cartridge wall from which it is formed and its radial thickness is less than that of the cartridge wall, as shown. The face end or extremity *f* of the cartridge wall takes the thrust of injection without suffering destructive shearing strain. For, said rim face partly encompasses the bore of the cartridge and relatively little shear is taken by the rugged annular

rib 26 which is well able to resist any such strain.

In the usual application for employment in the hypodermic syringe shown, the inner diameter of the cartridge as manufactured in quantity production varies widely, between 6.35 and 8.0 mm. and its outer diameter between 8.25 and 9.00 mm. The innermost diameter of the rim 26 varies between 5.45 and 5.75 mm.

According to the invention, the closure for the inturned end of the cartridge is in the form of a non-metallic plug 25 of resilient material and preferably a very fine grade of soft rubber that has been somewhat undercured. The rubber plug preferably includes a unitary head 28, the peripheral area of which rests against the face of the cartridge rim. The plug also has a peripheral groove 29 which may be rectangular in cross-section, as shown, and is immediately adjacent the head. Desirably, the plug is hollow, having a deep cup-shaped depression 30 in the inner end thereof, so as to afford a relatively thin web 31 for facility of penetration by the cannula.

For use with the cartridge above described, the diameter of the plug head 28 would be approximately equal to the outer diameter of the cartridge, that is, its diameter would be about 9 mm. The plug would be of diameter approximately of 7.5 mm, which for the reasons set forth hereinafter, will securely seal the mouths of all cartridges throughout the range above set forth of 6.35 to 8.00 mm. diameter. The effective length of the plug introduced into the cartridge would be approximately 4 mm. The depth and width of the peripheral groove would be less than .5 mm., preferably about .375 mm.; the diameter of the depression 30 would be about 4 mm. and its depth about 3 mm.

In Figs. 5 and 6 is shown one of various possible forms of apparatus for plugging the cartridge. That apparatus consists of a frame 35 which mounts a horizontal cylinder 36 that accommodates the plugging plunger 37, which is normally held by a coil spring 38 at the intake end of its stroke. A bell crank lever 39 is pivoted at 40 upon the frame and engages the end 41 of the plunger to be forced inward, desirably by a treadle operation transmitted through chain 42.

Affixed to the forward end of the cylinder 36 is the plugging chuck 43. That chuck has an intake port 44 at its top through which the plugs are successively introduced. The chuck also has a cartridge rest socket 45 affording an abrupt stop shoulder 46 for accommodating the inturned end 26 of the cartridge to be plugged. Intervening between the inlet port 44 and the cartridge rest 45 is a frusto-conical guide 47 coaxial with the plunger and the cartridge and tapering inward toward the cartridge stop shoulder 46. The maximum diameter of the guide is equal to that of the plug head 28 while its minimum diameter is substantially equal to the innermost diameter of the inturned cartridge rim 26.

The plunger has a main or effective diameter less than the maximum and greater than the minimum diameter of the guide 47. It also has a tip 48 of reduced diameter somewhat less than that of the opening defined by the inturned rim of the cartridge. The plunger has an effective stroke such as to cause the extremity of the reduced tip thereof to travel slightly beyond the stop shoulder 46 in the plugging chuck.

The plugging operation will be apparent from the above description, but will be briefly described. The plug is introduced through the in-

let port 44 formed as shown so as to bring its enlarged head to the right. The cartridge 11 is retained by hand against the stop shoulder 46. Upon depression of the treadle the plunger 37 is advanced against the resistance of spring 38 to force the rubber plug through the frusto-conical guide 47. In that operation the rim of the head 28 is folded backward for its underface to contact the wall of the guide 47, while the plug is gradually compressed so as readily to enter the cartridge at the inturned rim 26 thereof. As the plug enters the cartridge, the peripheral pressure of the guide is relieved and the plug expands into contact with the cartridge wall. Toward the end of the plunger stroke, the inturned cartridge rim enters and stretches groove 29 of the plug to accommodate the annular rib 26, and the plunger tip 48 forces the plug, and with it the cartridge, slightly away from the shoulder 46, permitting the folded rim of the plug head 28 to snap past stop shoulder 46 into place against the end of the cartridge.

After the plugging operation, whether performed by the apparatus above described, or otherwise, the empty plugged cartridge is sterilized according to conventional practice at a temperature in the order of 250 degrees F. In this operation the rubber plug expands and incidentally its vulcanization is completed, preferably without overcuring, so that the plug is permanently deformed to assume the contour of the inturned cartridge rim, as best shown in Fig. 4. The longitudinal expansion of the plug, and the possible slight reduction in diameter thereof, in no wise interferes with the security of seal, since that is effected chiefly at the region of the permanently deformed inturned rim engaging portion 50, shown in Fig. 4.

According to the present invention, even though the plug is made of the soft rubber preferred, its security of hold at the inturned rim 26 is astonishingly effective. The pressure exerted in injection is effectively cushioned by the rubber plug head 28 which guards against impact of the glass cartridge 11 against the metal holder 10. The relatively large peripheral area of glass contacting the head end of the plug 25 also guards against pushing the rubber plug into the cartridge under such pressure. As appears from Fig. 4, the glass cartridge is not apt to crack at its inturned rim 26, for the major stress imposed by the applied pressure is through the thickness of the cartridge wall and relatively little shear is applied to the annular rib 26 beyond line *t-t*. In pressure application, the hollow depression 30 of the plug becomes flared outward against the cartridge wall, but the mainly effective seal is at the extremely tight and relatively large area of engagement at the shaped region 50 of the plug against the inner or convex surface 26 of the cartridge rim at which region the plug is keyed or locked in place. At that region the seal of the single uniform diameter of plug is sufficiently secure, regardless whether the cartridge have an average bore, an oversize or an undersize bore between the limits above set forth. In use, pressures of 1000 lbs. per square inch or higher may be applied without the slightest tendency to leak about the plug. Even jerky manipulation of the syringe plunger will not lead to leak.

Where a rubber plug is used with considerable filler to impart the hardness required for tightly hugging a cylindrical wall to withstand pressures exerted in hypodermic syringes, such rubber is apt not only adversely to affect the contents, but,

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in the process of introducing the cannula, especially in filling the sealed cartridge, particles of the rubber may be cut therefrom and enter the cartridge, necessitating its rejection upon inspection. Such rejections in commercial practice have been as high as 10 to 12 per cent, or higher when a very hard rubber has been used. The soft rubber plug of the present invention will not be cut in penetration of the cannula so that no solid particles enter the cartridge.

With a plain cartridge, devoid of the inturned rib shown in Fig. 4, a rubber closure plug would have to be made of as many as five different calibres, to accommodate with sufficient security each of the various cartridges. That involves slow assembly due to the need for selecting the right plug for each cartridge with possible breakage in attempting to force a large plug into an undersize tube, or looseness in the converse relation, not to mention the cost of the many dies for the various calibers of plug and the need for large inventory, since various plug sizes must always be available. By the present invention but one caliber of plug is required, and no selective skill is needed in assembly, for each plug fits any and all cartridges with security affording more than ample factor of safety against leak under pressure.

It is apparent that while the invention has an important application to cartridges for hypodermic syringes, it is applicable for other uses, as for instance, for sealing serum vials or other containers. The rubber plug and the rim of the vial or container neck would be of proportionately larger dimensions than those shown and described.

As many changes could be made in the above article and apparatus and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. A cylindrical medicament cartridge having a slightly inturned rim presenting a rounded internal rib of width axially of the cartridge approximating the wall thickness, and of thickness radially of the cartridge less than the wall thickness, the extremity of said rim having a portion encompassing the bore of the cartridge, a soft rubber plug encompassed by said cartridge and having a disk-shaped head unitary therewith,

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of diameter substantially equal to the outer diameter of the cartridge and abutting said extremity, said plug having an initially generally rectangular peripheral groove adjacent said head, of width materially smaller than that of said annular rib, whereby said groove will be stretched to accommodate said annular rib, said plug will be permanently conformed to the contour of said annular rib as a result of heat applied in sterilizing the cartridge.

2. The method of hermetically sealing a vitreous medicament cartridge with a somewhat undercured soft rubber plug, which comprises introducing the plug through the open slightly inturned end of the cartridge and sterilizing the cartridge, thereby completing the vulcanization of the rubber plug so that the rubber becomes permanently set for snug engagement with the contour of the inturned rim.

3. The method of hermetically sealing a vitreous medicament cartridge that has an inner rounded annular rib at its rim, with a somewhat undercured soft rubber plug that has an annular groove of width smaller than that of said rib, which method comprises introducing the plug through the rib end of said cartridge, whereby the groove becomes stretched over said rib, and sterilizing the cartridge, thereby completing the vulcanization of the rubber plug, so that the rubber becomes permanently conformed to the contour of the annular rib.

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