Claims

What is claimed is:

1. An apparatus for removing a needle shield from a syringe, comprising:

a tubular member for enclosing the needle shield coupled to the syringe;

one or more cap engagement mechanisms provided at a distal end of the tubular member and configured for engagement with a distal cap provided for covering a distal end of the syringe; and

one or more shield engagement mechanisms provided at a proximal end of the tubular member and configured for engagement with the needle shield;

wherein, when the apparatus is pulled away from the syringe, the one or more shield engagement mechanisms exert force against the needle shield to remove the needle shield from the syringe.

2. The apparatus of claim 1, wherein the distal cap comprises an aperture and a flanged portion provided in the aperture, and wherein the one or more cap engagement mechanisms are configured to fit within the aperture in the distal cap and wherein the flanged portion of the distal cap is accommodated in a gap under the one or more cap engagement mechanisms.

3. The apparatus of claim 1, wherein the tubular member comprises two apertures, and wherein two shield engagement mechanisms are provided in the apertures.

4. The apparatus of claim 1, wherein the tubular member comprises three apertures, and wherein three shield engagement mechanisms are provided in the apertures.

5. The apparatus of claim 1, wherein the one or more shield engagement mechanisms are configured for engagement with a gap between the needle shield and the syringe.

6. The apparatus of claim 1, wherein the needle shield comprises a soft inner portion and a rigid outer portion.

7. The apparatus of claim 1, wherein the apparatus is configured for engagement with the needle shield coupled to the syringe before the syringe is inserted into a housing of an automatic injection device.

8. An automatic injection device, comprising:

a syringe;

a needle shield coupled to a distal end of the syringe;

a distal cap for covering the needle shield; and

a needle shield remover disposed between the needle shield and the distal cap, the needle shield comprising:

a tubular member for enclosing the needle shield coupled to the syringe,

one or more cap engagement mechanisms provided at a distal end of the tubular member and engaged with the distal cap, and

one or more shield engagement mechanisms provided at a proximal end of the tubular member and engaged with the needle shield;

wherein, when the needle shield remover is pulled away from the syringe, the one or more shield engagement mechanisms exert force against the needle shield to remove the needle shield from the syringe.

9. The automatic injection device of claim 8, wherein the distal cap comprises an aperture and a flanged portion provided in the aperture, and wherein the one or more cap engagement mechanisms are configured to fit within the aperture in the distal cap and wherein the flanged portion of the distal cap is accommodated in a gap under the one or more cap engagement mechanisms.

10. The automatic injection device of claim 8, wherein the tubular member comprises two apertures, and wherein two shield engagement mechanisms are provided in the apertures.

11. The automatic injection device of claim 8, wherein the tubular member comprises three apertures, and wherein three shield engagement mechanisms are provided in the apertures.

12. The automatic injection device of claim 8, wherein the one or more shield engagement mechanisms are for engagement with a gap between the needle shield and the syringe.

13. The automatic injection device of claim 8, wherein the needle shield comprises a soft inner portion and a rigid outer portion.

14. The automatic injection device of claim 8, wherein the needle shield remover is configured for engagement with the needle shield coupled to the syringe before the syringe is inserted into a housing of the automatic injection device.

15. A method for assembling an automatic injection device, comprising:

coupling a needle shield to a distal end of a syringe;

engaging one or more shield engagement mechanisms of a needle shield remover to the needle shield; and

inserting an assembly comprising the syringe, the needle shield and the needle shield remover into a housing of the automatic injection device.

16. The method of claim 15, further comprising:

coupling a distal cap to a distal end of the housing of the automatic injection device; and

engaging one or more cap engagement mechanisms of the needle shield remover to the distal cap.

17. The method of claim 16, further comprising:

when the needle shield remover is pulled away from the syringe, exerting force against the needle shield using the shield engagement mechanisms of the needle shield remover to remove the needle shield from the syringe.

18. The method of claim 16, wherein the distal cap comprises an aperture and a flanged portion provided in the aperture, and wherein the one or more cap engagement mechanisms are configured to fit within the aperture in the distal cap and wherein the flanged portion of the distal cap is accommodated in a gap under the one or more cap engagement mechanisms.

19. The method of claim 15, wherein the needle shield remover comprises a tubular member, and wherein the one or more shield engagement mechanisms are provided at a proximal end of the tubular member and the one or more cap engagement mechanisms are provided at a distal end of the tubular member.

20. The method of claim 19, wherein the tubular member comprises two apertures, and wherein two shield engagement mechanisms are provided in the apertures.

21. The method of claim 19, wherein the tubular member comprises three apertures, and wherein three shield engagement mechanisms are provided in the apertures.

22. The method of claim 15, wherein the one or more shield engagement mechanisms are configured for engagement with a gap between the needle shield and the syringe.

23. The method of claim 15, wherein the needle shield comprises a soft inner portion and a rigid outer portion.

Claims:

1. An apparatus for removing a needle shield from a syringe, comprising:

a tubular member for enclosing the needle shield coupled to the syringe;

one or more cap engagement mechanisms provided at a distal end of the tubular member and configured for engagement with a distal cap provided for covering a distal end of the syringe;

two shield engagement mechanisms provided at a proximal end of the tubular member and configured for engagement with the needle shield, the two shield engagement mechanisms configured such that,

when the apparatus is pulled away from the syringe, the two shield engagement mechanisms exert force against the needle shield to remove the needle shield from the syringe;

two apertures disposed in a sidewall of the tubular member, wherein each of the two shield engagement mechanisms is provided in a respective one of the two apertures; and

two cutout portions formed in the sidewall of the tubular member and circumferentially disposed in an alternating manner with the two apertures about the tubular member.

2. The apparatus of claim 1, wherein the distal cap comprises an aperture and a flanged portion provided in the aperture, and wherein the one or more cap engagement mechanisms are configured to fit within the aperture in the distal cap and wherein the flanged portion of the distal cap is accommodated in a gap under the one or more cap engagement mechanisms.

3. The apparatus of claim 1, wherein the tubular member comprises three apertures, and wherein three shield engagement mechanisms are provided in the apertures.

4. The apparatus of claim 1, wherein the two shield engagement mechanisms are configured for engagement with a gap between the needle shield and the syringe.

5. The apparatus of claim 1, wherein the needle shield comprises a soft inner portion and a rigid outer portion.

6. The apparatus of claim 1, wherein the apparatus is configured for engagement with the needle shield coupled to the syringe when the syringe is outside a housing of an automatic injection device.

7. The apparatus of claim 1, wherein the two shield engagement mechanisms for engagement with the needle shield each comprises an inclined protrusion provided at a portion of the sidewall of the tubular member abutting a corresponding one of the apertures, the inclined protrusion projecting toward the aperture and inclined inwardly into the bore of the tubular member.

8. The apparatus of claim 7, wherein the inclined protrusion is configured to project at an angle of between 30 degrees and 60 degrees relative to the longitudinal axis of the tubular member.

9. The apparatus of claim 1, wherein the tubular member includes a hollow central bore, and wherein the two shield engagement mechanisms for engagement with the needle shield each comprises:

a first inclined protrusion projecting, at a first end, from a sidewall of the tubular member, the first inclined protrusion configured to incline inwardly into the hollow central bore of the tubular member; and

a second inclined protrusion projecting, at a first end, from a second end of the first inclined protrusion, the second inclined protrusion configured to incline inwardly into the hollow central bore of the tubular member at an angle offset from the longitudinal axis and the transverse axis of the tubular member.

10. The apparatus of claim 9, wherein:

the first inclined protrusion is configured to project at an angle up to 20 degrees relative to the longitudinal axis of the tubular member; and

the second inclined protrusion is configured to project at an angle of between 30 degrees and 60 degrees relative to the longitudinal axis of the tubular member.

11. The apparatus of claim 1, further comprising:

one or more slots longitudinally extending along the sidewall of the tubular member, the one or more slots configured and positioned to enable radially outward movement of the sidewall during assembly of the apparatus with a needle shield.

12. The apparatus of claim 1, further comprising:

one or more grooves or protrusions extending longitudinally on an outer surface of the tubular member for maintaining alignment of the cutout portions at a substantially fixed angular position about a central longitudinal axis of the apparatus.

13. An automatic injection device, comprising:

a syringe;

a needle shield coupled to a distal end of the syringe;

a distal cap for covering the needle shield; and

a needle shield remover disposed between the needle shield and the distal cap, the needle shield comprising:

a tubular member for enclosing the needle shield coupled to the syringe,

one or more cap engagement mechanisms provided at a distal end of the tubular member and engaged with the distal cap,

two shield engagement mechanisms provided at a proximal end of the tubular member and engaged with the needle shield, the two shield engagement mechanisms configured such that,

when the needle shield remover is pulled away from the syringe, the two shield engagement mechanisms exert force against the needle shield to remove the needle shield from the syringe,

two apertures disposed in a sidewall of the tubular member, wherein each of the two shield engagement mechanisms is provided in a respective one of the two apertures, and

two cutout portions formed in the sidewall of the tubular member and circumferentially disposed in an alternating manner with the two apertures about the tubular member.

14. The automatic injection device of claim 13, wherein the distal cap comprises an aperture and a flanged portion provided in the aperture, and wherein the one or more cap engagement mechanisms are

configured to fit within the aperture in the distal cap and wherein the flanged portion of the distal cap is accommodated in a gap under the one or more cap engagement mechanisms.

15. The automatic injection device of claim 13, wherein the tubular member comprises three apertures, and wherein three shield engagement mechanisms are provided in the apertures.

16. The automatic injection device of claim 13, wherein the two shield engagement mechanisms are configured for engagement with a gap between the needle shield and the syringe.

17. The automatic injection device of claim 13, wherein the needle shield comprises a soft inner portion and a rigid outer portion.

18. The automatic injection device of claim 13, wherein the needle shield remover is configured for engagement with the needle shield coupled to the syringe when the syringe is outside a housing of the automatic injection device.

19. The automatic injection device of claim 13, wherein a housing of the automatic injection device comprises an inspection window, wherein the tubular member of the needle shield remover comprises one or more grooves or rails, and wherein the automatic injection device further comprises:

> a syringe sleeve having a tubular member for accommodating the syringe, the syringe sleeve comprising one or more rails or grooves for movable engagement with the one or more grooves or rails of the needle shield remover to maintain alignment between the inspection window of the housing and at least one of the cutout portions of the needle shield remover.

20. The automatic injection device of claim 19, wherein the syringe sleeve comprises an inspection window aligned with the inspection window of the housing and aligned with the at least one cutout portion of the needle shield remover.

21. The automatic injection device of claim 19, wherein the syringe sleeve comprises one or more grooves or rails for engagement with corresponding one or more rails or grooves in an inner surface of the housing of the automatic injection device.

22. An apparatus for removing a needle shield from a syringe, comprising:

> a tubular member for enclosing the needle shield coupled to the syringe;

one or more cap engagement mechanisms provided at a distal end of the tubular member and configured for engagement with a distal cap provided for covering a distal end of the syringe;

two shield engagement mechanisms provided at a proximal end of the tubular member and configured for engagement with the needle shield, the two shield engagement mechanisms configured such that, when the apparatus is pulled away from the syringe, the two shield engagement mechanisms exert force against the needle shield to remove the needle shield from the syringe; and

two cutout portions formed in the sidewall of the tubular member and circumferentially disposed in an alternating manner with the two shield engagement mechanisms about the tubular member.

23. The apparatus of claim 22, wherein the distal cap comprises an aperture and a flanged portion provided in the aperture, and wherein the one or more cap engagement mechanisms are configured to fit within the aperture in the distal cap and wherein the flanged portion of the distal cap is accommodated in a gap under the one or more cap engagement mechanisms.

24. The apparatus of claim 22, wherein the two shield engagement mechanisms are configured for engagement with a gap between the needle shield and the syringe.

25. The apparatus of claim 22, wherein the apparatus is configured for engagement with the needle shield coupled to the syringe when the syringe is outside a housing of an automatic injection device.

26. The apparatus of claim 22, wherein the two shield engagement mechanisms for engagement with the needle shield each comprises an inclined protrusion provided at a portion of the sidewall of the tubular member abutting a corresponding one of the apertures, the inclined protrusion projecting toward the aperture and inclined inwardly into the bore of the tubular member.

27. The apparatus of claim 26, wherein the inclined protrusion is configured to project at an angle of between 30 degrees and 60 degrees relative to the longitudinal axis of the tubular member.

28. The apparatus of claim 22, wherein the tubular member includes a hollow central bore, and wherein the two shield engagement mechanisms for engagement with the needle shield each comprises:

a first inclined protrusion projecting, at a first end, from a sidewall of the tubular member, the first inclined protrusion configured to incline inwardly into the hollow central bore of the tubular member; and

a second inclined protrusion projecting, at a first end, from a second end of the first inclined protrusion, the second inclined protrusion configured to incline inwardly into the hollow central bore of the tubular member at an angle offset from the longitudinal axis and the transverse axis of the tubular member.

29. The apparatus of claim 28, wherein:

the first inclined protrusion is configured to project at an angle up to 20 degrees relative to the longitudinal axis of the tubular member; and

the second inclined protrusion is configured to project at an angle of between 30 degrees and 60 degrees relative to the longitudinal axis of the tubular member.

30. The apparatus of claim 22, further comprising:

one or more slots longitudinally extending along the sidewall of the tubular member, the one or more slots configured and positioned to enable radially outward movement of the sidewall during assembly of the apparatus with a needle shield.

31. The apparatus of claim 22, further comprising:

one or more grooves or protrusions extending longitudinally on an outer surface of the tubular member for maintaining alignment of the cutout portions at a substantially fixed angular position about a central longitudinal axis of the apparatus.