Summary

Exemplary embodiments provide a needle shield remover that reliably engages with a distal cap of an automatic injection device and with one or more needle shields coupled to a syringe of the device. An exemplary needle shield remover includes one or more inwardly-projecting shield engagement mechanisms that reliably engage with the needle shields, and one or more cap engagement mechanisms that reliably engage with the distal cap. When a user removes the distal cap, the needle shield remover reliably removes the needle shields (e.g., a soft needle shield and a rigid needle shield) from the syringe, thereby exposing the injection needle for performing an injection. In an exemplary assembly method, an exemplary needle shield remover is engaged to a needle shield coupled to a syringe, prior to insertion of the syringe and needle shield remover assembly into a housing of the automatic injection device. This exemplary assembly method allows visual inspection, outside the housing of the device, to ensure that the needle shield remover is correctly and reliably engaged to the needle shield before the syringe and needle shield remover assembly is inserted into the housing.

In accordance with one aspect of the present invention, an apparatus is provided for removing a needle shield from a syringe. The apparatus includes a tubular member for enclosing the needle shield coupled to the syringe. The apparatus also includes one or more cap engagement mechanisms provided at a distal end of the tubular member and configured for engagement with a cap provided for covering a distal end of the syringe. The apparatus also includes 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 inwardly projecting from a side wall of the proximal end of the tubular member, each of the two needle shield engagement mechanisms comprising a first inclined wall that extends from the side wall of the tubular member 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; wherein each of the two shield engagement mechanisms comprises a second inclined wall coupled to the first inclined wall and extending inwardly into a cavity of the tubular member.

In accordance with another aspect of the present invention, an automatic injection device is provided. The automatic injection device includes a syringe, a needle shield coupled to a distal end of the syringe, and a distal cap for covering the needle shield. The automatic injection device also includes a needle shield remover disposed between the needle shield and the distal cap. The needle shield includes 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 two shield engagement mechanisms provided at a proximal end of the tubular member and engaged with the needle shield, the two shield engagement mechanisms inwardly projecting from a side wall of the proximal end of the tubular member, each of the two needle shield engagement mechanisms comprising a first inclined wall that extends from the side wall of the tubular member, wherein, 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, wherein each of the two shield engagement mechanisms comprises a second inclined wall coupled to the first inclined wall and extending inwardly into a cavity of the tubular member.

In accordance with another exemplary embodiment, a method is provided for assembling an automatic injection device. The method includes coupling a needle shield to a distal end of a syringe. The method also includes engaging one or more shield engagement mechanisms of a needle shield remover to the needle shield. The method

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

Brief Description to the Drawings

The foregoing and other objects, aspects, features, and advantages of exemplary embodiments will become more apparent and may be better understood by referring to

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 cap provided for covering a distal end of the syringe; and

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 inwardly projecting from a side wall of the proximal end of the tubular member, each of the two needle shield engagement mechanisms comprising a first inclined wall that extends from the side wall of the tubular member such that when the apparatus is pulled away from the syringe, the two needle shield engagement mechanisms exert force against the needle shield to remove the needle shield from the syringe; wherein each of the two shield engagement mechanisms comprises a second inclined wall coupled to the first inclined wall and extending inwardly into a cavity of the tubular member.

2. The apparatus of claim 1, wherein the 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 cap and wherein the flanged portion of the cap is accommodated in a gap under the one or more cap engagement mechanisms.

3. The apparatus of claim 1, further comprising two apertures disposed in the side wall of the tubular member, and wherein each of the two shield engagement mechanisms is provided in a respective one of the two apertures.

4. The apparatus of claim 3, further comprising two cutout portions formed in the side wall of the tubular member and circumferentially disposed in an alternating manner with the two apertures about the tubular member.

5. 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.

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 first inclined wall comprises a peripheral edge to engage with the needle shield.

8. The apparatus of claim 1, wherein: the second inclined wall comprises a peripheral edge to engage with the needle shield.

9. The apparatus of claim 1, wherein: the first inclined wall is configured to project at an angle up to 20 degrees relative to a longitudinal axis of the tubular member; and

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

10. The apparatus of claim 1, wherein the two shield engagement mechanisms project inwardly into a cavity of the tubular member at an angle relative to a longitudinal axis.

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

12. The apparatus of claim 1, wherein each of the shield engagement mechanisms is configured to project at an angle of between 30 degrees and 60 degrees relative to the longitudinal axis of the tubular member.

13. The apparatus of claim 1, further comprising: one or more slots longitudinally extending along the side wall of the tubular member, the one or more slots configured and positioned to enable radially outward movement of the side wall during assembly of the apparatus with a needle shield.

14. 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.

15. 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 remover 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

two shield engagement mechanisms provided at a proximal end of the tubular member and engaged with the needle shield, the two shield engagement mechanisms inwardly projecting from a side wall of the proximal end of the tubular member, each of the two needle shield engagement mechanisms comprising a first inclined wall that extends from the side wall of the tubular member, wherein, 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, wherein each of the two shield engagement mechanisms comprises a second inclined wall coupled to the first inclined wall and extending inwardly into a cavity of the tubular member.

16. The automatic injection device of claim 15, wherein the 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 cap and wherein the flanged portion of the cap is accommodated in a gap under the one or more cap engagement mechanisms.

17. The automatic injection device of claim 15, wherein the needle shield remover further comprises two apertures disposed in the side wall of the tubular member, and wherein each of

the two shield engagement mechanisms is provided in a respective one of the two apertures.

18. The automatic injection device of claim 15, wherein the two shield engagement mechanisms are for engagement with a gap between the needle shield and the syringe.

19. The automatic injection device of claim 15, 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.

20. The automatic injection device of claim 17, further comprising two cutout portions formed in the side wall of the tubular member and circumferentially disposed in an alternating manner with the two apertures about the tubular member.

21. The automatic injection device of claim 15, wherein the two shield engagement mechanisms project inwardly into a cavity of the tubular member at an angle relative to a longitudinal axis.

22. The automatic injection device of claim 15, wherein the needle shield remover is configured for engagement with the needle shield coupled to the syringe after the syringe is inserted into a housing of an automatic injection device.

23. The automatic injection device of claim 15, 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 protrusions, and wherein the automatic injection device further comprises:

a syringe sleeve configured to maintain alignment between the inspection window of the housing and at least one of the cutout portions of the needle shield remover.

24. The automatic injection device of claim 23, 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.

25. The automatic injection device of claim 15, wherein the cap and the needle shield remover form a single assembly, and the cap and the needle shield remover are configured to move relative to each other along a longitudinal axis.