Nov. 12, 1935. S. D. GOLDBERG 2,020,828

HYPODERMIC SYRINGE AND CLOSURE CAP FOR CONTAINERS

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Fig. 1.

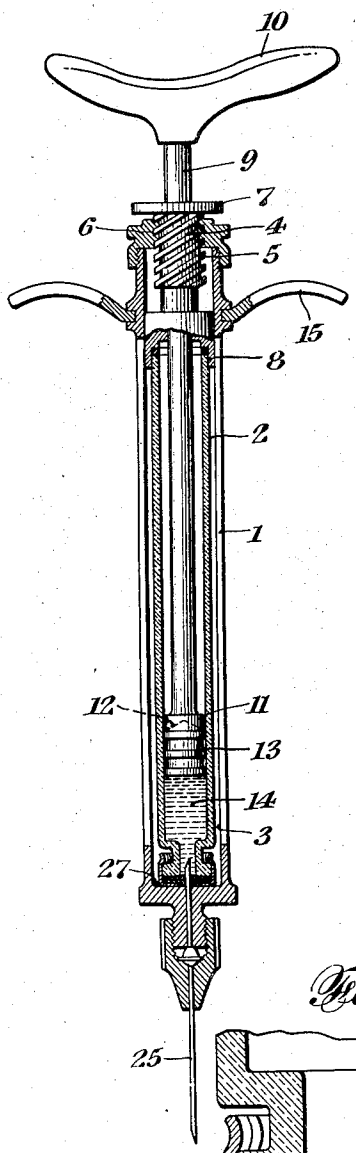


Fig. 2.

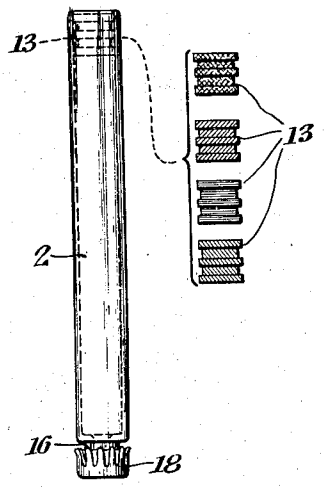


Fig. 3.

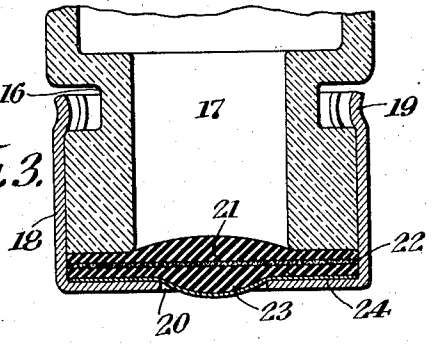


Fig. 4.

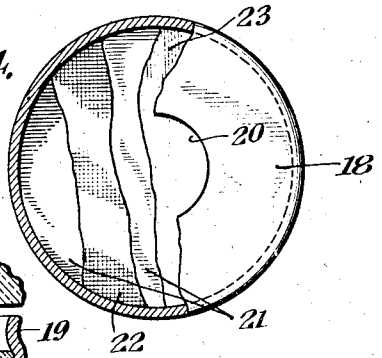
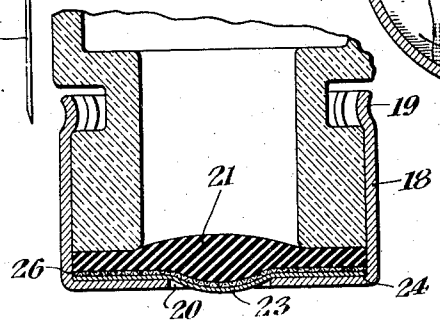


Fig. 5.



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Fig. 8.

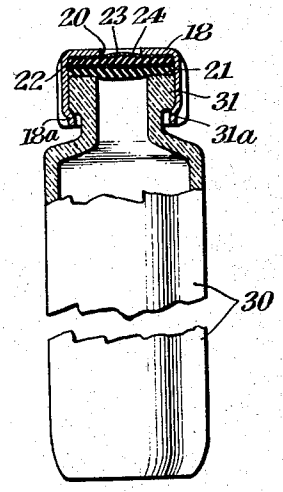


Fig. 7.

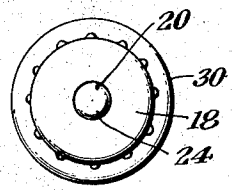


Fig. 6.

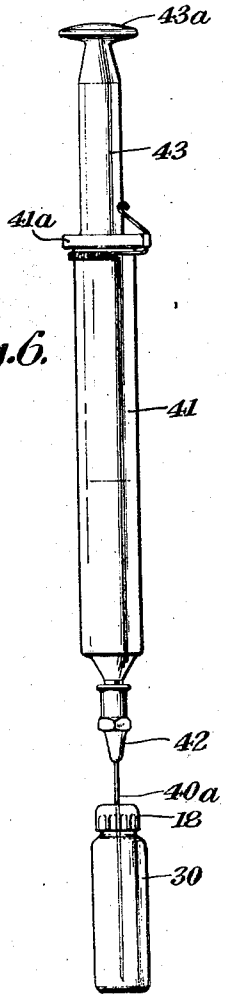
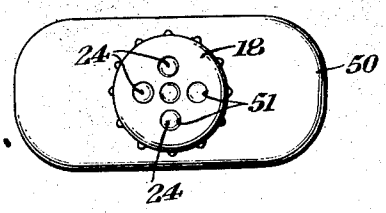


Fig. 9.



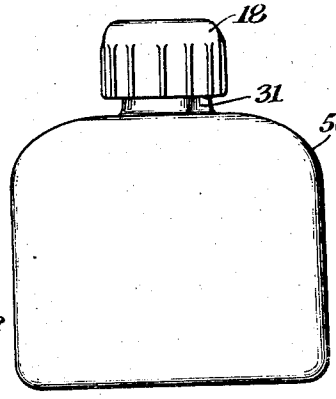
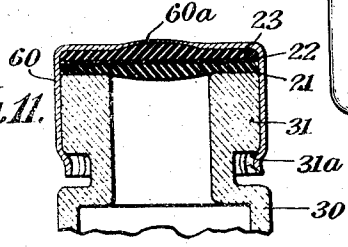


Fig. 10.

Fig. 11.



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HYPODERMIC SYRINGE AND CLOSURE CAP FOR CONTAINERS

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Application June 12, 1933, Serial No. 675,361

3 Claims. (Cl. 128—218)

This invention relates to hypodermic syringes, particularly the tubes or cartridges therefor. The invention also has reference to a closure cap adapted to close and seal the tube or cartridge of a hypodermic syringe, or a phial or container which receives a serum, medicament or the like.

Objection to the use of the several types of cartridge now employed including a glass tube arranged to be punctured at one end by a cannula, has been made because of the difficulty of properly sterilizing the part to be pierced by the cannula. This is true not only of the usual tube sealed at the end by a rubber plug but it also applies to the device of my U. S. Letters Patent No. 1,843,554. In the employment of the device of said Letters Patent, I have found when the metal cap and rubber diaphragm are forced into place to close one end of the cartridge, the pressure exerted on the rubber in making a leak-tight joint is such that distortion of the rubber at the aperture of the metal cap may occur. This distortion may occur as a depression of the rubber at the aperture which allows foreign septic matter to become lodged in the cap, making cleansing difficult. Alcohol or other antiseptic may be employed to wipe off the puncturable part of the various types of cartridge before the cannula is inserted, but spores are not usually killed thereby. Flaming of the part to be pierced is not satisfactory because it is difficult to insure that the germs and spores are removed from rubber thereby, and also if the rubber burns and the needle is thrust through charred material it may introduce harmful impurities into the blood stream. In addition I have found that the pressure on the rubber diaphragm of the cap described in said Letters Patent has sometimes resulted in making the rubber curl at its edges where it joins the mouth of the tube, which may result in a leak at this point.

An object of the present invention accordingly is to do away with the disadvantages above noted and to provide a cartridge which may be readily flamed to remove spores, bacteria and the like. Another object of the invention is to avoid the objectionable distortion of the diaphragm seal of the cap.

The same objects and advantages also apply to another form of the invention as illustrated herein in connection with a closure cap for a phial or container.

The invention accordingly comprises the novel devices and combinations thereof, specific embodiments of which are described herein by way of example only and in accordance with the manner in which I now prefer to practice the invention.

This application is a continuation in part of my pending application Serial No. 502,320, filed December 15, 1930.

Referring now to the accompanying drawings which form a part of this specification and illustrate by way of example, embodiments of the invention:—

Fig. 1 is a sectional elevation of the syringe showing a form of the improved cartridge with the cannula projecting through the cap;

Fig. 2 is an elevation of the cartridge itself, showing also four colors for plugs to designate strength of solutions;

Fig. 3 is an enlarged longitudinal sectional elevation of the cap end of the cartridge;

Fig. 4 is an enlarged plan view of the sealing diaphragm showing the preferred manner in which it is made up;

Fig. 5 is an enlarged longitudinal sectional elevation of a modified form of the cap end of the cartridge;

Fig. 6 is a sectional elevation of another form of syringe;

Fig. 7 is a plan view of the phial or container shown in Fig. 8;

Fig. 8 is a vertical sectional view, partly in elevation, of a phial or container having my novel closure cap applied thereto;

Fig. 9 is a plan view of the phial or container shown in Fig. 10;

Fig. 10 is an elevational view illustrating a modification of the invention; and

Fig. 11 is a vertical sectional view illustrating a modified form of closure cap.

The syringe of Fig. 1 includes a tubular cartridge holder 1 adapted to retain the cylindrical cartridge or tube 2 which is preferably of glass. In order to permit the admission of the cartridge the holder has an opening 3 which is of proper length for this purpose. In order to hold the cartridge in place the upper end is engaged by rotatable plug 4 having exterior screw-threads 5 coacting with interior screw-threads 6 on the upper part of the holder 1. The top of this plug is provided with a knurled portion 7 so that it may be rotated to move it towards or away from the end of the cartridge. The lower end of the plug is provided with depending flange 8 which fits around the upper end of the cartridge. Passing through the plug is the plunger shaft 9 at the upper end of which is the hand grip 10 and on the lower end of which is the plunger 11, provided with a dished portion 12 in the face there-

of. The plunger coacts with the piston 13 which when forced downwardly by the plunger exerts pressure on the anesthetic or other liquid 14 contained in the cartridge. The cavity or dished portion 12 provides an annular edge on the plunger which engages the piston plug 13 and prevents the plunger from slipping with possible fracture of the glass tube 1 when pressure is applied thereon through the hand grip 10. The usual finger grip 15 at the upper end of the syringe is provided to be gripped when the plunger is forced downwardly by the pressure of the hand on the hand grip 10. The plugs are preferably given distinctive colorings to indicate the strength of the solutions therein. For example, as shown in Fig. 2 the colors selected are orange, tan, blue and green representing different strengths of anesthetic medicament employed.

As shown more clearly in Figs. 2 to 4 inclusive, the piston 13 closes one end of the cartridge and the opposite end is closed by a crimped cap, the closure effected by the cap being such that enormous pressure may be brought to bear on the liquid in the cartridge by pressure of the hand on the plunger, it being necessary to use such pressure under certain conditions of operation with syringes of this type, without danger of opening the closure and thereby causing a leak of anesthetic solution into the patient's mouth or elsewhere. The tube 2 has its side wall pinched in near the end of the tube so as to provide an annular recess 16 and at the same time the inner bore of the tube is lessened as shown at 17. Over the end opening, opposite the plug 13 is placed the closure cap. This cap comprises a cup-shaped metal portion 18 and a diaphragm portion therein made up preferably of successive layers of rubber, cloth, rubber and metal foil. The metal portion is generally cylindrical in form having an open end, the edges of which are crimped as shown at 19 into the recess 16 so that the cap makes a fluid-tight engagement capable of resisting high pressure, independent of the other parts of the syringe.

The metal portion 18 of the cap is provided with a hole 20. The diaphragm is disk-shaped and consists preferably of a layer 21 of rubber, an intermediate layer of stiffening material such as cloth 22, and another layer of rubber 23. The layers of rubber 21 and 23 with the cloth 22 sandwiched between are preferably made up by laying down a sheet of unvulcanized rubber compounded for vulcanization, then a layer of cloth over which is placed another layer of unvulcanized rubber compounded for vulcanization. These three layers are rolled together and then vulcanized, after which a layer of aluminum foil 24 of non-oxidizing type and preferably of aluminum about .002 inch in thickness is placed over the last layer of rubber. The thickness of the foil will vary somewhat in accordance with the character of the metal employed. The foil should be of such thickness that it will resist the usual handling to which cartridges of this type are subjected, but will readily permit the cannula to pass therethrough. The foil 24 may also be of tin or copper or the like. In addition, aluminum, tin, copper, or equivalent foil may be plated, as with chromium or the like, and used as above specified. The assembly of rubber, stiffening material and rubber should also be of such thickness and character to readily permit the passage of the cannula therethrough. The assembled rubber, cloth, rubber and foil is then cut into disk-shaped diaphragms by a suitable die and is assembled into the metal portion 18 of the cap. The metal and diaphragm are then assembled on the end of the tube 2 and crimped in place to make the leak-tight joint mentioned.

When the cartridge as so prepared is assembled in the holder, the cannula 25 passes through the foil, rubber, cloth, and rubber and into the interior of the tube 2. When pressure is exerted on the piston plug, the liquid will then flow under pressure through the cannula.

In preparing the cartridge as indicated, all parts are thoroughly sterilized and the anesthetic or other medicament contained in the cartridge is introduced in aseptic condition. The process of filling is preferably the same as that set forth in my aforesaid United States Letters Patent. Assuming that the rubber and cloth have been properly sterilized when the aluminum foil is assembled with it and the whole placed on the end of the tube, the aluminum foil serves to prevent bacteria, spores and the like from gaining access to the rubber and cloth within. When pressure is employed in assembling the cap on the tube, the aluminum foil is forced tightly against the inner edges of the aperture 20 and makes a tight joint therewith. Septic matter may, of course, occur on the outside of the aluminum foil but this will be removed by flaming as indicated below. In assembling the rubber and cloth it may be desired to employ only one thickness of rubber covered by a layer of cloth and to vulcanize the rubber without the cloth being applied thereto. In that event it may be desirable to soak the cloth in an antiseptic material such as phenol or mercurochrome or the like or otherwise independently sterilize it before it is assembled with the rubber. Such an assembly is shown in Fig. 5 wherein the cloth layer 26 impregnated with antiseptic material as mentioned, is shown assembled with a single layer of rubber 21. The layer of aluminum foil 24 is then assembled in the manner mentioned above and after cutting out the diaphragms so made up, they are placed in the metal portion of the cap. After assembly, when the cartridge comes into the hands of the consumer, assuming that the sterility of the interior of the cartridge has remained as provided in manufacture, the chief concern of the dentist or other operator with the device is to eliminate contamination from the exterior parts. The cannula may be sterilized in the usual way. In order to sterilize the aluminum foil at the aperture of the cap, I hold this in the flame of an alcohol lamp or other burner and heat it. The heating destroys germs, spores and the like. The aluminum foil is a material which may be flamed without injury to itself. I have flamed cartridges in this way many times and have found that after the cartridge has been thoroughly sterilized by this method, the rubber of the diaphragm has not become melted or otherwise injured by the treatment. The passage of the cannula through the aluminum foil and the other parts of the diaphragm may be thus readily effected without contaminating the liquid inside the tube. Furthermore I have found that by the use of the layers of rubber and cloth or like stiffening material, the objectionable distortion of the rubber does not occur at the aperture 20 of the cap. A perfectly smooth surface instead is provided with no depression in which bacteria might lie and from which they might be difficult to remove even by flaming.

The cartridge as so prepared and used with the

syringe of Fig. 1 is introduced through the opening 3, the screw-threaded clamping plug 4 having been moved upwardly in order to admit the cartridge. The end of the cannula 23 being in place at the aperture 20, the plug is rotated to engage the end of the cartridge and force it toward the cannula whereupon the sharp end of the cannula penetrates the foil, rubber cloth and rubber penetrating into the interior of the tube. At the same time the cartridge is firmly seated and clamped in place between the plug and the flat inner wall 27 of the holder. By pressing the plunger, liquid then passes through the cartridge to the cannula 23 into the area to be anesthetized or otherwise treated. High pressures may be employed by the dentist or other practitioner with this type of cartridge without danger of leakage through the cap.

Referring now to Figs. 7 and 8, 30 represents a phial or container formed preferably from glass or equivalent material. As shown, the phial 30 terminates in an upper neck section 31, the upper portion of which preferably is thickened to thereby provide an annular rim or shoulder 31a utilizable as hereinafter described.

The phial disclosed in Figs. 7 and 8 may be sealed by a closure cap corresponding with the one hereinbefore discussed in connection with Fig. 5 although, as illustrated, it is preferable that the closure cap of Fig. 3 be thus utilized. Accordingly, the closure cap of Figs. 7 and 8 is shown as comprising a metal cup-shaped portion 18, or equivalent, provided with a hole 20. Between said cup-shaped portion 18 and the top of the phial 30 is a suitable sealing member, such as the disk-shaped diaphragm which comprises the lower rubber layer 21, the intermediate layer of stiffening cloth 22, and the upper rubber layer 23. Between said rubber layer 23 and the top section of the cup-shaped portion 18 is disposed the layer of aluminum foil 24, or equivalent.

The aforesaid phial 30 is intended to receive any suitable liquid material such, for example, as a serum, anesthetic or other medicament. Assuming that said phial and the various parts of this closure cap are in sterile condition, a proper amount of the liquid material may be introduced into the phial whereupon the closure cap, with the component parts thereof related to each as shown in Fig. 8, is placed in position on the phial neck section 31 and, by application of pressure, the cup-shaped portion 18 is secured to said neck section 31 with the lower peripheral edge 18a of the cylindrical section of said member 18 being folded around or locked against the annular shoulder 31b. As a result, the rubber diaphragm member 21 is held, under compression, against the upper surface of said neck section 31 to positively seal the phial in a desired manner. Further, as a result of the described operation, the foil 24 is forced tightly against the inner edge of the cup-shaped portion 18 at its aperture 20 to thereby produce a tightly sealed joint between said cup-shaped portion 18 and the foil 24.

In view of the foregoing, it follows that the exposed section of the foil 24 may be flamed to destroy septic matter whereupon, as shown in Fig. 6, the needle of any suitable syringe may be passed interiorly of the phial 30 by a piercing action effected, in succession, on the foil 24, rubber member 23, cloth member 22, and rubber member 21.

Inasmuch as the liquid material in the phial 30 is drawn into the syringe of Fig. 6 by suction and is then expelled under pressure, it necessarily follows that said syringe is of different character than the one illustrated in Fig. 1. Accordingly, in Fig. 6, I have merely illustrated a conventional syringe which comprises a glass barrel 41 which communicates with the needle 40a, the latter being secured to the lower end of the barrel 41 by a slip-on Luer shank 42. A plunger barrel 43 carrying a knob 43a at the upper end thereof is reciprocatory interiorly of the barrel 41 in close-fitting engagement therewith. The barrel 41 comprises a flange 41a which may be engaged by the fingers of the operator when the plunger barrel 43 is to be depressed to effect the ejecting operation.

Obviously, with the parts related as shown in Fig. 6, the plunger barrel 43 may be moved upwardly to draw the liquid contents of the phial 30, by suction, into the barrel 41. Then, the needle 40a may be withdrawn from the closure cap of phial 30 whereupon the injecting operation may be proceeded with.

In Figs. 9 and 10, I have illustrated a modified form of the invention. The phial 30 of Fig. 8, preferably, is of such size that it contains sufficient liquid material for but one injection whereas the phial or bottle 50 of Figs. 9 and 10 contains sufficient liquid material for a number of injections. Accordingly, with the phial 50, I use a closure cap which is the same as the closure cap of Figs. 3 and 8 with the exception that the top section of the cup-shaped portion 18 is provided with a plurality of apertures or holes 51 in lieu of a single opening 20. A foil member 24 is associated with the closure cap of Fig. 9, and this foil is sealed with respect to the cup-shaped portion 18 around each of the apertures 51.

Accordingly, when liquid material is to be withdrawn from the phial 50, the section of foil material defined by one of the apertures 51 is flamed whereupon the needle 40a is passed through said aperture 51 and the underlying diaphragm material. Then, by operating the plunger barrel 43, a charge of liquid material from the phial 50 may be drawn into the syringe barrel 41. The needle 40a may now be withdrawn from the closure cap of said phial 50, the closure cap automatically resealing itself by reason of the expansive tendency of the rubber diaphragm members 21 and 23.

When another charge of material is to be withdrawn from the phial 50, the operation described above is repeated with the exception that there is selected for flaming and piercing an aperture 51 which, previously, has not thus been utilized.

With a closure cap of the character thus described in connection with Figs. 9 and 10, it is obvious that insertions of the syringe needle 40a into the phial 50 may be effected in an absolutely sterile manner. This for the reason that each insertion of said needle is through a section of the closure cap previously not used for this purpose and which is sealed with respect to other parts thereof. Obviously, an arrangement of this character is highly advantageous and successful in practice.

In Fig. 11, I have illustrated a modified form of closure cap which may be utilized in lieu of any of the closure cap arrangement hereinbefore described. As will be noted, the closure cap of Fig. 11 is generally similar to those shown in Figs. 3 and 8 with the exception that the foil member as such is not utilized with the closure cap of said Fig. 11. In lieu thereof, the cup-shaped portion 60, which is generally similar to the above described cup-shaped portion 18, is formed with a thin, foil-like section 60a which is readily flam-

able and through which the syringe needle is readily insertable.

Assuming that the various parts of the closure cap of Fig. 11 are in sterile condition, it is obvious that the phial, container or the like may be sealed in an absolutely sterile manner. Since the cup-shaped portion 60 is sealed with respect to the other closure cap parts, it follows, due to flamable characteristics noted above, that access may be had to said phial, container, or the like without danger of contamination by septic matter.

The cup-shaped portion 60 may be formed from aluminum or other suitable material and the thin foil section 60*a* may be produced in such a practical way as will occur to those skilled in the art.

It will be understood that the closure cap of Fig. 11 may be used with phials such as shown in Figs. 8 and 10, or with tubes, cartridges or the like. In addition, it will be understood that the cup-shaped portion 60 may be used with a sealing arrangement such as shown in Fig. 5 as well as with the sealing arrangement of Figs. 3 and 8.

While I have described my improvements in great detail and with respect to preferred forms thereof, I do not desire to be limited to such details or forms since many changes and modifications may be made and the invention embodied in widely different forms without departing from the spirit and scope thereof in its broader aspects. Hence I desire to cover all modifications, forms and embodiments coming within the language or scope of any one or more of the appended claims.

What I claim as new and desire to secure by Letters Patent, is:—

1. A medicament container having a closure comprising a resilient member, a protective layer therefor, an apertured cap for holding said resilient member and protective layer firmly in position for sealing the interior of said container against germs or the like, the dispensing end of the container having means formed out of the material of the container with which said cap engages and locks, the protective layer and resilient member being puncturable through the apertured cap by a cannula without removing said cap or otherwise breaking the seal, said protective layer being sterilizable by flaming to present a substantially sterile surface through which the cannula may pass to the interior of the container.

2. In a syringe, in combination, a cartridge holder, a cannula at one end thereof and a plunger at the other end thereof, a cartridge in said holder having an end opening closed by a piston plug and a cap over the end of the cartridge secured in a fluid-tight engagement with said end capable of resisting high pressure independently of said holder, said cap comprising a metal portion and a rubber diaphragm and stiffener therefor and a protective coating capable of being sterilized by flame, said metal portion holding said diaphragm in place.

3. A medicament cartridge to be inserted in a syringe holder comprising a tube having one end closed by a piston plug and a closure for sealing the opposite end of said tube comprising a rubber material and a foil thereover, said foil being secured over said rubber material by a cap sustaining said foil independently of said syringe holder, said closure sealing the interior of said cartridge against germs or the like, said foil and rubber material being puncturable by a cannula without otherwise breaking the seal, said foil being sterilizable by flaming to present a substantially sterile surface through which the cannula may pass to the interior of the cartridge.

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