DRUG DELIVERY DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims the priority of U.S. Provisional Application No. 62/908,472, filed September 30, 2019, entitled "Drug Delivery Device," and U.S. Provisional Application No. 62/975,557, filed February 12, 2020, entitled "Drug Delivery Device," each of which is incorporated herein by reference.

FIELD OF DISCLOSURE

[0002] The present disclosure relates to drug delivery devices. More particularly, the present disclosure relates to safe and proper handling of such devices before, during, and after an injection.

BACKGROUND

[0003] A general aversion to exposed needles, as well as health and safety issues, have led to the development of drug delivery devices which conceal a needle or other insertion member prior to use and which automate various aspects of an injection process. Such devices offer a variety of benefits as compared with traditional methods of drug delivery including, for example, delivery via a conventional syringe.

[0004] Many drug delivery devices provide limited visual access to the inner workings of the device due to their complexities and to ease user apprehensions. As a consequence, users may not be able to accurately identify a remaining quantity of drug in the device, and thus may preemptively remove the device from the injection site prior to administration of a full dose. Conversely, users may take an opposite approach where they hold the device against the injection site for an excessively long period of time to ensure the full dose was administered. Doing so may result in user discomfort, uncertainty, and/or unease.

[0005] To reduce complexity, some drug delivery devices do not incorporate a mechanism for retracting the needle within a housing after dosing is complete. When the device is removed from the injection site, the needle may therefore protrude outside of the housing. To cover the exposed needle in the post-delivery state, certain devices will deploy a spring biased guard from inside the device. However, if an external force is applied to the guard which is greater than the biasing force of the spring, the needle may be re-exposed. Ensuring that the guard conceals the needle in the post-delivery state is therefore a concern.

[0006] The present disclosure sets forth drug delivery devices embodying advantageous alternatives to existing drug delivery devices, and that may address one or more of the challenges or needs mentioned herein.

SUMMARY

[0007] There is provided a drug delivery device including a housing having an opening, a drug storage container, a plunger, a drive mechanism, a guard, a lock, and an indicator. The drug storage container may include a delivery member having an insertion end configured to extend at least partially through the opening in the housing. The drive mechanism may be activatable to drive the plunger in a distal direction to expel a drug from the drug storage container through the delivery member. The guard may be guard moveably disposed adjacent to the opening and operably coupled to the drive mechanism. The lock may be selectively engageable with the guard to limit movement of the guard in the proximal direction. The indicator may be coupled to the drive mechanism to generate an audible signal during drug delivery.

[0008] According to a first aspect of the present invention, there is provided a drug delivery device including a housing having an opening, a drug storage container, a plunger, a drive mechanism, a guard, and a lock. The drug storage container may include a delivery member having an insertion end configured to extend at least partially through the opening in the housing. The drive mechanism may be activatable to drive the plunger in a distal direction to expel a drug from the drug storage container through the delivery member. The guard may be moveably disposed adjacent to the opening and operably coupled to the drive mechanism. Moving the guard in a proximal direction relative to the housing may cause the guard to directly or indirectly activate the drive mechanism. The lock may be disposed at least partially within the guard and rotatable between a first rotational position wherein the lock permits movement of the guard in the proximal direction and a second rotational position wherein the lock limits movement of the guard in the proximal direction.

[0008a] According to a second aspect of the present invention, there is provided a drug delivery device comprising: a housing having an opening; a drug storage container including a delivery member having an insertion end configured to extend at least partially through the opening in the housing; a plunger; a drive mechanism activatable to drive the plunger to expel a drug from the drug storage container through the delivery member; and an indicator operably coupled to the drive mechanism to generate a continuous or repeating audible signal during drug delivery, and to cease generating the continuous or repeating audible signal when drug delivery is complete.

[0009] There is provided an arrangement for a drug delivery device. The arrangement may include a guard and a lock. The guard may be configured to selectively cover an insertion end of a delivery member of the drug delivery device. Furthermore, the guard may have an extended position wherein the guard extends at least partially through an opening in a housing of the drug delivery device and a retracted position wherein the guard is disposed away from the extended position. The lock may be rotatable between a first rotational position wherein the lock permits movement of the guard from the extended position to the retracted position and a second rotational position wherein the lock limits movement of the guard from the extended position to the retracted position.

[0010] There is provided a drug delivery device including a housing having an opening, a drug storage container, a plunger, a drive mechanism, and an indicator. The drug storage container may include a delivery member having an insertion end configured to extend at least partially through the opening in the housing. The drive mechanism may be activatable to drive the plunger in a distal direction to expel a drug from the drug storage container through the delivery member.

[0011] There is provided a drug delivery device including a housing having an opening, a plunger, a drive mechanism, an end cap removably coupled with the housing adjacent to the opening when in a storage position, and a drug storage container including a delivery member having an insertion end configured to extend at least partially through the opening in the housing. The drive mechanism may be activatable to drive the plunger to expel a drug from the drug storage container through the delivery member. The housing may include a housing-anti-rotation feature. The end cap may include an end cap anti-rotation feature that, when the end cap is in the storage position, is adjacent to and substantially in-line with the housing anti-rotation feature.

[0012] There is provided a method of assembling a drug delivery device. The method may include: (i) providing a guard configured to selectively cover an insertion end of a delivery member of the drug delivery device, (ii) positioning a lock at least partially within the guard, the lock being rotatable between a first rotational position wherein the lock permits movement of the guard relative to the delivery member and a second rotational position wherein the lock limits movement of the guard relative to the delivery member, and (iii) determining whether a first opening in the guard is rotationally aligned with a second opening in the lock.

[0013] According to a third aspect of the present invention, there is provided a drug delivery device including a housing having an opening, a drug storage container, a plunger, a rotational biasing member, and a mechanical linkage. The drug storage container may include a body portion defining a longitudinal axis and a delivery member having an insertion end configured to extend at least partially through the opening during a delivery state. The plunger may be moveable in a distal direction to expel a drug from the drug storage container through the delivery member. The rotational biasing member may be initially held in an energized state and configured to rotate about the longitudinal axis when

released, The mechanical linkage may be operably coupled to the plunger and the rotational biasing member. Furthermore, the mechanical linkage may be configured to convert rotation caused by the release of rotational biasing member into movement of the plunger in the distal direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] It is believed that the disclosure will be more fully understood from the following description taken in conjunction with the accompanying drawings. Some of the drawings may have been simplified by the omission of selected elements for the purpose of more clearly showing other elements. Such omissions of elements in some drawings are not necessarily indicative of the presence or absence of particular elements in any of the exemplary embodiments, except as may be explicitly delineated in the corresponding written description. Also, none of the drawings is necessarily to scale.

[0015] Fig. 1A is a perspective view of a drug delivery device according to an embodiment of the present disclosure, in a pre-delivery state.

What is claimed is:

1. A drug delivery device comprising:

a housing having an opening;

a drug storage container including a delivery member having an insertion end configured to extend at least partially through the opening in the housing;

a plunger;

a drive mechanism activatable to drive the plunger in a distal direction to expel a drug from the drug storage container through the delivery member;

a guard moveably disposed adjacent to the opening and operably coupled to the drive mechanism, wherein moving the guard in a proximal direction relative to the housing causes the guard to directly or indirectly activate the drive mechanism; and

a lock disposed at least partially within the guard and rotatable between a first rotational position wherein the lock permits movement of the guard in the proximal direction and a second rotational position wherein the lock limits movement of the guard in the proximal direction.

2. The drug delivery device of claim 1, comprising a container holder fixed relative to the housing, the drug storage container being disposed at least partially within the container holder.

3. The drug delivery device of claim 2, wherein one of the lock and the container holder includes a cam and the other one of the lock and the housing includes a cam follower.

4. The drug delivery device of claim 3, including a biasing member configured to bias the cam follower against the cam to urge the lock to rotate from the first rotational position toward the second rotational position.

5. The drug delivery device of claim 4, wherein the biasing member exerts a proximally directed biasing force on the lock.

6. The drug delivery device of claim 1, wherein one of the lock and the housing includes a cam and the other one of the lock and the housing includes a cam follower.

7. The drug delivery device of claim 6, comprising a biasing member configured to bias the cam follower against the cam to urge the lock to rotate from the first rotational position toward the second rotational position.

8. The drug delivery device of claim 7, wherein the biasing member exerts a proximally directed biasing force on the lock.

9. The drug delivery device of any one of claims 1 to 8, the lock including a distally facing abutment surface selectively engageable with a proximally facing abutment surface of the guard.

10. The drug delivery device of any one of claims 1 to 9, the guard having an extended position wherein the guard extends at least partially through the opening in the housing and a retracted position wherein the guard is disposed away from the extended position toward the housing.

11. The drug delivery device of claim 10, comprising a first projection extending outwardly from the lock and a second projection extending inwardly from the guard, wherein the first and second projections engage one another to retain the lock in the first rotational position.

12. The drug delivery device of claim 11, wherein the second projection slides out of engagement with the first projection to allow the lock to rotate away from the first rotational position toward the second rotational position when the guard moves from the extended position to the retracted position.

13. A drug delivery device comprising:

a housing having an opening;

a drug storage container including a delivery member having an insertion end configured to extend at least partially through the opening in the housing;

a plunger;

a drive mechanism activatable to drive the plunger to expel a drug from the drug storage container through the delivery member; and

an indicator operably coupled to the drive mechanism to generate a continuous or repeating audible signal during drug delivery, and to cease generating the continuous or repeating audible signal when drug delivery is complete.

14. The drug delivery device of claim 13, the indicator being rotatable relative to the housing.

15. The drug delivery device of claim 14, wherein activating the drive mechanism causes the drive mechanism to rotate the indicator relative to the housing.

16. The drug delivery device of claim 5, wherein the drive mechanism ceases rotating the indicator when drug delivery is complete.

17. The drug delivery device of any one of claims 15 or 16, the drive mechanism including a rotational biasing member initially held in an energized state and a mechanical linkage operably coupling the rotational biasing member and the plunger, wherein the mechanical linkage is configured to rotate as the rotational biasing member de-energizes.

18. The drug delivery device of claim 17, the mechanical linkage including a plunger guide having a proximal end and a distal end, the plunger being at least partially disposed within the distal end of the plunger guide, the proximal end of the plunger guide being coupled to the indicator such that the indicator rotates jointly with the plunger guide.

19. The drug delivery device of any one of claims 14 to 18, comprising:

a first plurality of projections coupled to the indicator; and

a second plurality of projections concentrically arranged with the first plurality of projections,

wherein the first plurality of projections slidably engages the second plurality of projections to generate the continuous or repeating audible signal during drug delivery.

20. A drug delivery device comprising:

a housing having an opening;

a drug storage container including a body portion defining a longitudinal axis and a delivery member having an insertion end configured to extend at least partially through the opening during a delivery state;

a plunger moveable in a distal direction to expel a drug from the drug storage container through the delivery member;

a rotational biasing member initially held in an energized state and configured to rotate about the longitudinal axis when released; and

a mechanical linkage operably coupled to the plunger and the rotational biasing member, the mechanical linkage being configured to convert rotation caused by the release of rotational biasing member into movement of the plunger in the distal direction.

21. The drug delivery device of claim 20, wherein the mechanical linkage is configured to convert rotation caused by the release of the rotational biasing member into movement of the plunger in the distal direction without causing the plunger to rotate.

22. The drug delivery device of any one of claims 20 or 21, wherein the mechanical linkage includes a nut having a threaded inner surface engaging a threaded outer surface of the plunger.

23. The drug delivery device of claim 22, wherein a distal end of the rotational biasing member is fixedly secured to the nut.

24. The drug delivery device of any one of claims 22 or 23, wherein the rotational biasing member surrounds at least a portion of the nut.

25. The drug delivery device of any one of claims 21 to 24, comprising a lock having an initial position wherein the lock prevents the nut from rotating and a second position wherein the lock does not prevent the nut from rotating.

26. The drug delivery device of claim 25, wherein the lock is configured to move in a proximal direction while moving from the initial position to the second position.

27. The drug delivery device of any one of claims 25 or 26, comprising a guard member moveably positioned adjacent to the opening, wherein the guard member has an extended position wherein the guard member extends at least partially through the opening in the housing and a retracted position wherein the guard member is positioned away from the extended position toward the housing.

28. A drug delivery device comprising:

a housing having an opening;

a drug storage container including a delivery member having an insertion end configured to extend at least partially through the opening in the housing;

a plunger;

a drive mechanism activatable to drive the plunger in a distal direction to expel a drug from the drug storage container through the delivery member;

a guard moveably disposed adjacent to the opening and operably coupled to the drive mechanism; and

a lock selectively engageable with the guard to limit movement of the guard in a proximal direction.