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A. E. ERICSON ET AL

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HYPODERMIC SYRINGE AIR OPERATED

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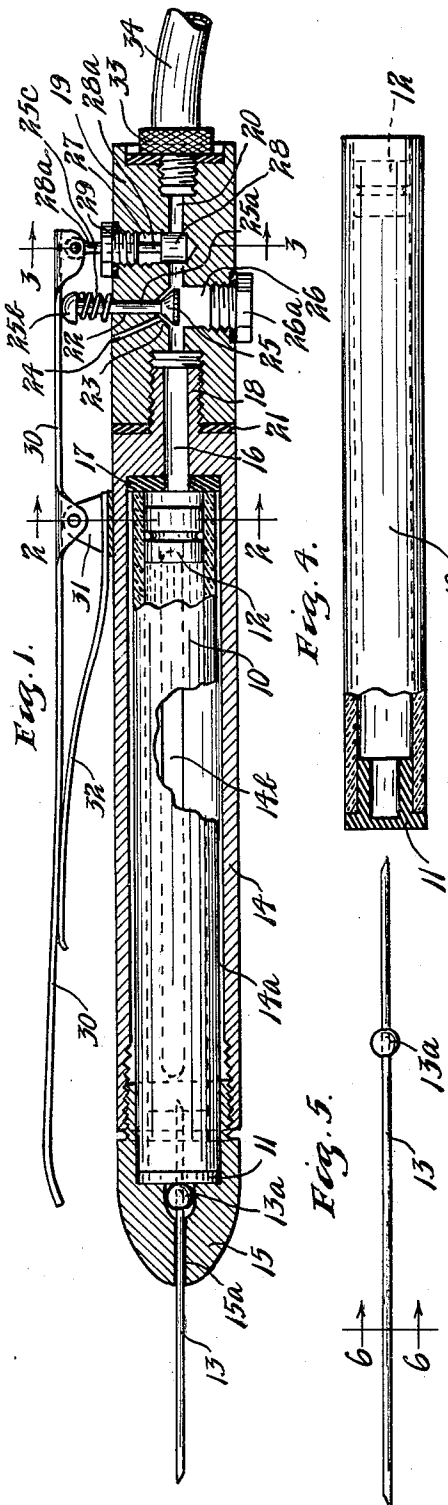


Fig. 1.

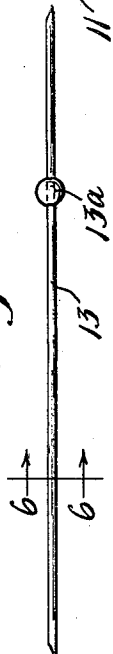


Fig. 2.

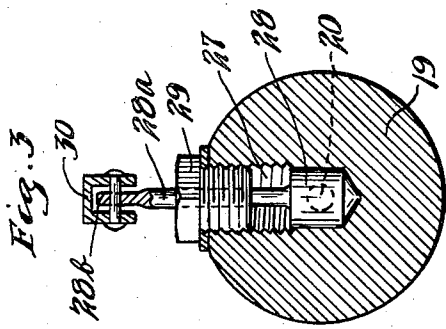


Fig. 3.

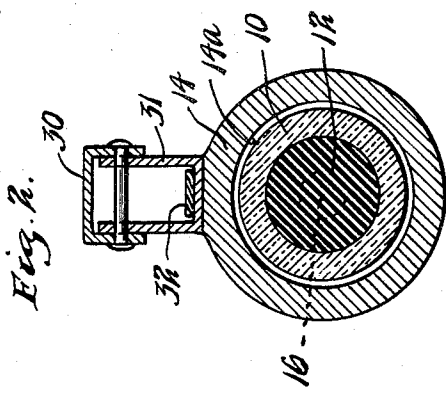


Fig. 4.



Fig. 5.

INVENTORS.
ADOLPH E. ERICSON.
GILBERT C. ZEIDLER.
BY THEIR ATTORNEYS.
Williamson & Williamson

UNITED STATES PATENT OFFICE

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HYPODERMIC SYRINGE—AIR OPERATED

Adolph E. Ericson and Gilbert C. Zeidler,
Minneapolis, Minn.

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6 Claims. (Cl. 128—218)

Our invention relates to hypodermic syringes and particularly to hypodermic syringes for use with cartridges.

In dental work a hypodermic syringe is usually held like a pencil while inserting the needle in the patient's gum and after the needle has been inserted the syringe is operated to inject the liquid contained therein. With the types of hypodermic syringes now in use the operator must change his grip upon the syringe after inserting the needle to a grip which will permit operation of the syringe to effect injection of the liquid. This change in grip not only consumes time but also usually unavoidably causes movement of the needle in the tissue of the patient's gum resulting in pain and irritation.

It is an object of our invention to provide a hypodermic syringe adapted for use with cartridges and which can be operated without the need of the operator changing his grip thereon.

Another object is to provide such a hypodermic syringe wherein actuation of the liquid injecting elements thereof is controlled by a very easily operated control element located adjacent the forward or needle-carrying end of the syringe.

Still another object is to provide such a hypodermic syringe which is operated by air pressure rather than by effort applied by the operator.

Yet another object is to provide such a hypodermic syringe wherein air pressure controlled by a suitable valve is applied directly to the rubber plunger of a cartridge retained within the syringe.

A further object is to provide such a hypodermic syringe of simple, rugged and inexpensive construction and particularly adapted for easy and effective maintenance of the same in sanitary and antiseptic condition.

These and other objects and advantages of the invention will more fully appear from the following description, made in connection with the accompanying drawing, wherein like reference characters refer to the same or similar parts throughout the various views, and in which:—

Fig. 1 is a longitudinal sectional view of our hypodermic syringe with a cartridge and needle of conventional form retained therein;

Fig. 2 is a cross-sectional view taken along the line 2—2 of Fig. 1 as indicated by the arrows;

Fig. 3 is a cross-sectional view taken along the line 3—3 of Fig. 1 as indicated by the arrows;

Fig. 4 is a partially broken away side view of a cartridge suited for use with our hypodermic syringe;

Fig. 5 is a side view in large scale of a hypo-

dermic needle for use in connection with the cartridge shown in Figs. 1 and 4, and

Fig. 6 is a section on an enlarged scale taken along the line 6—6 of Fig. 5.

Referring to the drawing, our hypodermic syringe is designed for use with cartridges such as the one shown in Fig. 4 and hypodermic needles such as the one shown in Fig. 5 both of these articles being of substantially conventional form and available on the market. The cartridge shown in Fig. 4 consists of an open ended glass tube 10 having a soft rubber plug 11 in its forward end to seal the same and a soft rubber slidable plunger 12 located in the interior of the tube 10 near the rear end thereof. A liquid to be hypodermically injected is contained within the glass tube 10 between the plug 11 and the plunger 12. The needle 13, shown in Fig. 5, has a bore extending through its entire length and is sharpened at both ends. Somewhat rearwardly of the center of the needle a generally spherical enlarged element 13a is secured thereon as shown, the length of the needle from the element 13a rearwardly being less than the sum of the length of the plug 11 and plunger 12.

The cartridge shown in Fig. 4 and the needle 13 are assembled for use by piercing the rubber plug 11 of the cartridge with the sharpened rear end of the needle 13 and forcing the needle toward the interior of the cartridge to bring the enlarged element 13a of the needle into abutment with the outer end of the rubber plug 11. The needle is of course coaxially aligned with the cartridge.

Our hypodermic syringe includes a barrel 14 having a cylindrical chamber 14a therewithin of suitable proportions and dimensions to receive and hold a cartridge of the form described above and illustrated in Fig. 4. The forward end of the chamber 14a is closed by a cap 15 which is shaped as shown in Fig. 1 and is screw-threadedly attached to the forward end of the barrel 14. The cap 15 is provided with a concentrically located aperture of suitable diameter for accommodation of a needle such as shown in Fig. 5 and of increased diameter at its rear or inner portion for accommodation of the enlarged portion 13a on the needle 13.

The rear end of the chamber 14a is closed except for a passage 16 extending rearwardly therefrom and a washer 17, formed of compressible material, is disposed in the rearmost portion of the chamber. The rear end of the barrel 14 is provided with a rearwardly extending, externally screw-threaded portion 18 of reduced diam-

eter for the purpose of attaching a valve body. The passage 16 in the rear end of the barrel 14 extends through the reduced portion 18.

A cylindrical valve body 19 having an axially extending bore or passage 20 therethrough, is screw-threadedly mounted on the reduced portion 18 of the barrel 14 by means of internal screw threads in an enlarged forward portion of the passage 20. A washer 21, formed of compressible material, is placed between the rear end of the barrel 14 and the forward end of the valve body 19 to provide a seal therebetween.

An aperture 22 extends radially from the upper portion of the outer periphery of the valve body 19 to the axially located bore 20 and at its inner end is enlarged to form a conical valve seat 23. An air release duct 24 extends from a point on the conical face of the valve seat 23 to the exterior of the valve body 19. A conical air release valve 25, positioned to cooperate with the valve seat 23, has a stem 25a extending through the radial aperture 22 in snugly fitting but slidable relation thereto to a point somewhat outward of the outer periphery of the valve body 19. A button 25b of larger diameter than the stem 25a is secured to the outer end of the stem 25a and a helical compression spring 25c is disposed under compression concentrically about the stem 25a between the button 25b and the outer periphery of the valve body 19. An aperture 26 of larger diameter than the valve 25 extends radially from the axial bore 20 to the lower portion of the outer periphery of the valve body 19 in diametrical alignment with the aperture 22. A plug 26a is screw-threadedly engaged in the aperture 26 to close the same.

Somewhat rearwardly of the valve 25 an aperture 27, having a diameter exceeding that of the axial bore 20, extends radially from the upper portion of the exterior periphery of the valve body 19 to intersect the axial bore 20 and to extend therebeyond to a point a short distance therebelow. A cylindrical air admission valve 28, disposed in the inner portion of the aperture 27, has a stem 28a extending concentrically of the aperture 27 to a point somewhat outward of the exterior surface of the valve body 19. A gland 29, screw-threadedly engaged with the outer portion of the aperture 27 encircles the medial portion of the valve stem 28. The outer end of the valve stem 28a is formed into an eye 28b.

A valve actuating lever 30, located adjacent the upper sides of the barrel 14 and the valve body 19 and extending longitudinally thereof is pivotally mounted at its medial portion to a bracket 31 which is rigidly mounted on the barrel 14. A flat spring 32, mounted at its inner end on the bracket 31 extends forwardly and outwardly to bear against the inner side of the forward portion of the lever 30 to urge the same away from the barrel 14. The rearmost portion of the lever 30 is loosely pivotally connected to the eye 28b on the stem 28a of the air admission valve 28 and a portion of the lever 30 located slightly forward of its rearmost portion bears upon the button 25b on the stem 25a of the air release valve 25.

The rearmost end of the axial bore 20 is of increased diameter and is internally screw-threaded to permit engagement with a coupling member 33 attached to one end of an air supply hose 34. The other end of the hose 34 may be connected to a source of compressed air (not shown).

The barrel 14 is provided with one or more longitudinal slots 14b throughout most of its

length to permit observation of the quantity of liquid within the cartridge 10.

In normal use of our hypodermic syringe the cap 15 is removed from the barrel 14 and a cartridge fitted with a needle, as previously described, is inserted in the chamber 14a so as to be disposed as shown in Fig. 1. The apertured portion 15a of the cap 15 is slipped over the forward or outer portion of the needle 13 and the cap is attached to the barrel 14. The forward portion of the plug 11 of the cartridge will engage the inner side of the cap 15 to form a seal therewith and the element 13a of the needle 13 will be confined in the enlarged rear portion of the aperture 15a to prevent forward displacement of the needle. Engagement of the element 13a with the plug 11 of the cartridge will prevent rearward displacement of the needle. The washer 17 will seal the rear end of the tube 10 of the cartridge to the rear portion of the barrel 14. The interior of the tube 10 of the cartridge at the rear of the plunger 12 will obviously be in communication with the passage 16 and the forward portion of the axial bore 20 of the valve body 19.

The air release valve 25 is normally open and the air admission valve 28 is normally closed as shown in Fig. 1. The flat spring 32 normally urges the forward portion of the lever 30 away from the barrel 14 and hence the rear portion of the lever at the other side of the pivot point of the lever is urged toward the valve body 19 to hold the air admission valve in closed position and to overcome the release valve spring 25c and hold the air release valve 25 open.

In effecting a hypodermic injection the hypodermic syringe is held like a pencil and the needle is inserted in the tissue in which the injection is to be made. The operator may then, without changing his grip on the syringe, press the forward end of the lever 30 toward the barrel against the pressure of the flat spring 32 and hence move the rear portion of the lever 30 in a direction outward from the valve body 19. The first part of this movement removes the pressure normally exerted by the lever 30 on the air release valve button 25b and permits the spring 25c to seat the air release valve 25 to close the air release duct 24. The movement of the lever 30 also acts to pull the air admission valve into a partially open or fully open position dependent upon the distance through which the operator moves the forward end of the lever 30.

When the air admission valve is open air will pass from the hose 34 through the axial bore 20 and the passage 16 into the portion of the interior of the tube 10 of the cartridge lying rearward of the plunger 12 of the cartridge. Air pressure acting on the rear of the plunger 12 will drive the same forwardly to force the liquid contained in the cartridge out through the bore of the needle.

When the desired portion of the liquid in the cartridge has been discharged through the needle the operator releases the forward end of the lever 30 thus permitting the flat spring 32 to return the lever 30 to its normal position. As shown in Fig. 1, the air admission valve is closed and the air release valve is open when the lever 30 is in its normal position. Closing of the air admission valve 28 of course stops the influx of air and opening of the air release valve 25 permits the exhausting of sufficient air through the air release duct 24 to remove all air pressure from the plunger 12 of the cartridge and hence instantly halts

further movement of the plunger 12 after the operator releases the lever 30.

If the entire contents of the cartridge are discharged the rubber plunger 12 of the cartridge will engage the inner end of the needle to seal the same and hence prevent any air from following the liquid even though the supply of air is not immediately shut off. Since the forward end of the cartridge is sealed to the cap 15 by the rubber plug 11 of the cartridge and the rear end of the cartridge is sealed to the barrel 14 by the compressible washer 17 it is apparent that no air can leak past the cartridge toward the forward end of the syringe. Obviously it is impossible for any air to be ejected through the needle 13.

The operator may so operate the lever 30 as to open the air admission valve 28 to various degrees so as to vary the rate of air admission and so vary the speed with which the plunger 12 of the cartridge is driven forwardly.

Obviously, removal of a used cartridge and needle is permitted by removing the cap 15 from the barrel 14.

It is to be noted that the barrel 14 and cap 15 are so constructed as to present no corners or recesses capable of collecting dirt and that all portions of both the exterior and interior of the barrel and cap are readily accessible for thorough cleansing when the cap is removed from the barrel. From the above it is apparent that our syringe may be easily and effectively kept in clean and antiseptic condition.

It is obvious that the forward end of the actuating lever 30 may be easily operated without the need of the operator changing his grip upon the syringe or causing any movement of the needle in the tissue which would subject the patient to pain or discomfort. Elimination of the need for the operator changing his grip upon the syringe also acts to minimize the time consumed in making an injection.

It is apparent that we have invented a novel, efficient and reliable air operated hypodermic syringe for use with cartridges which is capable of being conveniently and rapidly operated with a minimum of pain or discomfort to the patient on whom it is used.

It will, of course, be understood that various changes may be made in the form, details, proportions and arrangement of the parts without departing from the scope of our invention, which, generally stated, consists in a device capable of carrying out the objects above set forth and in the novel parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:—

1. In a hypodermic syringe for use with cartridges each comprising a tube having a closure at one end and a slidable plunger within the medial portion thereof, a barrel having a chamber therewithin adapted to receive one of said

cartridges, means at the rear end of said barrel for connection to a source of compressed air, a valved passage between said means and the rear end of said chamber, and means for establishing communication between the rear end of said chamber and the exterior of said barrel when said valve is closed.

2. In a hypodermic syringe for use with cartridges each comprising a tube having a closure at one end and a slidable plunger within the medial portion thereof, a barrel having a chamber therewithin adapted to receive one of said cartridges, an air admission passage communicating with the rear end of said chamber and adapted to be connected with a source of compressed air, an air release passage communicating with the rear end of said chamber and extending to the exterior of said barrel, valve means in each of said passages, and a common actuating element for said valves, said actuating element being arranged for closing one of said valves as the other of said valves is opened.

3. The structure defined in claim 2 and said actuating element being operable from a point adjacent the forward end of said barrel.

4. In a hypodermic syringe for use with cartridges each comprising a tube having a puncturable closure at the forward end and a slidable plunger within the medial portion thereof, a barrel having a chamber therewithin adapted to receive one of said cartridges, means at the rear end of said barrel for connection to a source of compressed air, a valved passage between said means and the rear end of said chamber and means for establishing communication between the rear end of said chamber and the exterior of said barrel.

5. In a hypodermic syringe for use with cartridges each comprising a tube having a puncturable closure at the forward end and a slidable plunger within the medial portion thereof, a barrel having a chamber therewithin adapted to receive one of said cartridges, means at the rear end of said barrel for connection to a source of compressed air, a valved passage between said means and the rear end of said chamber and a restricted air relief passage connected to said chamber and extending to the exterior of said syringe.

6. In a hypodermic syringe for use with cartridges each comprising a tube having a puncturable closure at the forward end and a slidable plunger within the medial portion thereof, a barrel having a chamber therewithin adapted to receive one of said cartridges, means at the rear end of said barrel for connection to a source of compressed air, a valved passage between said means and the rear end of said chamber, a restricted air relief passage in communication with said chamber and extending to the exterior of said syringe, and a valve in said passage.

ADOLPH E. ERICSON.
GILBERT C. ZEIDLER.