Claims

1. A retractable syringe ~~(100)~~ comprising:

a barrel ~~(140)~~;

a needle unit comprising a needle ~~(1520)~~, an interior of the needle ~~(1520)~~ being in fluid communication with a chamber within the barrel ~~(140)~~;

a retention mechanism ~~(1540)~~ for retaining the needle unit at one end of the barrel ~~(140)~~;

a hollow plunger ~~(120)~~ movable within the barrel ~~(140)~~ towards the needle unit;

a drive mechanism ~~(1600)~~ for driving the needle unit into the plunger ~~(120)~~; and

a cutting crown ~~(1200)~~ at the end of the plunger ~~(120)~~ facing the needle unit, the cutting crown ~~(1200)~~ being arranged for cutting the retention mechanism ~~(1540)~~ as the plunger ~~(120)~~ is advanced, so that the drive mechanism ~~(1540)~~ retracts the needle unit into the barrel ~~(140)~~;

the profile of the cutting crown ~~(1200)~~ including at least two cutting teeth ~~(1220)~~ which cut a first portion of the retention mechanism ~~(1540)~~ before other portions of the cutting crown cut other portions of the retention mechanism ~~(1540)~~, the at least two cutting teeth ~~(1220)~~ having interspaced between each consecutive cutting tooth ~~(1220)~~ an arcuate bridge ~~(1210)~~ spanning from tooth to tooth.

2. ~~A~~The retractable syringe of claim 1, ~~(100) comprising:~~

~~a barrel (140);~~

~~a needle unit comprising a needle (1520), an interior of the needle (1520) being in fluid communication with a chamber within the barrel (140);~~

~~a retention mechanism (1540) for retaining the needle unit at one end of the barrel (140);~~

~~a hollow plunger (120) movable within the barrel (140) towards the needle unit;~~

~~a drive mechanism (1600) for driving the needle unit into the plunger (120); and~~

~~a cutting crown (1200) at the end of the plunger (120) facing the needle unit, the cutting crown (1200) being arranged for cutting the retention mechanism (1540) as the plunger (120) is advanced, so that the drive mechanism (1540) retracts the needle unit into the barrel (140);~~

~~the profile of the cutting crown (1200) including one or more cutting teeth (1220) which cut a first portion of the retention mechanism (1540) before other portions of the cutting crown cut other portions of the retention mechanism (1540),~~

wherein the ~~one or more~~ cutting teeth ~~(1220)~~ taper~~s~~ inwardly towards a longitudinal axis ~~(122)~~ of the plunger ~~(120)~~.

3. ~~A~~The retractable syringe ~~(100) according to any preceding~~of claim 1, further comprising a piston ~~(130)~~ disposed over the cutting crown ~~(1200)~~, the piston ~~(130)~~ being arranged to be cut by the cutting crown ~~(1200)~~ before the cutting crown ~~(1200)~~ cuts the retention mechanism ~~(1540)~~.

4. ~~A~~The retractable syringe ~~(100) according to~~of claim 3, wherein the outer surface ~~(1320)~~ of the piston ~~(130)~~ has a domed profile, and upon the plunger ~~(120)~~ being moved towards the needle unit, the piston ~~(130)~~ contacts an end surface ~~(1461)~~ of the chamber at a contact area, said contact area gradually expanding towards a central axis of the chamber.

5. ~~A~~The retractable syringe ~~(100) according to~~ of claim 3, ~~or claim 4~~ further comprising a guiding means ~~(1330)~~ extending inwardly from the inner surface of the piston ~~(130)~~, the guiding means ~~(1330)~~ suitable for guiding the one or more cutting teeth ~~(1220)~~ towards a weak portion ~~(1380)~~ of the piston ~~(130)~~.

6. ~~A~~The retractable syringe ~~(100) according to~~ of claim 5, wherein the weak portion ~~(1380)~~ of the piston ~~(130)~~ forms an annular perimeter about a central portion ~~(1385)~~ of the piston ~~(130)~~.

7. ~~A~~The retractable syringe ~~(100) according to~~of claim 5, ~~or claim 6~~ wherein the guiding means ~~(1330)~~ is deformed when the cutting crown ~~(1200)~~ breaks the weak portion ~~(1380)~~.

8. ~~A~~The retractable syringe ~~(100) according to any preceding~~of claim 1, ~~in which~~ the needle unit further comprising~~es~~:

a needle holder ~~(1560)~~ having an inwardly facing threaded surface; ~~(1585), and~~

a needle assembly ~~(200)~~ comprising a needle ~~(1520)~~ and a needle hub ~~(1510)~~ surrounding the needle ~~(1520)~~ and having an outwardly facing threaded surface ~~(520)~~; and

an aperture ~~(565)~~ of the needle assembly ~~(200)~~ facing a passage ~~(1530)~~ of substantially the same bore defined by the needle holder ~~(1560)~~ and extending into the chamber in the barrel ~~(140)~~.

9. A method for operating a retractable syringe ~~(100)~~ according to ~~any preceding~~ claim 1~~, the method including~~ comprising:

depressing the plunger ~~(120)~~ within the barrel ~~(140)~~, whereby the cutting teeth ~~(1220)~~ cut at least one first portion of the retention mechanism ~~(1540)~~, and subsequently other portions of the cutting crown ~~(1200)~~ cut one or more second portions of the retention mechanism ~~(1540)~~ which are spaced from the first portions circumferentially around an axis of the barrel ~~(140)~~.

~~10. An elongate needle assembly (200) for attachment to a syringe unit having a plunger movable within a barrel, to form a syringe assembly, the needle assembly (200) comprising:~~

~~a hub (1510) with an outwardly-facing threaded surface for mating with an inwardly-facing threaded surface (1575) of the syringe,~~

~~a needle (1520) extending from a first end of the hub (1510), and~~

~~a neck (510) extending from a second end of the hub (1510) and terminating at an end face (560), the neck (510) having a smooth outer surface~~

~~suitable as a guiding surface for leading the inwardly-facing threaded surface (1575) of the syringe to the outwardly-facing threaded surface of the hub (1510); and~~

~~wherein the needle assembly (200) defines a central passage (1530) of substantially constant bore extending from the end face (560) and along a central axis of the needle (1520), to a tip of the needle (1570).~~

~~11. A needle assembly (200) according to claim 10 wherein the needle (1520) is encased in a protector (1700), the protector (1700) being formed as a single piece together with the hub (1510), the protector (1700) being connected to the hub (1510) by a frangible portion (550).~~

~~12. A needle assembly (200) according to claim 10 or 11 wherein the protector (1700) further comprises a wing (530) extending from an outer wall of the protector (1700), whereby a user can deliver rotational force to the protector (1700) about a longitudinal axis (202) of the protector (1700).~~

~~13. A syringe assembly which is a combination of a needle assembly (200) 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 (1510),~~

~~the central passage (1530) of the needle assembly (200) 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 (200) according to claim 13, comprising mating the needle assembly (200) with the syringe unit (100).~~