Title: SYRINGE WITH INTERCHANGEABLE AND RETRACTABLE NEEDLE PLATFORM

Abstract

This invention relates to a safety syringe needle device which has medical and industrial application. More particularly, this invention pertains to a syringe which, after being used by a person to inject medication or fluid into a patient, or in sampling or exposure to toxic materials, or the like, can be transformed by the person to withdraw the needle into the barrel of the syringe for disposal purposes, thereby eliminating needlestick injuries among such persons. A syringe comprising (a) a hollow elongated barrel means (8, 132); (b) penetration means (2, 4; 2, 6) which is adapted to removably engage with an end (10) of the barrel means; (c) plunger means (16) adapted to fit within and move axially in the hollow barrel means; the plunger means causing a pumping action within the interior of the barrel means between the plunger means and the end of the barrel means when the plunger means is pushed into the interior of the barrel means in the direction of the end of the barrel means; and (d) engaging means (24, 28, 44, 46, 52, 104) at the end of the plunger means proximate to the penetration means, the engaging means being adapted to engage the end of the penetration means when the plunger means is fully inserted into the interior of the barrel means in the direction of the end of the barrel means and cause the penetrating means to part from the end of the barrel means and to be withdrawn into the interior of the barrel when the plunger means is withdrawn away from the end of the barrel means. An adapter (80) for a syringe having a piston and a needle base fitting in the end of the syringe comprising: (a) a protrusion formed at one end of the adapter for fitting inside the hollow of a base affixed to a syringe needle; (b) releasable engagement means (90) formed in the exterior of the adapter and being adapted to releasably engage with the interior of the needle receiving end of a syringe barrel; and (c) an engagement means (86) formed in the end of the adapter opposite the protrusion, said engagement means being adapted to engage with the piston end of a syringe plunger.

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SYRINGE WITH INTERCHANGEABLE
AND RETRACTABLE NEEDLE PLATFORM

FIELD OF THE INVENTION

This invention relates to a novel safety disposal syringe needle device which has medical and industrial application. More particularly, this invention pertains to a syringe which, after being used by a person to inject medication or fluid into a patient, or withdraw fluids from a patient after sampling or exposure to toxic materials, or the like, can be transformed by the person to withdraw the needle into the barrel of the syringe for disposal purposes, thereby eliminating needlestick injuries among such persons.

BACKGROUND OF THE INVENTION

Needlestick injuries among medical personnel such as health care workers are of growing concern because of disease transmission, particularly the deadly virus known as HIV-1 (AIDS) and Hepatitis B. The AIDS virus for which there is no known cure is estimated to infect 5-10 million people worldwide and is spreading rapidly. Although in 1985 medical publications stated that no health care workers had become infected with the AIDS virus, it is now known that there is a significant risk to health care workers. A report in the New England Journal of Medicine, August 14, 1988, indicates that the risk of acquiring HIV-1 infection is 0.35 - 0.74% per needlestick injury. The reported incidence of needle stick injuries to medical staff has been reported at 25.3 per 100 beds annually. In one New York Hospital, at least 7% of house doctors have sustained needle stick injuries while caring for AIDS patients.
Transmission rates of Hepatitis B after needle-stick exposure are much higher than that occurring with the HIV virus and may be 6 - 30%. The Center for Disease Control has estimated 200-300 health care workers die annually in the U.S.A. from occupationally acquired Hepatitis B.

With presently used syringes with projecting needles, potentially dangerous needlestick injuries are commonplace and most often occur between the time the medication is injected into the patient and the time the syringe is disposed of. Most injuries occur while recapping the needle or when disposing of it into a disposal container. However, maintenance personnel who handle disposed materials are also subject to needlestick injuries.

At present, there is no reason to believe that the AIDS epidemic will come to a quick end. Canada's frequency rate at the present time is 100.2 cases per 1,000,000. The United States is a frightening 377.1 cases per 1,000,000. In Canada, according to current data projections, the incidence of AIDS rate at least doubles every eighteen months.

A number of patents disclose syringes or the like having needle protecting features. U.S. Patent No. 4,592,744, Jagger et al., June 3, 1986, illustrates a disposable medical needle apparatus with a self-sheathing needle assembly. The self-sheathing safety needle has a case with a small closed end and a large open end. A needle assembly is located within the case with the needle projecting through the small closed end. A hub is connected to the needle assembly inside the case. The connector on the hub cooperates with a receiver on the small end to hold the needle assembly in the case. A flange on the hub cooperates with an inward projection in the case.
based from the small end to prevent movement of the needle out of the case when the needle is withdrawn from the opening in the small end. The nozzle of a syringe pushed into the hub withdraws the needle when the syringe is withdrawn. A rubber stopper on a vacuum tube withdraws the needle after the rubber stopper turns the flange to release the connector from the receiver.

U.S. Patent No. 4,804,370, granted February 14, 1989, Haber et al., discloses a disposable disease control syringe which reduces the frequency of accidental needle strikes to health care workers and prevents health-threatening reuse of the needle cannula by drug abusers. The syringe includes a cylinder having an open proximal end, a substantially closed distal end, and a retractable needle projecting through the distal end. A piston assembly having a detachable stem and a needle capturing receptacle moves axially and distally through the syringe cylinder to expulse fluid medication and to selectively engage the needle at the most distal aspect of the cylinder. The piston assembly is then withdrawn proximally through the cylinder, whereby to relocate the needle from the distal end to the proximal cylinder end. The needle capturing receptacle is locked at the proximal end of the syringe cylinder with the needle cannula retracted within and completely shielded by the cylinder. The stem is then detached from the piston assembly and discarded, thereby creating a disposal cartridge with the needle cannula rendered permanently irretrievable therewithin. Alternatively, the piston assembly can be driven distally through the cylinder for correspondingly moving the needle into contact with a puncture resistant shield located at the distal end of the cylinder, whereby the needle is axially collapsed and destroyed within the cylinder.
U.S. Patents Nos. 4,542,749, Caselgrandi et al., and 3,306,290, Weltman, disclose syringes with protected needle designs.

U.S. Patent No. 4,631,057, Mitchell, discloses a syringe which has on the body of the syringe a needle guard which can be moved from a position which shields the needle, to a retracted position which exposes the needle. U.S. Patent No. 4,425,120, Sampson, granted January 10, 1984, also discloses a shielded hypodermic syringe with a needle guard mounted on the barrel which may be extended or retracted to protect or expose the needle. U.S. Patent No. 4,573,976, Sampson et al., also discloses a shielded needle syringe comprising a needle guard which can be retracted or extended relative to the body of the syringe, means being provided for releasably retaining the guard in the retracted position. U.S. Patent No. 3,884,230, Wulff, granted May 20, 1975, discloses a flexible needle and guard and device for a hypodermic syringe. This design appears to be directed mainly to avoiding breakage of the needle when the syringe is being used.

U.S. Patent No. 4,258,713, Wardlaw, discloses an automatic disposable hypodermic syringe which has means for driving the hypodermic needle from a retracted position within the housing of the syringe to an injecting position whereby a portion of the needle protrudes from the housing. This device does not disclose a feature whereby the needle can be protected or retracted after use. U.S. Patent No. 4,085,737 discloses a blood sampling syringe which includes an apparatus for protecting the open end of the needle of the syringe. The device is intended for minimizing risk of contamination of the needle tip after a blood sample has been taken. U.S. Patent No. 4,266,543, Blum, granted May 12, 1981, discloses a hypodermic needle protection means which is designed so that the needle can be slidably moved
to the interior of the needle support means upon application of pressure.

U.S. Patent No. 4,266,544, Wardlaw, granted May 12, 1981, discloses an improved disposable syringe wherein retracting means movably mounted on the housing of the syringe is adapted to pull the needle from its projecting position to a safe position whereby the needle is covered by a portion of the syringe. U.S. Patent No. 4,139,009, Alvarez, discloses a hypodermic needle assembly with a retractable needle cover, the needle cover comprising a plurality of elastically resilient arms extending between a hub portion and a slide member, the arms acting as a restoring force for urging the slide member back over the needle forward portion when the syringe is withdrawn from contact with the skin of a patient.

U.S. Patent No. 4,774,964 discloses a device which is designed to withdraw blood from a patient. It is not a syringe per se. It is not used for injecting fluids into a patient. However, the device has the capacity to withdraw the needle into the barrel housing.

**SUMMARY OF THE INVENTION**

This invention relates to a safety disposable syringe. More particularly, this invention pertains to a syringe which after being used by a health care person to inject medication or fluid into a patient or withdraw fluids from a patient, can be transformed by that person to withdraw the needle into the barrel of the syringe for disposal purposes, thereby eliminating the occurrence of needle sticking injuries among such health care persons. This syringe can also be used in industrial processes for sampling or adding substances which may be toxic. After such function, the needle is withdrawn into the barrel to prevent contamination at any further point in the process.
or during disposal. The syringe and retractable needle feature is adapted to be used with a variety of interchangeable needles of different diameter and length utilizing a universal Luer lock coupling mechanism.

The invention pertains to a syringe comprising:
(a) a hollow elongated barrel means; (b) penetration means which is adapted to removably engage with an end of the barrel means; (c) plunger means adapted to fit within and move axially in the hollow barrel means; the plunger means causing a pumping action within the interior of the barrel means between the plunger means and the end of the barrel means when the plunger means is pushed into the interior of the barrel means in the direction of the end of the barrel means; and (d) engaging means at the end of the plunger means proximate to the penetration means, the engaging means being adapted to engage the penetration means when the plunger means is fully inserted into the interior of the barrel means in the direction of the end of the barrel means and cause the penetrating means to part from the barrel means and to be withdrawn into the interior of the barrel when the plunger means is withdrawn away from the end of the barrel means.

In the syringe, the penetrating means can be a hollow needle which is pointed at one end thereof, and at the end opposite to the pointed end is formed to mate with the penetration means engaging end of the barrel means. An abutting means can be positioned within the interior of the barrel means and permits the plunger to be inserted into the interior of the barrel means through one end but deters the plunger means from being withdrawn from the interior of the barrel means. Alternatively, the barrel means may have two abutting means in the interior of the barrel means, the two abutting means being adapted to trap the plunger means between them when the plunger means is partially withdrawn from the barrel means.
In the syringe as defined, the engaging means may be a hook. The needle engaging means may be a female and male thread combination which is engaged by rotating the plunger relative to the barrel and penetrating means. Alternatively, the engaging means may be a cam-lock combination, the cam on the base of the needle penetrating means engaging with a receiving groove formed in the needle proximate end of the plunger, the cam-lock means engaging by rotating the plunger relative to the barrel.

In another version of the syringe, the end of the plunger proximate the penetrating means can be formed with a snap-over attachment, and the end of the penetrating means proximate the plunger can be formed with a projection which is adapted to receive and be secured by the snap-over attachment.

In a further embodiment of the syringe, the penetration means at the end proximate the plunger may be bent radially, and mate with a groove formed in the end of the plunger proximate to the bent end of the penetration means, the bent end of the penetration means and the groove in the plunger being engaged by rotating the plunger relative to the barrel of the syringe.

The needle engaging means in the syringe can be a dual female thread combination, the dual threads being formed in opposite ends of the engaging means, and a male thread means being formed on the exterior of the engaging means outside one of the female threads, the exterior male thread means being of opposite thread rotation to the dual female thread means. The end of the needle proximate to the engaging means can have a male thread removable engageable with the proximate female thread of the engaging means. The plunger proximate to the engaging means can have a male thread engageable with the female thread of the
engaging means opposite to the female thread engaging the male thread of the needle means.

The invention also relates to an adapter for a syringe having a piston and a needle base fitting in the end of the syringe comprising: (a) a protrusion formed at one end of the adapter for fitting inside the hollow of a base affixed to a syringe needle; (b) releasable engagement means formed in the exterior of the adapter and being adapted to releasably engage with the interior of the needle receiving end of a syringe barrel; and (c) an engagement means formed in the end of the adapter opposite the protrusion, said engagement means being adapted to engage with the piston end of a syringe plunger.

The piston engaging means of the adapter can be a self-aligning, non-jamming spiral flight - flat driving fact combination and the releasable engagement means on the piston can be a flat driving faces which engage with the flat driving faces of the adapter. The penetration means of the syringe can be releasably engaged with the end of the barrel means by means of an adapter, and the adapter means can be adapted to engage with the engaging means at the end of the plunger means proximate to the penetration means by rotating the plunger means. The adapter means can be releasably connected to the end of the barrel means by a female-male thread combination, and the means of the adapter means adapted to engage the flat driving face engaging means of the plunger means can be a spiral flight-flat-driving face combination.

The penetration means of the syringe can be a needle which is fitted with a Luer lock, the Luer lock being engaged with the adapter means. The needle-Luer lock combination and the adapter can be disengaged from the end of the barrel means by latch means which engages with the adapter when the plunger means is pushed to the needle end
of the barrel and rotated to minimally withdraw and activate the engagement means.

The adapter can protrude partially from the penetration means end of the hollow barrel means and can have a thread direction which is the same as or opposite to the thread direction of the barrel means engaging the penetration means. The adapter can be designed to protrude partially from the penetration end of a syringe barrel.

**DRAWINGS**

In the drawings which illustrate specific embodiments of the invention, but which should not be construed as restricting the spirit or scope of the invention in any way:

Figure 1a illustrates a side elevation view of the needle and hub components of a first embodiment of the syringe;

Figure 1b illustrates a side elevation view of the barrel of a first embodiment of the syringe;

Figure 1c illustrates a side elevation view of the plunger, bung and hook of a first embodiment of the syringe;

Figure 1d illustrates an end elevation view of the hook;

Figure 2 illustrates a side elevation partial-section view of a first embodiment of the syringe assembly with the needle and hub secured to an end of the barrel, and the plunger and its bung and hook partially inserted into the interior of the barrel, prior to use of the syringe;
Figure 3 illustrates a side elevation partial-section view of a first embodiment of the syringe assembly with the plunger and its bung and hook fully inserted into the interior of the barrel so that the hook extends into the interior of hub;

Figure 4 illustrates a side elevation partial-section view of a first embodiment of the syringe with the plunger, bung, hook and needle fully withdrawn into the interior of the barrel and the distal end of the plunger broken-off from the bung end of the plunger;

Figure 5 illustrates a side elevation partial section view of an alternative embodiment of the syringe which has a double screw action needle and hub engagement mechanism and the end of the plunger away from the needle and hub engagement mechanism has therein a cavity which can fit over the opening in the end of the plunger after the needle and hub are withdrawn into the interior of the barrel.

Figure 6 illustrates a detail view of the double screw action needle and hub engagement mechanism.

Figure 7 illustrates a side elevation partial section view of the needle and hub withdrawn into the interior of the barrel and the broken away part of the plunger placed over the opening in the head end of the barrel.

Figure 8 illustrates a side elevation partial-section view of a second embodiment of the syringe with a screw-lock plunger-needle hub connection;

Figure 9 illustrates a detailed side elevation partial-section view taken along section A-A of Figure 11
of a first design of a plunger with a right-hand or left-hand cam-lock rotation to secure the plunger to the needle hub for withdrawing the needle into barrel of the syringe;

Figure 10 illustrates a detailed side elevation partial-section view taken along section A-A of Figure 11 of a second design of a plunger with a right-hand or left-hand cam-lock rotation to secure the plunger to the needle hub and a second right-hand or left-hand rotation locking means which provides a double locking action between the plunger and needle hub;

Figure 11 illustrates an end elevation view of the needle end of the syringe illustrated in Figure 8;

Figure 12 is a section view taken along section line B-B of Figure 9 showing the syringe barrel handle and syringe plunger handle at a 45° angle to one another to activate the right-hand rotation cam locking action;

Figure 13 illustrates a detailed side elevation partial-section view of side scoring on a plunger of a syringe with an oval flange cam lock;

Figure 14 illustrates a detailed end elevation view of the cam lock mechanism of the embodiment of the syringe illustrated in Figure 9;

Figure 15 illustrates a side elevation partial-section view of a plunger with a snap-on socket type needle hub connection;

Figure 16 illustrates a side elevation partial-section view of a plunger with a snap-on socket type needle hub connection;
Figure 17 illustrates a side elevation partial-section view of a plunger with a snap-on socket type needle hub connection combined with a right-hand rotation option;

Figure 18 illustrates a section view taken along section line A-A of Figure 16;

Figure 19 illustrates a side elevation partial-section view of a bent needle embodiment of a needle hub connection;

Figure 20 illustrates a top elevation partial-section view of a bent needle embodiment of a needle hub connection;

Figure 21 illustrates a side elevation partial-section view of a bent needle embodiment of a needle hub connection coupled with a right-hand rotation option;

Figure 22 illustrates a detailed end view of the diagonal slot in the end of the piston-plunger with the bent needle end fitted in the slot;

Figure 23 illustrates a detailed end view of the diagonal slot in the end of the piston-plunger rotated in the slot to grip the bent end of the needle;

Figure 24 illustrates a side elevation partial-section view of an embodiment of the syringe wherein the needle and hub are rotatably detachable from the barrel and the plunger threadedly engages the interior of the hub;

Figure 25a illustrates a side elevation partial-section view of the syringe with the needle and hub drawn within the interior of the barrel and the remote end of the plunger that is broken away, formed with a hollow threaded cap-like opening; and
Figure 25b illustrates a side elevation partial-section view of the syringe with the broken away plunger portion threadedly engaged with the male threaded end of the hub at the top of the barrel.

Figures 25c and 25d illustrate sequential side elevation views of an alternative design of syringe where the part of the plunger adjacent the break away weak point is threaded and is screwed into the opening in the end of the barrel vacated by the needle and hub when pulled into the barrel.

Figure 26 illustrates a side elevation partial-section view of an embodiment of the syringe wherein the piston is adapted with a latch which snaps into place in an adapter after the piston is fully depressed and rotated.

Figure 27 illustrates a side elevation partial section view of an adapter which mates with the needle platform.

Figure 28 illustrates a side elevation section view taken along section line C-C of Figure 29.

Figure 29 illustrates an end view of the latch mechanism of the piston depicted in Figure 26.

Figure 30 illustrates a side elevation view of an alternative design of adapter;

Figure 31 illustrates a side elevation partial section view of the alternative design of adapter; and

Figure 32 illustrates a side elevation partial section view of an embodiment of the syringe wherein an
adapter is mounted so that it partially extends from the front end of the barrel.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS OF THE INVENTION

Most disposable syringes can be used with a variety of interchangeable needles with different diameter and length. The needles are connected by what is known as a Luer connector, which may be of two types. One is a simple conical device which accepts the needle base. This version is often described as a Luer tip. To detach the needle, it is simply pulled off. The other connector type is often described as a Luer lock. The Luer lock has a simple screw thread locking mechanism that permits the base of the needle to be screwed on to the syringe so that it cannot be pulled off without unscrewing. In this disclosure, the universal coupling mechanism connecting the needle to the syringe will be referred to as a Luer lock version of the Luer connector unless otherwise indicated. It should be recognized that the claims to the invention relate to both the plain Luer tip and the Luer lock mechanisms. The interchangability capability of a Luer lock allows for the most appropriate needle to be used for syringe filling and patient injection. In many cases, to save time, a different larger needle is used to fill the syringe with fluid prior to injection. A needle of fine calibre to minimize pain to the patient, and tissue damage, is often used for intra-muscular or subcutaneous injection. In addition, if the same needle is used to puncture a vial in order to fill the syringe with medication, there is a potential for contamination of that needle from the vial, if the vial stopper carries a contaminant. Under most circumstances, this would not pose a significant risk. However, if the patient has reduced immunity to infection, the ability to change to an entirely new sterile needle for patient injection may become important.
Although the prior art describes syringes which can protect the needle by a variety of means, including those which involve withdrawing the needle into the interior of the barrel of the syringe, such syringes do not allow for interchangability of the needle or for the universal Luer lock coupling mechanism which is an important feature of the syringe. Most commercially available syringes employ a Luer lock. Since the subject invention is adapted for use with a Luer lock, it can directly replace syringes currently in use and requires no change in technique or procedure until after the syringe has been used. In addition, most currently produced needles can be used in the usual manner on this syringe.

After use, once the needle has been withdrawn into the barrel, the syringe plunger can be snapped off. It is designed so that it can be screwed onto the front of the syringe and thereby prevent any possibility of the needle within the barrel protruding through the front of the syringe again. This is an important factor for a health care worker using the syringe and also for any healthcare workers subsequently handling garbage which might contain a contaminated syringe.

This invention pertains to a syringe which, after being used by a health care worker or hazardous industries worker, or the like, to inject medication or fluid into a patient, or withdraw fluid from a patient, or in sampling toxic material, for example, in an industrial process, can be transformed by the worker to withdraw the needle into the barrel of the syringe for disposal purposes, thereby eliminating potentially harmful needlestick injuries among such workers. In industrial applications, the storage of a contaminated needle is similarly effected within the barrel to prevent further contamination of the environment or process.
With any of the various embodiments of the basic syringe design, the needle is retracted by the user into the interior of the body of the syringe immediately after it is withdrawn from the patient's body tissue, or after exposure to hazardous situations. Thus, the needle is not exposed for accidental contact at any time after the needle has contacted the potentially hazardous patient's body fluids, or other hazardous materials. This retraction feature eliminates the possibility of potentially dangerous needlestick injuries occurring with contaminated needles.

The safety syringe of the invention is simple to operate and is only slightly more expensive to manufacture than presently used syringes. Another advantage is that the syringe design closely resembles currently used syringes and thus there should be no difficulty in obtaining good acceptance among workers such as medical institutional workers. Moreover, the operation of the subject syringe is easy to teach to such workers and requires no unusual skills or manual dexterity.

Syringes that are in current commercial use normally consist of four components, a needle cap which is removed prior to use, a hollow needle which is mounted on a hub with a Luer lock, a barrel to which the hub is attached, and a plunger with a bung (piston) at the head end of the plunger. The plunger is inserted within the barrel head end first and can be pushed into the interior of the barrel in order to pump fluid contained in the barrel out through the interior of the hollow needle. The subject invention, in various embodiments, includes several basic modifications which do not dramatically change the appearance of the conventional syringe.

Referring to the drawings, Figures 1a, 1b and 1c illustrate the three basic components which make up a first
embodiment of the novel needle retractable syringe. Figure 1a illustrates in side elevation partial section view the construction and interaction of the needle 2 and cup 4 which fits detachably within the interior of base 6 of the syringe. Base 6 has a female thread in the base of its interior. Figure 1b illustrates in side elevation partial section view the construction interaction of the barrel 8, the partially closed threaded hub receiving end 10, which is located at the top of the barrel 8, and the barrel base 12 which is formed at the bottom the barrel 8. A circular rim-like catch 14 is formed in the interior of the barrel 8 immediately above the barrel base 12 and provides a stop to deter full withdrawal of the plunger 16 from the interior of the barrel 8. Alternatively the needle may during manufacture be affixed integrally to the syringe base and be removable only during retraction into the barrel after the syringe has been used.

Figure 1c illustrates the construction of the plunger 16, which includes a bung (piston) 18 which fits snugly against the interior of the barrel 8 and serves to force the liquid contents of the interior of the hollow barrel 8 (usually medication) out the interior of the hollow needle 2, and in a common situation into the body of a patient, when the plunger 16 is manually pushed into the interior of the barrel 8. A thumb or finger press 20 is formed at the base of the plunger 16, while the base 22 of the bung 18 serves to align the plunger 16 within the interior of the barrel 8, and deter full withdrawal of the plunger 16 from the barrel 8 by abutting catch 14. Affixed to the top central area of the bung 18 is a five tine metal hook 24.

Figures 2, 3 and 4 illustrate in sequential side elevation partial-section views, the syringe in assembled state, with the components in various positions. Figure 2 illustrates the syringe assembly when it is charged with a
fluid such as fluid medication, or the like, ready for use. The fluid is contained in the volume space immediately above the bung 18 and below the threaded hub receiving end 10. When the plunger 16 is fully pushed by thumb or finger press 20 upwardly into the interior of the barrel 8, the fluid contents of the syringe are extruded by plunger 16 and bung 18 through the hollow interior of needle 2 and out the pointed end. At the same time, one or more of the tynes of the hook 24 engages with the interior of cup 4 as illustrated in Figure 3. Subsequently, as illustrated in Figure 4, when the plunger 16 is almost fully withdrawn from the interior of barrel 8, the hook 24 pulls the cup 4, and the attached needle 2, downwardly through the interior of base 6, and into the interior of barrel 8. Thus all of the needle 2 is retracted into the interior of the barrel 8. If desired, the portion of the plunger 16 which extends beyond base 12 can be broken off at the weakened section, as illustrated in Figure 4, and the two components disposed of in smaller pieces.

As seen in Figure 1a, the metal of the needle is extended to form a bell shaped cup 4, which fits within the interior of and is affixed to the plastic base 6. By using this construction, in this embodiment, the likelihood that a break will occur between the needle 2 and the cup 4 is minimized. The needle 2 and the cup 4 are formed in one piece, and since the metal is stronger than the plastic forming the base 6, a break between the metal and the plastic is encouraged.

When the plunger 16 is fully depressed into the interior of the barrel 8, the one or more of the tynes of hook 24 engage the interior of the cup 4, and then, when the plunger 16 is withdrawn, the hook 24 pulls on the interior of the cup 4 and causes it to break away from hub 6. Once a full break has been made, needle 2 and cup 4 are
drawn into the interior of the barrel 8 by further withdrawing the plunger 16.

The syringe of the invention has a built-in safety feature in that the needle 2 can only be withdrawn into the interior of the barrel 8 up to the point that guide 22 abuts the catch 14 located around the interior rim of the base of the barrel 8. Thus, unless considerable effort is exerted, it is not possible to pull the needle 2 cap 4 and plunger 16 completely through the barrel 8. The catch 14 is designed so that when the components are assembled, it is easy to insert the bung 18, with the hook 24, and the guide 22 through the interior of the one-way catch 14, and into the interior of the barrel 8 but it is difficult to fully withdraw these components. Once the needle 2 is withdrawn into the barrel 8 by hook 24, it is not supported laterally and tips to one side against the barrel 8, thereby making it virtually impossible to push the needle 2 back through the base 6. The tynes of hook 24 are not necessarily of the same length, which encourages tipping of the needle 2 to one side. Breaking off the portion of the plunger 16 that extends beyond barrel base 12 ensures that the used needle 2 cannot be pushed back through base 6, thereby exposing the sharp point of the needle 2 beyond hub 6. Also, it is usually easier to dispose of two smaller shorter components than one elongated one.

Figures 5 through 31, illustrate nine alternative embodiments of the body fluids precautions syringe.

Figure 5 illustrates a side elevation partial section view of a preferred embodiment of the syringe which has a double screw action needle and base engagement mechanism 80. The end of the plunger 16 away from the needle and base engagement mechanism 80 has therein a cavity 82 which can fit over the cup 84 and opening in the
end of the barrel 8 after the needle 2 and base 6 are withdrawn into the interior of the barrel 8 (See Figure 7).

Figure 6 illustrates a detail view of the double screw action needle and base engagement mechanism 80. The mechanism 80 is constructed so that it has right hand female thread 86 of one size diameter in a cup-like opening at one side, a right hand female thread 88 of a narrower size diameter in a cup-like opening in the opposite side, and a left-hand male thread 90 on the exterior of the mechanism 80 outside the interior female thread 88.

Base 6 screws into female thread 88 and the syringe is used in this configuration for injecting medication into a patient. However after use, to operate the mechanism 80, to enable the needle to be withdrawn into the barrel 8, the head end of the plunger and bung 18 are screwed right handed into the female thread 86. Once fully engaged, then further right hand action on left-handed thread 90, unscrews thread 90. The entire mechanism 80 including the needle 2 can then be withdrawn into the interior of the barrel 8. The right hand and left hand threads can, of course, be reversed to operate in the reverse manner, if that is required.

Figure 7 illustrates a side elevation partial section view of the needle 2 and base 6 withdrawn into the interior of the barrel 8 and the cavity 82 of the broken away part of the plunger 16 placed over the opening and cup 84 in the head end of the barrel 8.

Figure 8 illustrates a side elevation partial-section view of a second embodiment of the syringe which is constructed to have a screw-lock plunger-needle hub connection. As can be seen in Figure 8, the barrel 8 has the syringe plunger 16 disposed therein. The plunger 16 carries at its frontal end (the left end as seen in Figure

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8) a piston 26 which is constructed of a resilient material such as resilient rubber so that it snugly engages the inner cylindrical surface of the barrel 8. The piston 26 is connected to the plunger 16 by means of a plunger flange 36. The frontal end of the plunger 16 is constructed to have therein a cylindrical cavity which has a female thread 28 formed in the wall of the cavity. The base of the base 6 is constructed to have a male hub thread 34, which is formed to match and engage the female thread 28 formed in the opening in the front end of the plunger 16. Figure 8 also illustrates piston stop 15 formed in the rear end of the interior of the barrel 8 (the right side as seen in Figure 8). Piston stop 15 serves the same purpose as catch 14 as discussed in relation to Figures 1 to 4 above. A cap 32 protects the needle 2 and fits over the base 6. Cap 32, when engaged after the needle 2 is withdrawn prevents exposure of the needle 2 if it is accidentally pushed back through the opening at the forward end of the syringe.

In use, the plunger 16 and piston 26 are disposed within barrel 8 as illustrated in Figure 8. The cap 32 is removed and the pointed end of the needle 2 is inserted into the medication. At this time, female base thread 34 is not engaged in male thread 28. The fluid medication is drawn into the interior of the barrel 8 by suction action created by withdrawing press 20 and plunger 16 from the interior of barrel 8, as is conventional. Once the desired quantity of medication has been drawn into the interior of the barrel 8, and air is eliminated, the sharp end of the needle 2 is inserted into an appropriate location on the patient. The medication that is held within the interior of barrel 8 is injected through the interior of needle 2 into the patient by asserting thumb or finger pressure on press 20. Once the medication has been injected into the patient, the piston 26 has moved to the position illustrated in Figure 8. It is then necessary to initiate the action which is ultimately used to withdraw the base 6 and
the needle 2 into the interior of the barrel 8. This is done by asserting a clockwise rotation on press 20, which engages male hub thread 34 in female thread 28 in the end of plunger 16 (assuming that threads 28 and 34 are right-hand threads). Base 6 and plunger 16 are then intimately engaged by threads 34 and 28 interacting with each other. Press 20 can then be withdrawn to pull the plunger 16 from the interior of barrel 8. By this action, the base 6 and needle 2 are pulled into the interior of barrel 8 until the rear end of piston 26 comes to rest against piston stop point 15. At this point, the plunger break point 30 has been withdrawn exterior of barrel 8, and consequently plunger 16 can be broken into two parts at the plunger break point 30. The two parts of the syringe can then be disposed of with complete safety since the needle 2, which might have been exposed to harmful virus, or the like, has been withdrawn into the interior of barrel 8, while the part of the syringe 16 that has been broken away at break point 30, has not been exposed to any medicine and can be discarded without danger. It will be recognized that break point 30 is an option which need not necessarily be built into plunger 16. Breaking the syringe into two parts permits easy disposal whereas one elongated syringe, with the plunger withdrawn might be difficult to dispose of in certain instances.

Figure 9 illustrates a detailed side elevation partial-section view taken along section line A-A of Figure 11 of a first design of a piston 26 with a right-hand cam-lock rotation (rather than a thread configuration) to secure the forward end of the piston 26 to the needle base 6 for withdrawing the needle 2 into the barrel of the syringe. The cam-lock option illustrated in Figure 9 operates by asserting a right-hand rotation on the press 20, relative to the barrel 8. In this way, cam-lock ridge 42, which is formed in the base of base 6, rotates into helical engagement with cam-lock groove 44. This combination
replaces the male hub thread 34 and female thread 28 combination illustrated in Figure 8, as discussed previously. Once the cam-lock ridge 42 is engaged snugly within cam-lock groove 44, the needle 2 and base 6 can be withdrawn into the interior of the barrel 8.

Figure 10 illustrates a detailed side elevation partial-section view of a second design of a plunger with a right-hand cam-lock rotation (similar to that illustrated in Figure 9). However, the design shown in Figure 10 also includes a second hub rim 38 which is formed in the base area of base 6. The purpose of hub rim 38 is to engage left hand thread 40, which is formed in the interior of the barrel 8, which houses the base 6. The alternative option illustrated in Figure 10 includes the right-hand cam-lock ridge 42, cam-lock groove 44 combination, discussed in association with Figure 9, but it has a second feature. A right-hand male hub rib 38 is formed in the exterior of base 6 forward of cam-lock ridge 42. A matching right hand female thread 40 is formed in the interior of the forward end of barrel 8, that is, the end which surrounds base 6. To operate the double action embodiment illustrated in Figure 10, cam-lock ridge 42 is first engaged in cam-lock groove 44 by clockwise (right hand) rotating press 20 relative to barrel base 12 (see Figure 8) and then, by means of a second right handed (counterclockwise) rotation, hub rim 38 is engaged within female left hand thread 40. The needle 2 and base 6 are then double engaged by two right hand twists and can then be withdrawn into the interior of the barrel 8. The double-action engagement mechanism ensures proper secure engagement of the plunger and base.

It should be recognized that the first and second options illustrated in Figures 9 and 10 respectively can be used in any of the alternative embodiments of the invention that are illustrated in Figures 11 through 23. It should
also be recognized that the double-action locking mechanism illustrated in Figure 10 can be right-right, left-left, right-left or left-right.

Figure 11 illustrates an end elevation view of the needle end of the syringe illustrated in Figure 8, and clearly illustrates the eccentric construction of right-hand cam-lock ridge 42. Ridge 42 is constructed generally in the form of an oval, the opposite ends of the oval being adapted to engage in the right-hand grooves of the cam-lock groove 44 (see Figure 9 or 10).

Figure 12 is a section view taken along section line B-B of Figure 9 and illustrates the syringe barrel base 12 and the press 20 rotated clockwise 45° relative to one another. This clockwise action engages cam-lock ridge 42 in cam-lock groove 44.

Figure 13 illustrates in detail a side elevation partial-section view of right-hand side scoring on the interior frontal opening a plunger of the syringe adapted for use with the oval flange cam-lock. As can be seen, by means of the helically angled right-hand groove 44, the right-hand oval shaped ridges 42, when they become mated in the interior of the pair of cam-lock grooves 44, rotate relative to one another in a helical fashion, thereby creating a secure fit.

Figure 14 illustrates a detailed end view of the cam-lock mechanism of the embodiment of the syringe illustrated in Figure 9. Barrel 8 and cam-lock ridge 42 are shown in solid lines. The dotted lines represent the cam-lock groove 44.

Figure 15 illustrates a side elevation partial-section view of a plunger 16 which is equipped with an alternative design engaging mechanism, namely a snap-on
socket type needle base connection. Figure 16 illustrates a side elevation view of the snap-on socket type needle base connection illustrated in Figure 15. As can be seen in these two illustrations, the forward end of the plunger 16 is constructed so that it has a "snap-on" fastener 46, which, when the plunger 16 is pushed strongly (in a leftwardly direction as seen in Figure 16) snaps over and embraces the longitudinal knob-like end 48 that is formed in the base of base 6. The snap-on fastener 46 and knob 48 engagement combination is an alternative embodiment which replaces the cam-lock ridge 42 and cam-lock groove 44 combination illustrated in Figures 9 through 14, as discussed previously. Unlike the thread combination 28, 34 (Figure 8) and cam-lock combinations (Figures 9 to 14), no rotational action is required to engage fastener 46 and knob 48. Once snap-on fastener 46 has been pushed over snap-over knob 48, the base 6 and needle 2 can be withdrawn into the interior of barrel 8 by pulling press 20 from the barrel 8.

Figure 17 illustrates the snap-on fastener 46-snap over knob 48 embodiment discussed previously in relation to Figures 15 and 16, but includes the option of a right-hand hub rim 38 and a right hand thread 40 secondary engagement mechanism (as discussed in detail previously in association with Figure 10).

Figure 18 illustrates a section view of the syringe taken along section line A-A of Figure 16. The rectangular construction of the snap-on fastener 46, which fits over snap over knob 48, can be readily seen. Also visible in Figure 18 are the plunger flange 36 (shown in dotted lines), barrel 8, needle 2, and barrel base 12. Figures 15 to 18 illustrate a cylindrical embodiment. It should be understood that alternative shapes such as hexagonal or octagonal can be used. The advantage would be that such a configuration would allow for rotary move-
ment to be transferred to the needle assembly and allow it to be broken away by rotation rather than by simple traction.

Figures 19 and 20 illustrate respectively side and side elevation partial-section views of a further alternative engaging mechanism, namely a bent needle hub engaging embodiment of the syringe. Figure 19, which depicts the side elevation view, incorporates the first option (that is, without optional hub rim 38, and right hand thread 40 combination). Figure 19 shows how the base end of the needle 2 is bent at right angles to form an upwardly projecting end 50. The end 50 fits into a slot and groove 52, which is formed in the forward end of the plunger 16. By rotating the plunger 16, and piston 26 about 90° relative to end 50, the end 50 engages in slot 52, thereby securely connecting the head end of plunger 16 with base 6 and needle 2. This engagement allows the base 6 and needle 2 to be withdrawn into the interior of the barrel 8, as described previously. Figure 21 illustrates the bent needle embodiment that was discussed above in relation to Figures 19 and 20, but including the option of a base rim 38, and a right hand thread 40, formed in the base 6 to provide a double engagement mechanism. As mentioned previously, either option 1 or option 2 (Figure 9 or 10), can be utilized in all embodiments of the syringe as discussed.

Figures 22 and 23 illustrate a detailed end view of slot 52 and needle end 50, the slot 52 being formed in the head end of the plunger 16. The bent needle end 50 is first inserted in slot 52, as illustrated in Figure 22, and then the end 50 is rotated 90° into a groove opening formed in the interior of the plunger 16, thereby engaging the base end of the needle 2 with the plunger 16.
Figure 24 illustrates a side-elevation partial-section view of an embodiment of the syringe wherein the needle and hub are rotatably detachable from the barrel and the plunger threadedly engages the interior of the base. The base of the needle 2 is threadedly and removably engangeable with the adapter 63 by threads 62. In turn the adapter 63 is threadedly and removably engageable with the barrel 8 by thread 64. The head end of the plunger 16 can engage with the interior of the adapter 63 by interior threads 65 and withdraw needle 2 and adapter 63 into the interior of the barrel 8. The interior of the head end of barrel 8 is shaped like an "M". The angled ends deter the needle 2 from pushing back through the opening in the end of the barrel 8.

Figure 25a illustrates a side elevation partial-section view of the syringe with the needle and hub drawn within the interior of the barrel and the remote end of the plunger that is broken away, formed with a hollow threaded cap-like opening; and

Figure 25b illustrates a side-elevation partial-section view of the syringe with the broken away plunger portion threadedly engaged with the male threaded end of the hub at the top of the barrel.

As shown in Figure 25a, the front of the barrel 8 can be formed so that it has male threads 70 around its circumference. Correspondingly, a mating cavity with mating female thread 72 can be formed in the thumb press end of plunger 16. If need be, the thumb press end of plunger 16 can be widened at location 74 in order to accommodate the cavity with the female thread 72.

With this embodiment, when the plunger 16 is broken away at break point 30, it can be used to cover the open end of syringe 8 by screwing female threads 72 onto

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male threads 70. In this way, both ends of the barrel 8 are closed, and there is no way that the potentially contaminated needle 2 can escape the interior of barrel 8.

Alternatively, once the plunger has been broken, the end distant from the thumb press and proximate to the fracture site can be fashioned to allow it to fit snuggly or screw into the now open end of the barrel (from which the needle has now been withdrawn into the barrel). If required, a second fracture site (not shown) can be fashioned in the plunger. This permits the plunger to be broken off at either of the two fracture sites according to the preference of the user.

Figures 25c and 25d illustrate sequential side elevation views of an alternative design of syringe where the part of the plunger 16 adjacent the break away weak point 30 is threaded 78 and is screwed into female threads 76 of the opening in the end of the barrel 8 vacated by the needle 2 and hub when pulled into the barrel 8.

Figure 26, illustrates a side elevation partial-section view of an embodiment of the syringe wherein the piston is adapted with a latch which snaps into place in an adapter (platform) after the piston is fully depressed and rotated clockwise. The embodiment illustrated in Figure 26 depicts the needle 2 embedded in a Luer lock 100, associated with the constricted end 10 of syringe barrel 8. The plunger 16 with a finger press 20 at the remote end thereof is positioned inside barrel 8. A stop catch 14 prevents the plunger 16 from being totally withdrawn from the interior of the barrel 8. Bung 18, which provides a tight fit with the interior of barrel 8, is mounted on the end of plunger 16 opposite finger press 20.

The operative needle engagement and detachment mechanism illustrated in Figure 26 is a combination of an
adapter 102, which cooperates with Luer lock 100, the combination fitting into the narrow end 10 of barrel 8. The end of plunger 16 opposite finger press 20 has a latch mechanism 104 formed inside bung 18. A pair of prongs 106 are formed in latch 104 and engage into grooves 108 in adapter 102 when the plunger 16 is fully advanced. The plunger 16 - adapter 102 engagement mechanism and subsequent adapter 102 - needle 2 disengagement mechanism has sequential aspects as follows: 1) initial full depression of the piston and plunger 16 which causes automatic self alignment of the latch 104 and ridges 120 with the flat driving faces 150 because of the self-aligning non-jamming spiral threads 118, 2) rotation of the plunger 16 which causes unseating of the adapter 102 at threads 110, 3) latching of the prongs 106 in grooves 108, and 4) withdrawal of the adapter 102 with the attached needle 2 into the barrel 8 of the syringe by withdrawing the plunger 16 by finger press 20. The pair of prongs 106 engaging in the respective grooves 108 of the adapter 102, enable the disengaged adapter 102, and the needle with the Luer lock 100, to be withdrawn. At this point, the needle 2, Luer lock 100, adapter 102, and bung 18 can be withdrawn into the interior of the barrel 8 by pulling finger press 20 away from the narrow end 10 of the syringe.

As can be recognized, the adapter 102 is an important feature of this embodiment of the invention. The adapter enables a standard Luer lock 100 to indirectly mate with latch 104 at the end of plunger 16. Moreover, the adapter 110 is designed so that it accommodates different sizes of needle 2 and Luer lock 100. Moreover, the adapter is designed so that it accommodates different sizes of needles via a Luer lock plain tip or other mechanism depending on the configuration of the outer coupling adapter.
Figure 26 illustrates a narrow point in the plunger which assists in breaking the plunger in two. If required, or desirable, two or more additional narrow points can be included to permit breakage at alternative locations.

Figure 27 illustrates in side elevation partial section view a preferred embodiment of the adapter 102. Nose 112 is adapted to fit inside the hollow of a standard Luer lock needle base or needle 100. The left hand thread 110 is also shown in Figure 27. The adapter 102 has opposite the nose 112 a cup-like edge 114 which is formed to receive the front end of latch 104. Formed inside the rim of cup 114 is a protrusion 116 which has a pair of self-aligning, non-jamming spiral male threads 118 formed thereon. A pair of flat driving faces 150 are also formed in protrusion 116. Prong engaging grooves 108 are also formed in the interior of the protrusion 116 at the point where the protrusion 116 joins with the cup 114. The advantage of this adapter design is that with the fast acting spiral threads 118 force alignment without jamming. Full axial movement of the plunger is possible with no rotation of the adapter forced by the alignment grooves because of the torque inflexion inherent in the plunger. Then after full depression of the plunger, and engagement of the flat driving faces 150, deliberate rotation increases the flexion to its limit. Further rotation causes the adapter 102 to rotate and disengage the thread seating in the front of the barrel 8. During this procedure, the prongs 106 and grooves 108 engage as the adapter is unseated, allowing the entire internal assembly to be withdrawn. At that point, further clockwise rotation of the plunger 16 by means of finger press 20 causes the threads 110 of adapter 102 to disengage from the interior narrow end 10. After unseating, the prone groove attachment can, on its own, allow the needle 2 assembly with prongs 106
engaged in grooves 108 to be withdrawn into the interior barrel 8 simply by withdrawing finger press 20.

Figure 28 illustrates a section view taken along section lines C-C of Figure 29. Figure 28 depicts a detailed view of the construction of the latch 104 and prongs 106. In the embodiment illustrated in Figure 28, the latch 104 has a pair of alignment ridges 120 formed in the interior of latch 104. These alignment ridges 120 assist engagement of the latch 104 with adapter 102.

Figure 30, which illustrates a side view of an alternative design of adapter 102, and Figure 31, which illustrates a partial cutaway section view of the adapter depicted in Figure 30, illustrate flared grooves 122, which are adapted to receive ridges 120 of latch 104. The flare assists in enabling the ridges 120 to be received into grooves 122. In this embodiment, the adapter does not have the fast acting non-jamming spiral threads 118, depicted in the adapter design illustrated in Figure 27.

The adapter 102 has a rim 124 which is designed to engage with the rim 126 of the Luer lock 100 to hold the two snugly together, and provide a fluid seal by the complementary configuration of the adapter and the front end of the syringe.

The embodiments of the invention depicted in Figures 26 to 31 have a number of advantages:

1. The preferred embodiment allows for universal coupling with all Luer lock needle connections.

2. Needle interchangeability during use of the syringe is possible, that is, different
needles can be used for filling the vial and for injecting the patient.

3. The needle platform (adapter) design allows for compatibility of the syringe with other custom design needles or any subsequent needle design, merely by altering the outer needle connection configuration platform.

4. The syringe hub can be permanently closed after use of the syringe by screwing on the broken plunger stalk after withdrawal of the needle into the barrel.

5. The novel coupling mechanism between the platform and the plunger allows for full axial movement of the plunger. Although transient mating of the prongs and grooves may occur, no functional attachment occurs until the adapter is unseated from the front of the barrel. At that time, the prong and groove attachment becomes functional to allow withdrawal of the platform (adapter) with the attached needle into the barrel.

Figure 32 illustrates a side elevation partial side section view of an embodiment of the invention related to that illustrated in Figures 26 to 30. The embodiment depicted in Figure 32 shows an adapter 130 which extends partially from the front end of the barrel 132. A standard Luer lock 134 is formed in the front end of the barrel 132. The Luer lock has a standard right hand thread 135. The barrel 132 has a left hand thread 137 to release the adapter 130 for withdrawal inside the barrel 132, after the syringe is used. A needle base 136 carrying needle 140 fits on the tapered front end of adapter 130 and screws into the right hand thread of the Luer lock 134. A given
clearance 138 permits the needle base 136 to be withdrawn into the interior of the barrel 132 after the adapter 130, base 136, and needle 140 are unscrewed and withdrawn into the barrel 132 by rotation of the plunger and engagement of the plunger adapter connection mechanism. As described previously, a Luer tip may be a simple conical device which accepts the needle base. This design could also be used in this embodiment, thus eliminating the screw connection of the needle base 136 and the Luer lock thread 135.

Another advantage is that by reducing the diameter of the platform needle combination, a thinner barrel can be manufactured. For a given capacity of syringe, this will allow the length of the syringe to be longer and therefore a longer needle to be accommodated within it. By placing the Luer lock threads in the barrel of the syringe rather than on the platform, the outer diameter of the platform needle combination is defined by the width of the needle base and not by the supporting outer plastic Luer lock mechanism. It is therefore possible to ensure as long a barrel as possible for a given capacity. The standard 3 cc syringe represents a main portion of the syringe market. A standard 3 cc syringe is often used with a 1-1/2 inch needle for intramuscular injection. Accordingly, the barrel of a 3 cc syringe should be at least 2-1/2 inches long to accommodate the withdrawn needle, adapter and plunger connector all within the barrel.

The foregoing embodiments discuss various means of enabling the plunger to be connected securely to the base 6 of the needle 2, to enable the plunger 16, when withdrawn, to pull the hub 6 and needle 2 into the interior of the barrel 8. In some versions including the adapter, the plunger-adapter coupling transfers no rotary action if the plunger connection is twisted in the wrong direction. This provides an overtightening safety feature. The adapter is released from the syringe if the correct rota-
tion is used. It will be recognized that these are illus-
trative of specific embodiments and there are other poss-
ible ways to make a secure connection for the purpose of
withdrawing the adapter and needle into the interior of the
barrel.

As will be apparent to those skilled in the art
in the light of the foregoing disclosure, many alterations
and modifications are possible in the practice of this
invention without departing from the spirit or scope
thereof. Accordingly, the scope of the invention is to be
construed in accordance with the substance defined by the
following claims.
CLAIMS

1. In a syringe constructed of a hollow elongated barrel, a needle and base, and a plunger means adapted to fit within and move axially in the hollow barrel, the plunger causing a pumping action within the interior of the barrel between the plunger and the end of the barrel, characterized by an adapter which is positioned between the plunger and the end of the barrel, the adapter being adapted at one end to removably engage with the base and the end of the barrel, and being adapted at the opposite end to removably engage with the end of the plunger that is proximate to the needle and base; and engaging means at the end of the plunger proximate to the needle and base, the engaging means being adapted to engage the end of the adapter when the plunger is fully inserted into the interior of the barrel in the direction of the end of the barrel and cause the needle and base, and the adapter, to part from the end of the barrel and to be withdrawn into the interior of the barrel when the plunger is withdrawn from the end of the barrel.

2. A syringe comprising:
(a) a hollow elongated barrel means;
(b) penetration and base means which is adapted to removably engage with an adapter located at one end of the barrel means;
(c) plunger means adapted to fit within and move axially in the hollow barrel means; the plunger means causing a pumping action within the interior of the barrel means between the plunger means and the end of the barrel means when the plunger means is pushed into the interior of the barrel means in the direction of the end of the barrel means;
(d) an adapter means which is positioned between the plunger and the end of the barrel means, the adapter means being adapted at one end to removably engage with the
base means and the end of the barrel means, and the adapter means being adapted at the opposite end to removably engage with the end of the plunger means that is proximate to the penetration and base means; and

(e) engaging means at the end of the plunger means proximate to the penetration and base means, the engaging means being adapted to engage the end of the adapter means when the plunger means is fully inserted into the interior of the barrel means in the direction of the end of the barrel means and cause the penetration and base means, and the adapter means, to part from the end of the barrel means and to be withdrawn into the interior of the barrel means when the plunger means is withdrawn from the end of the barrel means.

3. A syringe as defined in claim 2 wherein the penetration means is a hollow needle, is pointed at one end thereof, and the base is at the end opposite to the pointed end and is formed to mate with the adapter.

4. A syringe as defined in claim 3 wherein an abutting means is positioned within the interior of the barrel means and permits the plunger to be inserted into the interior of the barrel means through one end of the barrel means but deters the plunger means from being withdrawn from the interior of the barrel means.

5. A syringe as defined in claim 2, 3 or 4 wherein the needle engaging means is a hook.

6. A syringe as defined in claim 3 wherein the needle and base engaging means is a female and male thread combination, one thread being formed in the end of the adapter means proximate to the end of the plunger means and the other being formed in the end of the plunger means proximate the end of the barrel means.
7. A syringe as defined in claim 6 wherein the male thread part of the engaging means is in the end of the adapter means and the female thread engaging means is in the end of the plunger means.

8. A syringe as defined in claim 2 wherein the needle engaging means is a cam and lock combination, one being formed in the end of the needle penetration means proximate to the end of the barrel means and the other being formed in the end of the plunger means proximate the end of the barrel means, the combination being engaged by rotating the plunger means relative to the needle penetrating means.

9. A syringe as defined in claim 8 wherein the needle engaging means is a cam-lock combination, the cam on the base of the needle penetrating means engaging with a receiving groove formed in the needle proximate end of the plunger means, the cam-lock means engaging by rotating the plunger relative to the needle means.

10. A syringe as defined in claim 2 wherein the needle engaging means is a bent needle and bent needle receiving receptacle combination, one being formed in the end of the needle penetration means proximate to the end of the barrel means and the other being formed in the end of the plunger means proximate the end of the barrel means, the combination being engaged by rotating the plunger means relative to the needle penetrating means.

11. A syringe as defined in claim 10 wherein the needle penetration means at the end proximate the plunger is bent radially, and mates with a groove formed in the end of the plunger proximate to the bent end of the needle penetration means, the bent end of the needle penetration means and the groove in the plunger being engaged by
rotating the plunger relative to the needle penetration means.

12. A syringe as defined in claim 2 wherein the penetration means comprises a needle which is connected to a hub by a female and male thread combination, and the engaging means is a female and male thread combination which is engaged by rotating the plunger means.

13. A syringe as defined in claim 2 wherein the penetration means comprises a needle which is connected to a hub by a cam-lock combination, and the engaging means is a cam-lock combination which is engaged by rotating the plunger means.

14. A syringe as defined in claim 2 wherein the penetration means comprises a needle which is connected to the base which in turn is detachably connected by a male thread to a female thread in an end of the adapter means proximate to the end of the barrel and the needle penetration and base means and adapter means can be drawn into the interior of the barrel means by rotationally engaging the proximate end of the plunger means with threads on the adapter means which adapter in turn rotationally disengages the adapter means and the base means engaging the needle penetration means from the barrel means.

15. A syringe as defined in claim 2 wherein the end of the barrel means proximate to the penetration means is angled inwardly at its central area to the interior of the barrel means, to deter the likelihood that the penetration means will extend through an opening in the end of the barrel means, once the penetration means is withdrawn into the interior of the barrel means.

16. A syringe as defined in claim 2 wherein the end of the plunger means extending from the hollow barrel means
has formed therein a receptacle which is adapted to fit with the end of the hollow elongated barrel means, once the penetrating means is withdrawn into the interior of the barrel means.

17. A syringe as defined in claim 16 wherein the end of the plunger means extending from the barrel means is broken away from the rest of the plunger means, and is secured to the end of the barrel means through which the penetrating means is withdrawn by means of a male-female thread combination.

18. A syringe as defined in claim 17 wherein the broken plunger can be used to plug the open end of barrel where the needle has been unscrewed and withdrawn into barrel.

19. A syringe as defined in claim 2 wherein the needle engaging means is a dual female thread combination, the dual threads being formed in opposite ends of the engaging means, and a male thread means being formed on the exterior of the engaging means outside one of the female threads, the exterior male thread means being of opposite thread rotation to the dual female thread means.

20. A syringe as defined in claim 19 wherein the end of the needle proximate to the engaging means has a male thread removably engageable with the proximate female thread of the engaging means.

21. A syringe as defined in claim 20 wherein the end of the plunger proximate to the engaging means has a male thread engageable with the female thread of the engaging means opposite to the female thread engaging the male thread of the needle means.
22. A hollow adapter for the interior of a syringe constructed of a barrel, a piston inside the barrel and a hollow needle and base fitting releasably attached in the end of the syringe comprising:

(a) a fitting formed at one end of the adapter, the fitting being adapted to engage with the base affixed to the syringe needle;

(b) rotationally releasable engagement means formed in the adapter, the engagement means being adapted to releasably engage with the needle and base receiving end of the syringe barrel; and

(c) a rotationally releasable engagement means formed at the end of the adapter opposite the fitting, said engagement means being adapted to engage with the end of the piston proximate to the needle and base fitting.

23. An adapter as claimed in claim 22 wherein the piston and engaging means of the adapter which connects the piston and the adapter by rotation of the piston.

24. An adapter according to claim 22 wherein the releasable base engagement means of the fitting of the adapter is a thread which is adapted to engage with a mating thread formed in the base.

25. A syringe as defined in claim 2 wherein the penetration and base means is releasably engaged with the end of the barrel means by mating spiral threads formed in the base and the adapter, and the adapter means is adapted to engage with the engaging means at the end of the plunger means proximate to the penetration and base means by a driving face formed in the end of the plunger means.

26. A syringe as claimed in claim 25 wherein the adapter means is releasably connected to the end of the barrel means by a female-male thread combination, and the
adapter means adapted to engage the engaging means of the plunger means has self-aligning faces and driving faces.

27. A syringe as defined in claim 26 wherein the penetration means is a needle which is fitted with a female Luer lock fitting, which is engaged with the adapter means with a plain Luer tip or Luer lock male fitting.

28. A syringe as defined in claim 27 wherein the needle-Luer lock combination and the adapter are disengaged from the end of the barrel means by latch means which engages with the adapter when the plunger means is pushed to the needle end of the barrel and rotated to activate the engagement means.

29. A syringe as defined in claim 25 wherein the adapter protrudes partially from the penetration and base means end of the hollow barrel means.

30. A syringe as defined in claim 29 wherein the barrel engagement means of the adapter has a thread direction which is opposite to the thread direction of the barrel means engaging the penetration and hub means.

31. An adapter as defined in claim 22 wherein the adapter is designed to protrude partially from the penetration end of a syringe barrel.

32. A syringe as defined in claim 27 wherein the barrel engagement means of the adapter has a thread direction which is the same as to the direction of rotation of the penetration and base means when engaged to the Luer lock.

33. An adapter as defined in claim 22 wherein the releasable engagement means (b) is a thread which is
adapted to engage with a thread formed in the needle and base end of the barrel.

34. An adapter as defined in claim 22 wherein the releasable engagement means (b) is a thread on the exterior of the base which is adapted to engage with a mating thread in the barrel means.

35. A syringe as defined in claim 2 wherein the penetration and base means is adapted to removably engage with the adapter by a thread combination running in a first direction, and the adapter-barrel engagement means and the adapter-plunger means are respective thread combinations which run in a second common direction.

36. A fluid drawing or dispensing syringe comprising:
(a) a hollow elongated barrel;
(b) a needle and base combination, the base being adapted to removably engage by rotation with either an adapter located at one end of the barrel, or the end of the barrel and the adapter;
(c) a plunger adapted to fit within and move axially in the hollow elongated barrel, the plunger causing a pumping action within the confined interior of the barrel between the plunger and the end of the barrel when the plunger is pushed into the interior of the barrel in the direction of the end of the barrel;
(d) an adapter which is positioned between the plunger and the end of the barrel, the adapter being adapted to removably engage with the needle and base, or the end of the barrel, at one end of the adapter, and at the opposite end of the adapter, the adapter being adapted to engage with the end of the plunger adjacent the adapter; and
(e) adapter engaging means at the end of the plunger proximate to the end of the barrel, the engaging means being adapted by rotational movement of the plunger
to engage the end of the adapter when the plunger is fully inserted into the interior of the barrel in the direction of the end of the barrel and cause the needle and base, and the adapter, to part from the end of the barrel and to be withdrawn into the interior of the barrel when the plunger is withdrawn from the end of the barrel.

37. A syringe as defined in claim 35 wherein the needle and base is adapted to removably engage with the barrel end or the adapter by a female-thread combination, the adapter being detachably rotationally connected to the barrel by means of a female-male thread combination, and the adapter being rotationally engageable with the plunger by means of a driving face on the adapter and a complementary driving face on the end of the plunger proximate to the adapter.

38. A syringe as defined in claim 37 wherein the end of the adapter proximate to the plunger has self-aligning lands and driving faces.

39. A syringe as defined in claim 36 wherein the thread of the needle and base-barrel end combination runs in one direction, and the thread combination of the adapter and end barrel thread combination run in an opposite direction.

40. A syringe as defined in claim 37 wherein the thread direction of the adapter and plunger engagement thread combination run in a direction opposite to the direction of the needle and base thread combination.

41. A syringe as defined in claim 37 wherein the functional direction of the adapter and plunger engagement driving faces run in a direction opposite to the direction of the adapter and barrel end thread combination.
42. A syringe as claimed in claim 26 wherein the adapter has axial locking means which comprises a groove and finger combination.

43. A syringe as claimed in claim 42 wherein the locking means comprises a groove in the adapter and the end of the plunger means which engages with the adapter and includes a resilient finger which fits into the groove when the adapter is partially disengaged from the barrel.

44. A syringe as claimed in claim 3 wherein the hub mates with both the adapter and the end of the barrel means.

45. A syringe as claimed in claim 2 wherein the needle, hub and adapter are permanently enclosed in the barrel means when the plunger is fully withdrawn into the interior of the barrel means, and the plunger is broken at a point of weakness in the plunger.

46. A syringe as claimed in claim 2 wherein the end of the plunger distal from the penetration and hub has formed therein a receptacle which is adapted to fit with the end of the hollow elongated barrel means, once the penetration and hub means is withdrawn into the interior of the barrel means.

47. A syringe as claimed in claim 46 wherein the receptacle is equipped with threaded locking engagement means.

48. A syringe as claimed in the claim 45 wherein the point of weakness has a cross-section which is narrower in one direction than the other.

49. A syringe as claimed in claim 45 wherein the point of weakness is notched.
FIG. 1a

FIG. 1b

FIG. 1c

FIG. 1d

FIG. 2

SUBSTITUTE SHEET
# INTERNATIONAL SEARCH REPORT

**International Application No**: PCT/CA 90/00095

### I. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both National Classification and IPC

| IPC | A 61 M 5/32 |

### II. FIELDS SEARCHED

Minimum Documentation Searched

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Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in the Fields Searched

### III. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>WO, A, 89/12475 (ALTERON INCORPORATED) 28 December 1989 see figures 1,3,5,7; page 7, lines 19-22; page 7, line 31 - page 8, line 7; page 9, lines 10-22</td>
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**IV. CERTIFICATION**

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ON INTERNATIONAL PATENT APPLICATION NO. CA 9000095
SA 35816

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