- preventing the trapping of air bubbles;
- allowing for easy inventory management as the needle assembly may be used with both retractable and conventional syringes;
- assuring the integrity of a virgin needle as the integrity is easily verified; and
- allowing for a tamper proof design that may prevent reuse or recycling.

Brief Description of the Figures

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is an exploded view of a syringe according to a first embodiment of the present invention;

Figure 2A is a cross-sectional view of the syringe of Figure 1 when assembled;

Figure 2B is a cross-sectional view of a piston of the syringe of Figure 2A when the piston is proximate a retention mechanism;

Figure 2C is a cross-sectional view of the piston as in Figure 2B when a cutting crown of the syringe is brought to bear against a weak portion of the retention mechanism;

Figure 2D is a cross-sectional view of the piston as in Figure 2B after the cutting crown cuts the piston and the retention mechanism;

Figure 3A is a cross-sectional view of the cutting crown of Figure 2B;

Figure 3B is a side view of the cutting crown as in Figure 3A;

Figure 3C is a perspective view of the cutting crown of Figure 2B;

- preventing the trapping of air bubbles;
- allowing for easy inventory management as the needle assembly may be used with both retractable and conventional syringes;
- assuring the integrity of a virgin needle as the integrity is easily verified; and
- allowing for a tamper proof design that may prevent reuse or recycling.

The present invention also provides any one of the embodiments disclosed below and indicated with the numbers 1 to 14.

1. A retractable syringe comprising:

a barrel;

a needle unit comprising a needle, an interior of the needle being in fluid communication with a chamber within the barrel;

a retention mechanism for retaining the needle unit at one end of the barrel;

a hollow plunger movable within the barrel towards the needle unit;

a drive mechanism for driving the needle unit into the plunger; and

a cutting crown at the end of the plunger facing the needle unit, the cutting crown being arranged for cutting the retention mechanism as the plunger is advanced, so that the drive mechanism retracts the needle unit into the barrel;

the profile of the cutting crown including one or more cutting teeth which cut a first portion of the retention mechanism before other portions of the cutting crown cut other portions of the retention mechanism,

2. A retractable syringe according to claim 1 further comprising a piston disposed over the cutting crown, the piston being arranged to be cut by the cutting crown before the cutting crown cuts the retention mechanism.

3. A retractable syringe according to claim 2 wherein the outer surface of the piston has a domed profile, and upon the plunger being moved towards the

needle unit, the piston contacts an end surface of the chamber at a contact area, said contact area gradually expanding towards a central axis of the chamber.

4. A retractable syringe according to claim 2 or claim 3 further comprising a guiding means extending inwardly from the inner surface of the piston, the guiding means suitable for guiding the one or more cutting teeth towards a weak portion of the piston.

5. A retractable syringe according to claim 4 wherein the weak portion of the piston forms an annular perimeter about a central portion of the piston.

6. A retractable syringe according to claim 4 or claim 5 wherein the guiding means is deformed when the cutting crown breaks the seal.

7. A retractable syringe according to any preceding claim wherein the one or more cutting teeth taper inwardly towards a longitudinal axis of the plunger.

8. A retractable syringe according to any preceding claim in which the needle unit comprises:

a needle holder having an inwardly facing threaded surface, and

a needle assembly comprising a needle and a needle hub surrounding the needle and having an outwardly facing threaded surface;

an aperture of the needle assembly facing a passage of substantially the same bore defined by the needle holder and extending into the chamber in the barrel.

9. A method for operating a retractable syringe according to any preceding claim, the method including:

depressing the plunger within the barrel, whereby the cutting teeth cut at least one first portion of the retention mechanism, and subsequently other portions of the cutting crown cut one or more second portions of the retention mechanism which are spaced from the first portions circumferentially around an axis of the barrel.

10. An elongate needle assembly for attachment to a syringe unit having a plunger movable within a barrel, to form a syringe assembly, the needle assembly comprising:

a needle,

a hub with an outwardly-facing threaded surface for mating with an inwardly-facing threaded surface of the syringe,

the needle assembly defining a central passage of substantially constant bore extending from a first end of the needle assembly and along a central axis of the needle, to a tip of the needle.

11. A needle assembly according to claim 10 wherein the needle is encased in a protector, the protector being formed as a single piece together with the hub, the protector being connected to the hub by a frangible portion.

12. A needle assembly according to claim 10 or 11 wherein the protector further comprises a wing extending from an outer wall of the protector, whereby a user can deliver rotational force to the protector about a longitudinal axis of the protector.

13. A syringe assembly which is a combination of a needle assembly according to any of claims 10 to 12, and a syringe unit having an inwardly-facing threaded surface mated with the outwardly-facing threaded surface of the needle hub,

the central passage of the needle assembly meeting a passage of the syringe unit having substantially the same bore and communicating with a chamber within a barrel of the syringe unit.

14. A method of forming a syringe assembly according to claim 13, comprising mating the needle assembly with the syringe unit.

Brief Description of the Figures

The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is an exploded view of a syringe according to a first embodiment of the present invention;

Figure 2A is a cross-sectional view of the syringe of Figure 1 when assembled;

Figure 2B is a cross-sectional view of a piston of the syringe of Figure 2A when the piston is proximate a retention mechanism;

Figure 2C is a cross-sectional view of the piston as in Figure 2B when a cutting crown of the syringe is brought to bear against a weak portion of the retention mechanism;

Figure 2D is a cross-sectional view of the piston as in Figure 2B after the cutting crown cuts the piston and the retention mechanism;

Figure 3A is a cross-sectional view of the cutting crown of Figure 2B;

Figure 3B is a side view of the cutting crown as in Figure 3A;

Figure 3C is a perspective view of the cutting crown of Figure 2B;