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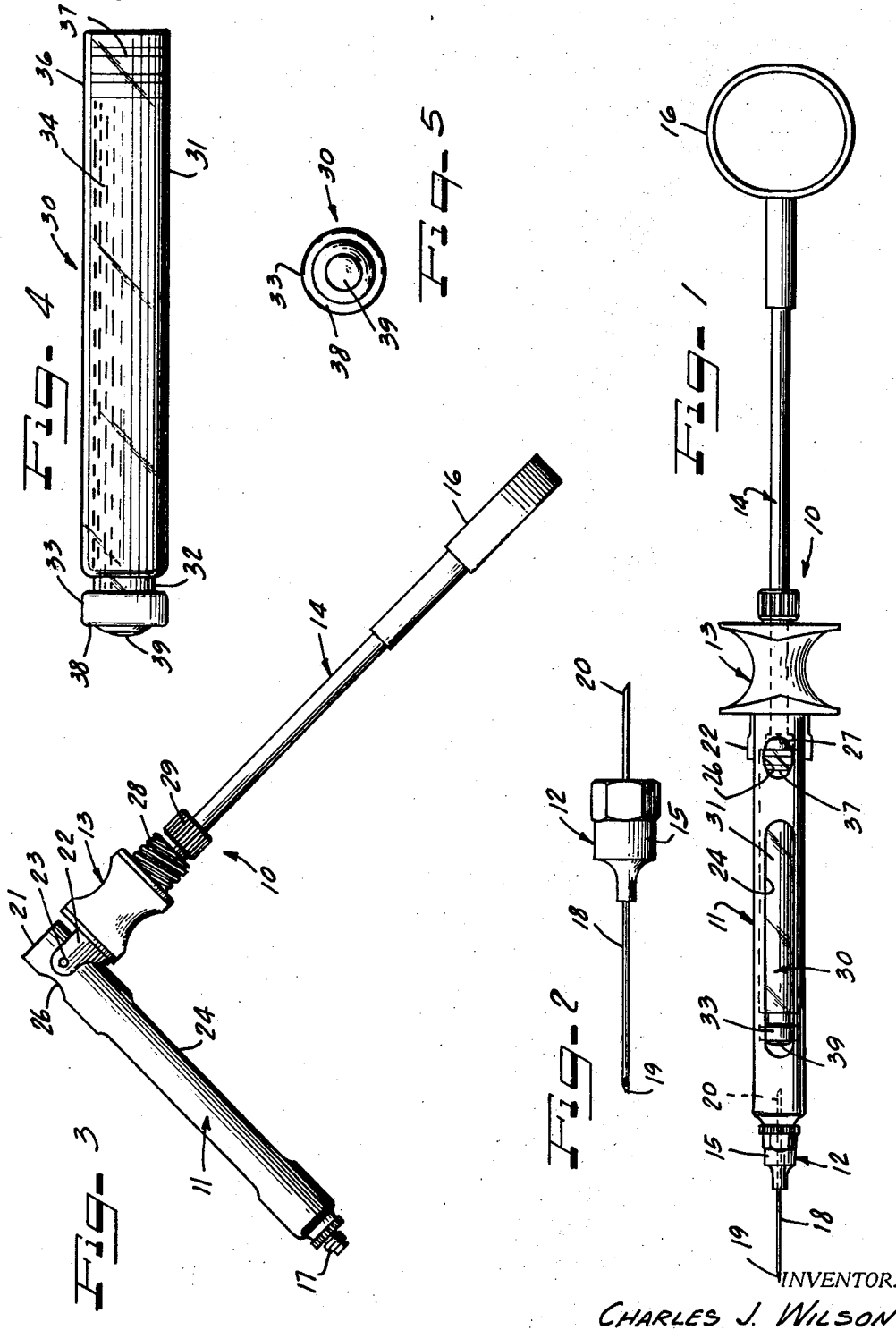
C. J. WILSON

3,495,591

METHOD FOR ADMINISTERING INJECTABLE LIQUIDS

Filed May 8, 1967

2 Sheets-Sheet 1



INVENTOR.  
CHARLES J. WILSON

BY *Hill, Sherman, Meier, Guss & Simpson* ATTORNEYS

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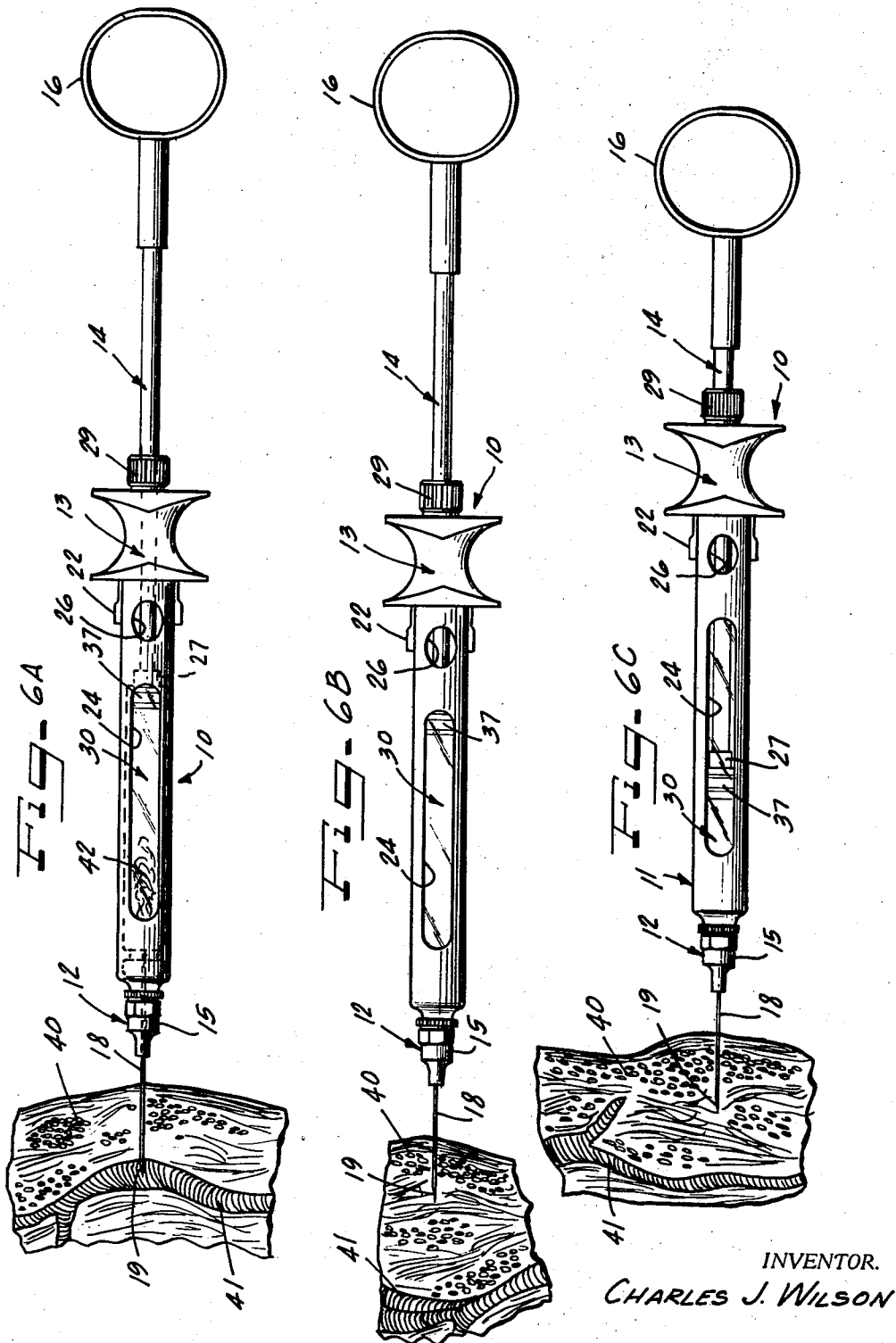
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METHOD FOR ADMINISTERING INJECTABLE LIQUIDS

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2 Sheets-Sheet 2



INVENTOR.

CHARLES J. WILSON

BY *Hill, Sherman, McLean, Good & Simpson*

ATTORNEYS

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3,495,591

**METHOD FOR ADMINISTERING  
INJECTABLE LIQUIDS**Charles J. Wilson, 1626 N. Prospect,  
Milwaukee, Wis. 53202

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4 Claims

**ABSTRACT OF THE DISCLOSURE**

A method is provided whereby a transparent cartridge containing injectable liquid is pre-packaged under a negative pressure to afford completely automatic aspiration when used in a syringe.

**BACKGROUND OF THE INVENTION****Field of the invention**

This invention relates generally to carpules and more particularly to pre-packaged cartridges filled with injectable liquid for injection.

**Description of the prior art**

It is known in the art to provide blood sample collection apparatus with evacuated vials so that a blood sample will be drawn upon inserting a syringe into a blood vessel. See U.S. Patents 3,141,460 and 3,143,109.

It is also known in the art to aspirate a syringe before injecting liquid medicine subcutaneously to avoid accidental adverse reactions to injectable liquids such as drugs or anesthetic. One such reaction may be caused, for example, by the injection of a liquid directly into the lumen of a blood vessel. For example, if a cardiac patient were to receive an injection of a liquid anesthetic directly into a vein or artery, a fatal stimulation may occur.

Prior art practitioners have attempted to solve the problem by mechanical aspiration devices of various types.

For example, the plunger of a syringe is pushed by thumb pressure against the cartridge piston of a carpule after the point of the needle has been inserted into the tissue of the patient. This forces the diaphragm at the front end of the cartridge against the rear end of the needle. Since the pressure required to move the sealing piston into the cartridge is greater than the pressure required for the needle to pierce the diaphragm, the rear end of the needle penetrates the diaphragm so that the hollow of the needle then communicates with the interior of the cartridge.

A small harpoon or hook formed on the end of the plunger is depressed into the piston, so that a reverse pressure on the plunger has the effect of pulling the piston backwardly slightly to cause a negative pressure in the cartridge for purposes of aspiration.

Several difficulties are encountered in attempting to use mechanical aspiration. One such difficulty arises in pulling the plunger and sealing piston backward by thumb pressure after the preliminary quantity of drugs has been discharged from the cartridge. While the thumb can exert great pressure when acting in the direction of the forefinger, it is extremely difficult to apply a pressure in the opposite direction. Furthermore, the effort required may cause movement of the entire syringe including the needle while it is embedded in the tissue. Also, as the plunger and the sealing piston are being pulled backwardly to create a vacuum in the cartridge for the visual blood check the plunger may be pulled back so far that the piston comes out of the cartridge body.

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Other prior art practitioners have used supplemental vacuum generators in combination with syringes. Such devices cannot be used with conventional syringes and oftentimes require provision of clumsy cumbersome devices which are difficult to operate. See U.S. Patents 2,771,879, 2,971,509 and 3,089,489.

A serious deficiency of any mechanical aspirator, of course, is inherent in the fact that the operator may inadvertently overlook the need of aspiration or may negligently avoid the use thereof.

It is contemplated by the present invention that a pre-packaged carpule or transparent cartridge containing injectable liquid be packaged and maintained under a discreet negative pressure. Thus, as one end of the carpule or cartridge is punctured by the rear end of the needle or cannula it is immediately and automatically subjected to a negative pressure condition, and if the point of the needle or cannula is lodged in a blood vessel a quantity of blood is immediately drawn into the cartridge as a tell-tale where it can be readily observed.

It is, therefore, an object of the present invention to provide an improved method for administering injectable liquids.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIGURE 1 is a front elevational view of a plunger-type syringe constructed in accordance with the principles of the present invention and having a pre-packaged injectable liquid-containing cartridge placed within the barrel of the cartridge and showing the plunger in a fully retracted position.

FIGURE 2 is an enlarged front elevational view of a needle assembly of the syringe.

FIGURE 3 is an elevational view of the syringe with the needle assembly removed and with the barrel cocked to permit breech-loading of a cartridge.

FIGURES 4 and 5 are respectively elevational front and end views of a carpule or cartridge constructed in accordance with this invention and pre-packaged under negative pressure.

FIGURES 6a-6c show the syringe in different stages in the administering of an injectable liquid with the tissue situs shown in cross-section.

**DESCRIPTION OF THE PREFERRED EMBODIMENT**

The present invention provides the advantages of completely automatic aspiration with any conventional syringe structure.

Referring to FIGURES 1-3, a typical plunger-type syringe with which the principles of this invention may be practiced is indicated generally at reference numeral 10 and comprises a tubular housing or barrel 11, a needle assembly 12 at one end of the barrel 11, a spool finger grip 13 at the other end of the barrel 11 and a plunger 14 mounted for movement into and out of the barrel 11. A thumb ring 16 is formed at the distal end of the plunger 14 to receive the thumb of the user, and finger grip 13 is spool-shaped to receive the fore and middle fingers of the users.

The needle assembly 12 comprises a body 15 internally threaded to be screwed onto a threaded stub 17 projecting from the needle end of the barrel 11. A cannula or hollow needle 18 extends through the body 15 and is pointed at a forward end 19 to reduce the force necessary to insert the tip of the needle into the tissue. A rear end 20 of the needle extends substantially beyond the body 15 and may also be pointed if desirable to facilitate puncture of the cartridge diaphragm as will become apparent hereinafter.

The syringe 10 is of the cocking type, that is, the plunger 14 is mounted for articulation with respect to the barrel 11 to enable the drug-containing cartridge to be

inserted into a rear or loading end 21 of the barrel. The present invention, however, is applicable to all of the plunger-type syringes which accommodate the pre-packaged cartridges regardless of the means by which the cartridge is loaded into the syringe.

In the illustrated embodiment a bifurcated bracket 22 extends from the finger grip 13 and comprises a pair of aligned pins as at 23 received in complementary bores formed in the barrel 11 for accommodating pivotal movement of the barrel with respect to the finger grip 13 and the plunger 14.

A plurality of openings or windows as indicated at 24 and 26 are formed in the barrel 11 to enable the user to see into the barrel. An enlarged head 27 is formed at the inner end of the plunger 14 and a threaded insert 28 is received in a complementarily threaded bore formed in the finger grip 13. A portion of the insert 28 may be knurled or splined as at 29 to facilitate threading of the insert. The barrel 11 can only be cocked as shown in FIGURE 3 when the head portion 27 is withdrawn completely out of the barrel 11, and such complete withdrawal of the head portion 27 is possible only when the insert 28 has been threaded outwardly to the position thereof shown in FIGURE 3.

Referring to FIGURES 4 and 5 a capsule or cartridge constructed according to the principles of this invention is indicated generally at reference numeral 30. The capsule or cartridge comprises a tubular enclosure wall 31 having a reduced diameter neck 32 and an enlarged head 33. The cartridge 30 is substantially filled with an injectable liquid 34 and a rear end 36 of the cartridge 30 is closed by means of a resiliently expansible seal piston or stopper 37 and a front end or nose 38 is closed by a needle-pervious self-sealing wall member 39. The piston 37 may be made of rubber and the needle-pervious wall member 39 may constitute a rubber diaphragm.

In filling and sealing the cartridge 30, the liquid 34 is filled and confined within the interior of the cartridge under a negative pressure. The piston or stopper 37 effectively seals the liquid to store the same under a vacuum condition within the cartridge 30. It is contemplated that the quantum of negative pressure be within the range normally produced by mechanical aspiration since it would not be necessary to attain negative pressures in an amount provided in blood samples collection evacuated vials.

In use, the barrel 11 of the syringe 10 is first cocked as shown in FIGURE 3 and a cartridge 30 exhibiting the characteristics of this invention is loaded head first into the barrel 11. The barrel is then articulated into the aligned position thereof shown in FIGURE 1 and the insert 28 threaded into the finger grip 13 to lock the barrel 11 in place. The cartridge 30 then resides within the barrel 11 in the position thereof shown in FIGURE 1. The user then places the fore and middle fingers of the hand across the spool finger grip 13 and the thumb through the ring 16.

With the plunger 14 still in a retracted position, the needle 18 is inserted into the tissue situs by penetrating the epidermis and making a subcutaneous placement of the end of the cannula. Thumb pressure is then applied to the plunger 14 to move the plunger head 27 into abutting engagement with the sealing piston 37. Further pressure on the plunger 14 moves the cartridge forwardly until the diaphragm 39 abuts the rear end 20 of the needle 18.

An added force is then applied to the plunger 14 to cause the rear end 20 of the needle to pierce the diaphragm 39 and as this occurs the hollow of the needle 18 is immediately subjected to a negative pressure without any further mechanical actuation whatsoever. If the point 19 of the needle 18 is improperly placed in the lumen of a blood vessel a stream of blood will be drawn into the cartridge 30. The wall 31 of the cartridge is at least partly constructed of glass, clear plastic or other transparent material so that the traces of blood within

the cartridge will constitute a tell-tale and can be easily observed by the user.

Assuming no traces of blood are seen within the cartridge 30, the user applies additional thumb pressure to the plunger 14 to push the sealing piston 37 toward the head portion 33 of the cartridge 30, thus expelling the drugs 34 from the cartridge, through the hollow of the needle 18 and into the tissue. In this respect it is noted that the diameter of the plunger head portion 27 is less than the diameter of the piston 37 so that it may travel into the tubular wall 31, and it is further noted that the needle 18 and the cartridge 30 are constructed and arranged so that the force required for the rear end 20 of the needle 18 to pierce and penetrate the diaphragm 39 is less than that required to push the piston 37 into the tubular wall 31.

FIGURES 6a-6c illustrate the relative disposition of the parts of the syringe in various stages of an injection. In FIGURE 6a the needle 18 has been inserted into tissue 40. Unbeknownst to the user, however, the point 19 is lodged in the lumen of a blood vessel 41. This fact is made known, however, as soon as the rear end of the needle punctures and penetrates the diaphragm 39 of the cartridge 30 since tell-tale traces of blood as indicated at 42 are observed within the cartridge and cloud the contents of the capsule with a distinctive blood red color. The needle 18 is then removed from the tissue 40 and a fresh cartridge is loaded into the syringe 10.

FIGURE 6b illustrates the needle 18 again inserted into the tissue 40 but this time the point of the needle is not lodged in a blood vessel. Thus, as the plunger 14 is depressed and the rear end 20 of the needle 18 punctures the diaphragm 39, automatic aspiration again takes place without any special effort on the part of the user. In this instance placement of the cannula is proper if no traces of blood are observed in the cartridge 30 through the window 24. The plunger 14 is then further depressed as shown in FIGURE 6c to expel the liquid 34 from the cartridge 30 through the hollow of the needle 18 and into the tissue 40.

It is thus apparent that the present invention enables the user of the syringe to check placement of the cannula automatically without resorting to mechanical aspirating techniques of any kind.

Injection terminology uses expressions such as "subcutaneous," meaning within the cutaneous tissues; "intradermal," meaning within the epidermis, and "intravenous," meaning within a vein. Aspiration is required in all types of injections. In a subcutaneous injection aspiration insures placement outside of a blood vessel. Those versed in the art will recognize that the present invention may also be useful in assuring the user that an intravenous injection is properly placed inside the blood vessel.

Although minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably come within the scope of my contribution to the art.

I claim as my invention:

1. The use of a pre-packaged carpule containing a supply of injectable liquid which includes the steps of, reducing the pressure in the carpule during packaging to a negative value so that the injectable liquid is permanently stored within the carpule under vacuum, penetrating tissue to place one end of a cannula at a selected situs, and concurrently communicating the other end of the cannula with the interior of the carpule, thereby to automatically produce temporary aspiration at the selected situs so that improper placement of said one end of the cannula in a blood vessel will produce a tell-tale warning in the carpule.
2. The use of a pre-packaged carpule with injectable liquids which includes the steps of,

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confining a supply of liquid in a container under negative pressure, and

simultaneously cannulating a subcutaneous tissue situs and the container with a common cannula to temporarily subject the tissue situs to the negative pressure of the supply of liquid so that blood from a vessel in the situs will be aspirated into the liquid supply as a tell-tale of improper cannula placement.

3. A method of injecting liquid into subcutaneous tissue containing blood vessels which includes the steps of,

(a) pre-packaging the liquid to be injected in a carpule under negative pressure,

(b) inserting one end of a cannula into a subcutaneous tissue situs, and

(c) communicating the other end of the cannula with the interior of the carpule,

whereupon the cannula will automatically be subjected to a negative pressure for drawing blood from a blood vessel up through the cannula into the interior of the carpule in the event of an improper placement of the cannula.

4. A method of intravenous injection of liquid which includes the steps of,

(a) pre-packaging the liquid to be injected in a carpule under negative pressure,

(b) inserting one end of a cannula into a vein, and

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(c) communicating the other end of the cannula with the interior of the carpule,

whereupon the cannula will automatically be subjected to a negative pressure for drawing blood from a blood vessel up through the cannula into the interior of the carpule to indicate proper placement of the cannula in the vein.

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RICHARD A. GAUDET, Primary Examiner

MARTIN F. MAJESTIC, Assistant Examiner

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