

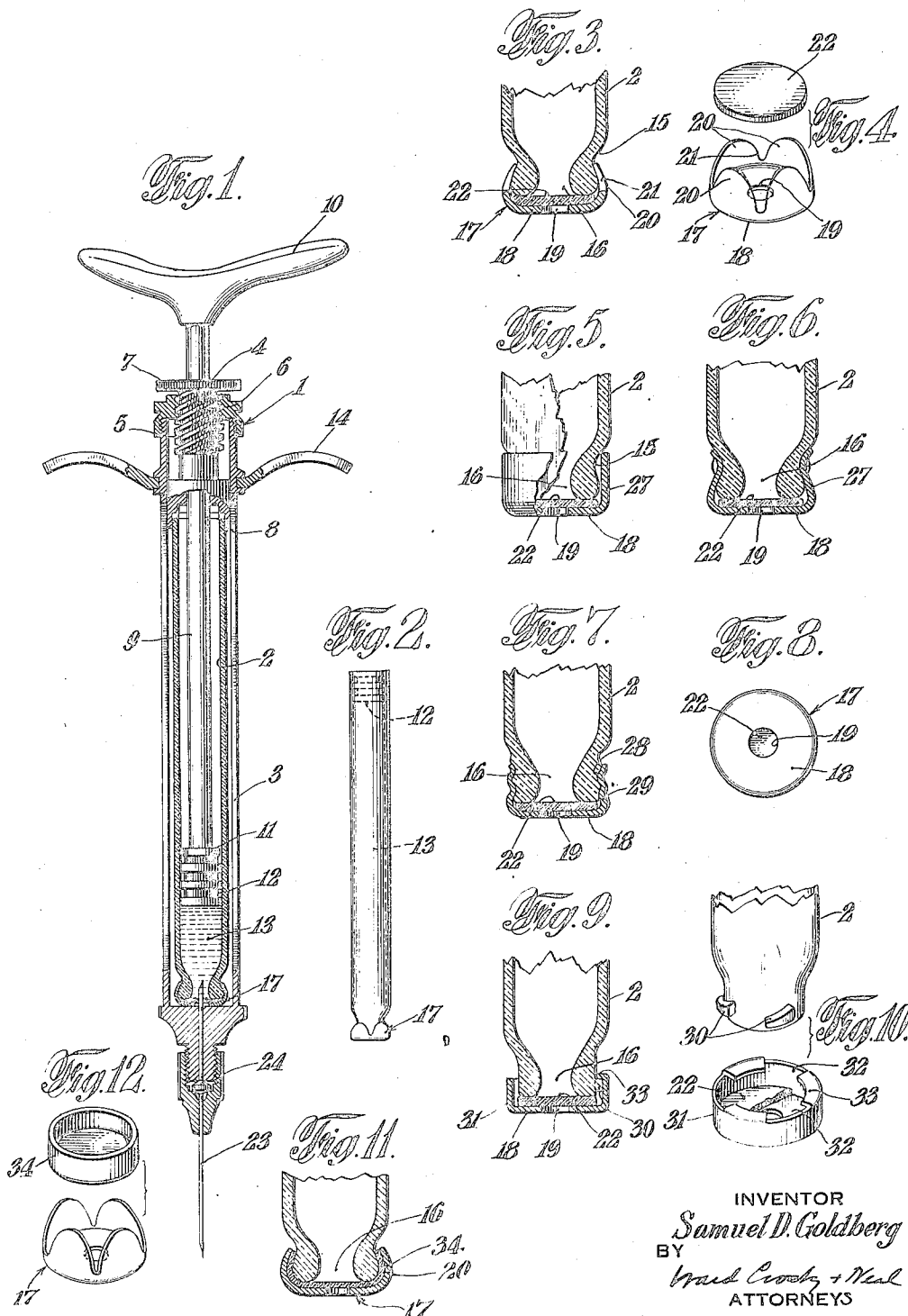
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SYRINGE AND TUBE THEREFOR

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SYRINGE AND TUBE THEREFOR

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This invention relates to hypodermic syringes and tubes or cartridges therefor. It includes a process for filling such tubes or cartridges.

5 Certain types of syringes heretofore in use have employed a glass tube having a uniform bore throughout and having in one end a rubber piston and in the other a rubber cap to be punctured by a cannula. The cap has an
10 integral flange lying against the end of the tube to prevent the cap from being forced into the tube upon insertion of the cannula. The syringe includes a plunger which moves the piston through the tube and expels its
15 contents through the cannula. The pressure on the cap at the cannula end in this type of syringe must be sufficient to force the liquid through the needle. If an obstruction of the flow occurs at the needle or elsewhere, more
20 pressure must be put on the plunger. This extra pressure frequently displaces the cap where the latter is spring-held in the casing, as is usually the case.

Where a flanged cap is used, it is necessary
25 for the manufacturer who fills the cartridges to carry three or four sizes of caps in stock because the diameters of the glass tubes used in the cartridges vary. This also requires gauging of the tubes to determine which size
30 cap shall be employed, and requires added checking of stock to make sure that the proper size is present along with the necessity for keeping money inactive through investment in a larger total of caps than would be
35 necessary if one size cap were used. Furthermore in filling the cartridge through the cap by means of a filling needle, the insertion of the filling needle may meet with so much resistance due to variations in the thickness of
40 the cap through which the needle must pass, that the cap will be forced inside the glass tube thus making it impossible to fill the tube and causing its rejection.

It is accordingly an object of this invention
45 to do away with the above difficulties and to provide a cap which shall be usable with various sized tubes and will permit filling of the tube, with a greatly decreased percentage of rejections. Another object of the invention
50 is to provide a cartridge which shall

have a larger capacity for the same size of glass tube. Another object is to provide a tube in which the cap employed shall give a smaller contact of diaphragm with solution
55 contained in the tube thus insuring greater stability of the solution. The solutions contained in these tubes are subject to decomposition when retained for a long period in contact with rubber. The elimination of at least some of this contact insures greater
60 length of life of the liquid. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the novel devices and combinations thereof together with the novel processes and steps of
65 processes to be employed with such devices and combinations, specific embodiments of which are described hereinafter by way of example and in accordance with which I now
70 prefer to practice the invention.

Referring now to the accompanying drawings which form a part of this specification and illustrate by way of example embodiments of the invention:—
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Fig. 1 is an elevation partly in section of a syringe showing a form of improved cartridge preferably of glass with the cannula projecting through the cap;

Fig. 2 is a view of the cartridge as filled
80 and ready to be inserted in the syringe;

Fig. 3 is a fragmentary enlarged detail sectional view showing the end of the cartridge sealed by the metal cap with rubber diaphragm shown in Fig. 1;
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Fig. 4 is a detail perspective view of the cap and rubber diaphragm to be inserted in the cap;

Fig. 5 shows a modified form of cap made of aluminum or similar metal ready to be
90 spun into the annular recess around the end of the tube;

Fig. 6 shows a similar view to Fig. 5 with the wall of the cap spun into the recess;
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Fig. 7 is a fragmentary sectional detail view showing a screw-threaded cap in place on the end of the tube;

Fig. 8 is an outer end view of the caps shown in the various figures showing the cen-
100

tral aperture through which the cannula passes;

Fig. 9 shows another form of closure in fragmentary sectional elevation employing a joint formed by the cap coacting with projecting lugs on the side of the cartridge;

Fig. 10 is a perspective fragmentary detail corresponding to Fig. 9, and

Fig. 11 is a fragmentary enlarged detail sectional view showing the end of the cartridge sealed by a metal cap, the diaphragm being in the form of a rubber cup enclosing the end of the cartridge, and

Fig. 12 is a detail perspective view of the cap and rubber diaphragm shown in Fig. 11.

The syringe includes a tubular holder 1 adapted to retain the 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 to admit the cartridge 2. In order to hold the cartridge in place, its upper end is engaged by a 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 2. 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 coacting with the piston 12 which when forced downwardly by the plunger exerts pressure on the anæsthetic or other liquid 13 contained in the cartridge. The usual finger grip 14 encased 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.

As shown in Fig. 2 the piston 12 closes one end of the cartridge and the opposite end is closed by a 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 exert such pressures under certain conditions of operation with syringes of this type, without danger of opening the closure and thereby causing a leak of anæsthetic solution into the patient's mouth or elsewhere. For this purpose the tube 2 has its side wall pinched in near the end of the tube so as to provide an annular recess 15 and at the same time the inner bore of the tube is lessened as shown at 16. The tube as so prepared is shown in Figs. 1 to 3. Over the tube is placed the cap 17. This cap looks like a crown having a base 18 which is perforated by a hole 19. From the base extend upwardly four sides 20 con-

forming in general to the circular curvature of the base and separated from one another by grooved notches 21. The rubber diaphragm 22 fits snugly over the base 18 covering and sealing the hole 19 and sealing as well the entrance to the cartridge. This cap is placed over the end of the cartridge and the side walls 20 are bent so that they conform to the curvature of the outer wall at the end of the cartridge, the extremities of the walls 20 lying at about the center of the annular groove 15. When the cartridge is positioned in the holder, the diaphragm 22 is ready to be pierced by a cannula 23 which is secured in place on the end of the holder by an interior threaded nut 24 cooperating with threads on the exteriorly threaded shank of the holder.

The piston 12 and the cap 17 seal the anæsthetic or other solution in the interior of the tube 2. The use of these sealing means permits a more efficient process of filling the cartridge to be employed than has heretofore been possible where the old type of flange rubber plug has been employed and at the same time other advantages arise from this construction. The process of filling which I prefer to practice with this tube is as follows:—The tube 2 and piston 12 after being carefully sterilized are brought to the filling device. The device introduces the anæsthetic or other liquid into the interior of the tube filling it to the brim while it is in upright position. The sterilized rubber diaphragm 22 and cap 17 are then slipped over the end of the tube and the side walls 20 of the cap are pressed into position so that they grip the walls of the tube 2. The cartridge is then ready for use. According to the old practice, it was necessary as pointed out above, to deliver the tubes of the filling device with the piston in place as well as the plug. These plugs due to the fact that they were made of molded rubber had walls of varying thickness to be penetrated by the needle used in the filling device and frequently due to the high pressure required to force the needle through the wall, the plug was driven into the tube thus making it impossible to fill the tube and causing its rejection after which it was necessary to take the piston and plug out of the tube and re-sterilize these parts and return them to the filling machine, all of which entailed loss of time, extra labor with consequent loss of efficiency and money. My device and process do away with these difficulties. In addition since the tube is filled brimful, the same size of glass tube gives a larger capacity as compared with the old form of cartridge in which the rubber plug occupied a substantial part of the tube. This increased capacity is important because it insures that a slight excess over the required amount of anæsthetic may be delivered to the patient. The usual dose of 2.5 c. c. is ordinarily sufficient for anæsthetic purposes, but it is im-

portant that this amount be present in the tube because if a less amount is present perhaps incomplete anaesthetization may occur. My construction insures that the proper amount shall always be present together with some excess. In addition the rubber diaphragm and cap may be always substantially of the same diameter. It is not necessary to have a series of rubber plugs as in the old device in order to fit accurately within the bore of the cartridge, since the rubber diaphragm does not need to fit within the bore of the cartridge. In addition the underside of the diaphragm is in contact with a small amount of liquid viz; that in the narrow bore as shown in my preferred embodiment. The amount of rubber and liquid in contact is reduced as compared with that in contact in the old rubber plug construction. Furthermore it has been found that the rubber diaphragms can be furnished in substantially uniform thickness, through the fact that they are simply stamped out of sheets of rubber. Such uniformity of thickness of the wall to be penetrated has not been found in the old rubber plugs which were molded and in which there was a cavity extending almost through to the end wall, through which end wall the cannula passed. On account of these plugs being molded, this cavity was of varying depth and on account of the resulting variation in the thickness of the wall to be pierced, the difficulties in filling mentioned above were encountered.

If I desire, I may fill my improved cartridge according to another method, that is, I may supply the tube with the piston in place and also the cap in place and then insert a filling needle through the aperture 19 and diaphragm 22 to fill the tube with the anaesthetic. In this case, the uniformity of thickness of the diaphragm is important in allowing the needle to penetrate it easily without forcing the diaphragm into the interior of the tube.

My tube as so prepared when used with the syringe is introduced through the opening 3, the screw-thread 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 19 and in contact with the rubber diaphragm 22, the plug is rotated to engage the end of the cartridge and force it towards the cannula whereupon the sharp end of the cannula penetrates the diaphragm and the cartridge is firmly seated and clamped in place between the plug and the flat inner wall 26 of the holder. By pressing the plunger, liquid then passes from the cartridge through the cannula 23 into the area to be anaesthetized. In use it has been found that the dentist or practitioner can exert a much higher pressure on the cartridge as compared in accordance with my invention, without danger of blowing out the cap than

it has been possible with the heretofore employed rubber plug.

Referring now more specifically to the modifications shown in Figs. 5 to 12, Figs. 5 and 6 show a similar form of closure to that already described in connection with Figs. 1 to 4. The annular groove 15 is provided as well as the constricted neck 16 and the diaphragm 22. In place of the metal cap providing the four side walls, I place over the end of the cartridge an aluminum cap which is here shown as cup-shaped with a continuous wall 27. The rubber diaphragm is seated in the bottom of this cap covering the opening 19. After the cap has been put into place in order to effect the closure, a spinning tool is applied on the outside of the cap opposite the deepest point of the annular recess and the cap is spun so that it conforms with the outer end wall of the cartridge 2 as shown more clearly in Fig. 6. In Fig. 7 instead of the annular recess 15 the glass at the end of the cartridge is provided with screw-threads 28 which are adapted to receive the threads of the screw-threaded top 29. The diaphragm 22 is inserted in this cap and the whole is screwed up to make a tight closure. In Figs. 9 and 10 is shown a construction made by forming wedge lugs 30 of glass integral with the glass of the cartridge 2 on the constricted end of the cartridge. The metal cap 31 is provided with slots 32 in an overhanging edge 33 through which slots the lugs 30 pass and then upon a partial rotation of the cap it is held in place on the end of the tube between the under wall of the rim 33 and the upper face of the plugs. In Figs. 11 and 12 a construction similar to that shown in Figs. 1 to 4 is shown. In place of the rubber disk 22, a rubber cup 34 is shown which is preferably slightly smaller in diameter than the end of the cartridge 2 so that it fits snugly over the end of the cartridge and clasps its sides. On top of this is placed the cap 17 and when the side walls 20 of the cap are placed in position they grip the side walls of the diaphragm cup 34 between the side walls 20 and the walls of the cartridge 2 around the opening 16. The modifications described have the advantages recited in connection with the preferred embodiment discussed above.

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 and 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. In a syringe, in combination, an open-ended medicament-containing tube closed at one end by a piston plug adapted to be forced therethrough to eject the medicament under considerable pressure, a tube holder, a cannula at the end of said tube and a closure situated at the end of the tube adjacent said cannula independent of the holder and capable of resisting relatively high pressure which may be produced by the movement of said piston plug comprising a resilient member puncturable by said cannula and closing around it to form a tight joint, and a metal retaining member secured about said resilient member to hold it on the end of said cartridge.

2. In a syringe, in combination, an open-ended cartridge tube, a piston plug therein to be moved therethrough for ejecting a medicament therefrom, a cartridge holder, a cannula at one end of said holder and a closure about the end wall of the cartridge leak-tight against the relatively high pressure which may be produced by the movement of said plug through said cartridge and independent of said holder comprising a combined rubber and metal cap, said rubber covering the mouth of said opening and said metal portion of the cap gripping the wall of the cartridge tube.

3. In a syringe, in combination, a cylindrical cartridge tube, a piston plug therein to be moved therethrough for ejecting a medicament therefrom, a cartridge holder, a cannula at one end of said holder, said cylindrical cartridge tube having a recess in the outer wall thereof at one end and a closure at the end wall of the cartridge leak-tight against the relatively high pressure which may be produced by the movement of said plug through said cartridge and independent of said holder comprising a combined rubber and metal cap, the rubber of said cap consisting of a flat disc closing the mouth of the cartridge tube, the metal portion of said cap firmly gripping the outer wall of the cartridge tube, so that the extremity of said metal portion will enter said recess and hold said rubber disc in position.

4. In a syringe, in combination, a cylindrical cartridge tube having end openings, a piston plug therein to be moved therethrough for ejecting a medicament therefrom a cartridge holder, a cannula at one end of said holder, said tube having a reduced cylindrical portion at one end so that the opening at that end is of less diameter than the bore of the tube and having a recess in the outer wall thereof and an apertured substantially cylindrical cap having a rubber and metal portion, said rubber portion consisting of a flat disc to be pierced by said cannula lying on and covering the opening of the reduced

cylindrical portion of the tube, while the metal portion of the cap has an aperture in the centre and its sides lie along the outer reduced portion of the tube, its circumferential ends entering said recess, thereby making a joint fluid and air-tight against the relatively high internal pressure which may be developed on movement of said plug through said cartridge independent of the holder between the rubber disc and the circumferential opening of the reduced tube.

5. In a syringe, in combination, a tube having end openings, a piston plug therein to be moved therethrough for ejecting a medicament therefrom a tube holder, a cannula at one end of said holder, said tube having a constricted end and a closure for the opening thereof consisting of a cup shaped rubber cap covering said opening and an apertured metal cap covering the rubber cap, the rubber cap covering the mouth and sides of the opening, the apertured cap gripping the rubber cap against the side walls of the tube and making thereby an air tight and fluid tight joint independent of said holder, and preventing the rubber cap from being forced out during the expulsion of the contents of the tube by said plug through the cannula, the closure effected by said rubber and metal cap being self-sustaining under high pressure which may be developed by movement of said piston plug in ejecting the medicament from the tube.

6. In a syringe, in combination, a cartridge, a cartridge holder having an opening for the introduction of the cartridge, a cannula at one end of said holder, hand operable means at the other end of the holder to move the cartridge toward the cannula for forcing the cannula into the cartridge and to hold the cartridge firmly in position, said cartridge having a substantially uniform bore from one end up to adjacent the other end and having a constriction at that point, the end opposite the constriction being closed by a piston, the constricted end being adapted to admit the cannula, a combined rubber and metal cap closing said constricted end, the rubber closing the mouth of the constricted end, the metal portion having an aperture in the center gripping the rubber portion by its bendable sides tightly against said constricted end and making thereby an air and fluid tight joint preventing the rubber portion from being forced out during the expulsion of the contents of the tube and also from being pushed inside the cartridge during the puncturing of the rubber portion of the cap by the needle, the closure effected by said rubber and metal cap thus provided being self-sustaining under high pressure which may be developed by movement of said piston plug in ejecting the medicament from the cartridge.

7. A medicament cartridge to be inserted in a syringe holder comprising a tube having

one end closed by a piston plug and the other end closed by a cap, comprising a resilient portion held in place by a metal retaining member, said resilient portion covering the mouth of the opening, and the retaining member gripping the side walls of the tube and making an air and fluid tight joint between said resilient portion and the edges of the tube against the relatively high internal pressure which may be developed by movement of said plug in ejecting the medicament from the cartridge and independent of the holder when in use.

8. A medicament cartridge to be inserted in a syringe holder comprising a tube having one end closed by a piston plug and an opening at the other end for admission of a cannula, said latter opening being closed by a resilient puncturable disc covering the mouth of said opening and a metal cap covering said disc and having a side wall gripping the wall of the cartridge, the closure thus provided being self-sustaining under high pressure developed by movement of said piston plug in ejecting the medicament from the cartridge.

9. A cartridge containing medicament to be inserted in a syringe holder having an opening at one end for the admission of a cannula, a piston plug in the other end, the outer side walls about said opening provided with an annular recess, a resilient puncturable rubber disc covering said opening and an apertured metal cap, said metal cap having side walls gripping the walls of the cartridge and lying partially in said recess and making an air and fluid tight joint between the disc and edges of the opening independent of said holder when in use, the closure effected by said cap and rubber disk thus provided being self-sustaining under high pressure developed by movement of said piston plug in ejecting the medicament from the cartridge.

10. A cartridge containing medicament to be inserted in a syringe holder having an opening at one end for admission of a cannula, a piston plug in the other end, the outer side wall about said opening provided with an annular recess, a resilient puncturable cup covering said opening, and an apertured metal cap covering said cup, said metal cap having side walls gripping the sides of the cup and the side walls of the cartridge and making a fluid and air tight connection between the resilient puncturable cup and walls of the glass independent of said holder, the closure effected by said puncturable cup and metal cap being self-sustaining under high pressure developed by movement of said piston plug in ejecting the medicament from the cartridge.

11. A cartridge containing medicament to be inserted in a syringe holder having an opening at one end for admission of a cannula, a piston plug in the other end, the outer side wall about said opening provided with an annular recess, a resilient puncturable cup covering

said opening, and a rigid retaining member surrounding and gripping said puncturable cup, said retaining member having a high tensile strength to grip the side wall of the cup, and the side walls of the cartridge and making a fluid and air tight connection between the resilient puncturable cup and walls of the tube independent of said holder, the closure effected by said puncturable cup and retaining member being self-sustaining under high pressure developed by movement of said piston plug in ejecting the medicament from the cartridge.

12. A medicament cartridge to be inserted in a syringe holder comprising a tube having one end closed by a piston plug and the other end closed by a puncturable cap comprising a resilient portion held in place by a rigid retaining member surrounding said resilient portion, said retaining member having a high tensile strength to grip the side wall of the tube and making a fluid and air tight connection between said resilient portion and walls of the tube independent of said holder, the closure effected by said puncturable cap comprising the retaining member being self-retaining under high pressure developed by movement of said piston plug in ejecting the medicament from the cartridge.

In testimony whereof I have signed my name to this specification.

SAMUEL D. GOLDBERG.