5,102,393; 5,267,963; 6,149,626; 6,270,479; and 6,371,939, each of which is incorporated by reference herein in its entirety.

In general, prior automatic injection devices, when operated, have a needle of a syringe configured to move forward and project from a protective housing prior to actuation of the piston of the syringe to eject a dose of liquid through the needle. Movement of the syringe toward the patient's skin such that the needle is exposed before pressurizing a liquid charge inside the syringe can help prevent the liquid from being discharged from the needle before the actual injection takes place.

However, there remains a need for further improvement of known automatic injection devices. For example, it can be desirable to inspect the contents of the automatic injection device prior to use. Also, it can be desirable to indicate when injection is completed. Such features are available in certain automatic injection devices, the features depend upon larger volume doses. However, there remains a need for an automatic injection device suitable for different volume doses and/or a wider range of dose volumes.

SUMMARY

The purpose and advantages of the disclosed subject matter will be set forth in and apparent from the description that follows, as well as will be learned by practice of the disclosed subject matter. Additional advantages of the disclosed subject matter will be realized and attained by the methods and systems particularly pointed out in the written description and claims hereof, as well as from the appended drawings.

In one aspect, there is provided an automatic injection device comprising:

a housing having a first end, a second end, and a barrel between the first end and the second end, the barrel comprising an elongated window to allow viewing of contents inside the housing;

a syringe disposed within the housing and having a first end, a second end, and a reservoir between the first end and the second end;

a plunger at least partially disposed within the syringe and comprising a visual indicator on a portion of the plunger; and

a syringe carrier disposed within the housing and configured to contain the syringe and displace the syringe within the housing between a first position and a second position, the syringe carrier being substantially transparent and having at least a first opening configured to align with the window and the reservoir when the syringe carrier is in the first position.

To achieve these and other advantages and in accordance with the purpose of the disclosed subject matter, as embodied and broadly described, the disclosed subject matter includes an automatic injection device comprising a housing, a syringe, a plunger, and a syringe carrier. The housing includes a first end, a second end, and a barrel between the first end and the second end. The barrel includes an elongated window to allow viewing of contents inside the housing. The syringe is disposed within the housing and has a first end, a second end, and a reservoir therebetween. The plunger is at least partially disposed within the syringe and includes a visual indicator disposed on a portion of the plunger. The syringe carrier is disposed within the housing and configured to contain the syringe and displace the

CLAIMS

We claim:

1. An automatic injection device comprising:

a housing having a first end, a second end, and a barrel between the first end and the second end, the barrel comprising an elongated window to allow viewing of contents inside the housing;

a syringe disposed within the housing and having a first end, a second end, and a reservoir between the first end and the second end;

a plunger at least partially disposed within the syringe and comprising a visual indicator on a portion of the plunger; and

a syringe carrier disposed within the housing and configured to contain the syringe and displace the syringe within the housing between a first position and a second position, the syringe carrier being substantially transparent and having at least one opening configured to align with the window and the reservoir when the syringe carrier is in the first position or to align with the window and the visual indicator when the syringe carrier is in the second position.

2. The automatic injection device of claim 1, the housing further comprising a beveled edge surrounding the elongated window to receive a shield.

3. The automatic injection device of claim 2, wherein the shield is configured to prevent UV radiation from entering the housing through the elongated window.

4. The automatic injection device of claim 1, wherein the elongated window has a substantially symmetrical oval shape.

5. The automatic injection device of claim 1, wherein the elongated window as at least one tapered end.

6. The automatic injection device of claim 1, the at least one opening comprising a first opening configured to align with the window and the reservoir when the syringe carrier is in the first position.

7. The automatic injection device of claim 6, wherein the syringe carrier is configured to allow viewing of substantially all of a liquid therapeutic agent in the reservoir when the syringe carrier is in the first position.

8. The automatic injection device of claim 6, the at least one opening further comprising a second opening configured to align with the window and the visual indicator when the syringe carrier is in the second position.

9 The automatic injection device of claim 8, the syringe carrier further comprising a middle portion between the first and second openings, the middle portion sized to resist deformation of the syringe carrier.

10. The automatic injection device of claim 8, wherein the first opening is positioned nearer to the first end of the housing than the second opening.

11. The automatic injection device of claim 1, the syringe carrier further comprising first and second legs, the first and second legs defining at least a portion of the at least one opening.

12. The automatic injection device of claim 1, the syringe carrier further comprising first and second pairs of legs, and the at least one opening comprising a front opening portion and a rear opening portion, the first pair of legs defining at least a portion of the front opening portion and the second pair of legs defining at least a portion of the rear opening portion.

13. The automatic injection device of claim 1, wherein the first position is a pre-injection position.

14. The automatic injection device of claim 1, wherein the second position is a post-injection position.

15. The automatic injection device of claim 1 further comprising a cap having an outer portion, the first end of the housing configured to receive the outer portion of the cap, the outer portion of the cap comprising a cap notch, a portion of the elongated window being aligned with the cap notch when the cap receives the housing to prevent obstruction of the window.

16. The automatic injection device of claim 1, further comprising a shroud at least partially disposed within the housing, a portion of the shroud disposed within the

housing having a shroud notch, the shroud notch being aligned with at least a portion of the elongated window to prevent obstruction of the window.

17. The automatic injection device of claim 1, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent having a volume of 0.4 mL.

18. The automatic injection device of claim 1, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent having a volume of 0.8 mL.

19. The automatic injection device of claim 1, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent comprising a protein.

20. The automatic injection device of claim 1, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent comprising adalimumab.

21. An automatic injection device comprising:

a housing having a first end, a second end, and a barrel between the first end and the second end, the barrel comprising an elongated window to allow viewing of contents inside the housing;

a syringe disposed within the housing and having a first end, a second end, and a reservoir between the first end and the second end;

a plunger at least partially disposed within the syringe and comprising a visual indicator on a portion of the plunger; and

a syringe carrier disposed within the housing and configured to contain the syringe and displace the syringe within the housing between a first position and a second position, the syringe carrier being substantially transparent and having first and second legs and an extension disposed therebetween, at least a portion of the extension configured to align with the window and the reservoir when the syringe carrier is in the first position.

22. The automatic injection device of claim 21, the syringe carrier further comprising a transparent side wall, at least a portion of the transparent side wall being configured to align with the window and the visual indicator when the syringe carrier is in the second position.

23. The automatic injection device of claim 21, wherein the first opening is positioned nearer to the first end of the housing than the second opening.

24. The automatic injection device of claim 21, wherein the first position is a pre-injection position.

25. The automatic injection device of claim 21, wherein the second position is a post-injection position.

26. The automatic injection device of claim 21, wherein the syringe carrier is configured to allow viewing of substantially all of a liquid therapeutic agent in the reservoir when the syringe carrier is in the first position.

27. The automatic injection device of claim 21, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent having a volume of 0.4 mL.

28. The automatic injection device of claim 21, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent having a volume of 0.8 mL.

29. The automatic injection device of claim 21, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent comprising a protein.

30. The automatic injection device of claim 21, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent comprising adalimumab.

CLAIMS

We claim:

1. An automatic injection device comprising:

a housing having a first end, a second end, and a barrel between the first end and the second end, the barrel comprising an elongated window to allow viewing of contents inside the housing;

a syringe disposed within the housing and having a first end, a second end, and a reservoir between the first end and the second end;

a plunger at least partially disposed within the syringe and comprising a visual indicator on a portion of the plunger; and

a syringe carrier disposed within the housing and configured to contain the syringe and displace the syringe within the housing between a first position and a second position, the syringe carrier being substantially transparent and having at least a first opening configured to align with the window and the reservoir when the syringe carrier is in the first position.

2. The automatic injection device of claim 1, the housing further comprising a beveled edge surrounding the elongated window to receive a shield.

3. The automatic injection device of claim 2, wherein the shield is configured to prevent UV radiation from entering the housing through the elongated window.

4. The automatic injection device of claim 1, wherein the elongated window has a substantially symmetrical oval shape.

5. The automatic injection device of claim 1, wherein the elongated window has at least one tapered end.

6. The automatic injection device of claim 1, wherein the syringe carrier is configured to allow viewing of substantially all of a liquid therapeutic agent in the reservoir when the syringe carrier is in the first position.

7. The automatic injection device of claim 1, the syringe carrier further comprising a second opening configured to align with the window and the visual indicator when the syringe carrier is in the second position.

8. The automatic injection device of claim 7, the syringe carrier further comprising a middle portion between the first and second openings, the middle portion sized to resist deformation of the syringe carrier.

9. The automatic injection device of claim 7, wherein the first opening is positioned nearer to the first end of the housing than the second opening.

10. The automatic injection device of claim 1, the syringe carrier further comprising first and second legs, the first and second legs defining at least a portion of the first opening.

11. The automatic injection device of claim 1, the syringe carrier further comprising first and second pairs of legs, and a second opening, the first opening comprising a front opening portion and a rear opening portion, the first pair of legs defining at least a portion of the front opening portion and the second pair of legs defining at least a portion of the rear opening portion.

12. The automatic injection device of claim 1, wherein the first position is a pre-injection position.

13. The automatic injection device of claim 1, wherein the second position is a post-injection position.

14. The automatic injection device of claim 1, further comprising a cap having an outer

portion, the first end of the housing configured to receive the outer portion of the cap, the outer portion of the cap comprising a cap notch, a portion of the elongated window being aligned with the cap notch when the cap receives the housing to prevent obstruction of the window.

15. The automatic injection device of claim 1, further comprising a shroud at least partially disposed within the housing, a portion of the shroud disposed within the housing having a shroud notch, the shroud notch being aligned with at least a portion of the elongated window to prevent obstruction of the window.

16. The automatic injection device of claim 1, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent having a volume of 0.4 mL.

17. The automatic injection device of claim 1, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent having a volume of 0.8 mL.

18. The automatic injection device of claim 1, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent comprising a protein.

19. The automatic injection device of claim 1, further comprising a liquid therapeutic agent in the reservoir, the liquid therapeutic agent comprising adalimumab.

20. The automatic injection device of claim 1, wherein the syringe carrier further comprises first and second legs and an extension disposed therebetween, at least a portion of the extension configured to align with the window and the reservoir when the syringe carrier is in the first position.

21. The automatic injection device of claim 20, the syringe carrier further comprising a transparent side wall, at least a portion of the transparent side wall being configured to align with the window and the visual indicator when the syringe carrier is in the second position.

22. The automatic injection device of claim 20, wherein the first opening is positioned nearer to the first end of the housing than the second opening.

23. The automatic injection device of claim 20, wherein the first position is a pre-injection position.

24. The automatic injection device of claim 20, wherein the second position is a post-injection position.

25. The automatic injection device of any of claims 6, 16, 17, 18, or 19, wherein the syringe carrier further comprises first and second legs and an extension disposed therebetween, at least a portion of the extension configured to align with the window and the reservoir when the syringe carrier is in the first position.