SUMMARY

The present invention comprises one or more of the features recited in the appended claims or the following features or combinations thereof:

According to the first aspect of the invention, there is provided a fluid delivery device for administering a first medicament and a second medicament, the fluid delivery device comprising: a housing; a first fluid reservoir configured to contain the first medicament within the housing; a second fluid reservoir configured to contain the second medicament within the housing; a needle having a first end configured to extend into the first fluid reservoir and a second end configured to extend from the housing; a basal pump chamber having hydraulic fluid and coupled to the first fluid reservoir; a basal drive mechanism having a hydraulic fluid reservoir, the hydraulic fluid reservoir including hydraulic fluid; a flow restrictor fluidly coupling the hydraulic fluid reservoir with the basal pump chamber, the basal drive mechanism configured to pressurize the hydraulic fluid in the basal pump chamber and engage the first fluid reservoir to provide a basal delivery of the first medicament; and a bolus drive mechanism coupled to the second fluid reservoir and configured to provide a bolus delivery of the second medicament.

According to the second aspect of the invention, there is provided a fluid delivery device for administering a first medicament and a second medicament, the fluid delivery device comprising: a housing configured to have a first fluid reservoir containing the first medicament and a second fluid reservoir containing the second medicament; a needle having a first end configured to extend into the first fluid reservoir and a second end configured to extend from the housing; a basal pump chamber having hydraulic fluid and coupled to the first fluid reservoir; a basal drive mechanism having a hydraulic fluid reservoir, the hydraulic fluid reservoir including hydraulic fluid; a flow restrictor fluidly coupling the hydraulic fluid reservoir with the basal pump chamber, the basal drive mechanism configured to pressurize the hydraulic fluid in the basal pump chamber and engage the first fluid reservoir to provide a basal delivery of the first medicament; and a bolus drive mechanism coupled to the second fluid reservoir and configured to provide a bolus delivery of the second medicament.

According to one ~~aspect~~embodiment of the disclosure, a fluid delivery device for administering a first medicament and a second medicament is provided. The fluid delivery device may function to administer a basal delivery of the first medicament and/or a basal delivery of the second medicament. Further, the fluid delivery device may function to administer a bolus delivery of the first medicament and/or a bolus delivery of the second medicament. In other words, any combination of basal and/or bolus deliveries of each of the first and second medicaments is contemplated.

Various configurations of basal drive mechanisms of the fluid delivery device may provide the basal delivery of the first and/or second medicament. For example, one basal drive mechanism may provide the basal delivery of only the first medicament, only the second medicament, or both the first and second medicaments. In instances where the basal drive mechanism provides the basal delivery of only one of the first and second medicaments, a second basal drive mechanism of the fluid delivery device may provide the basal delivery of the other medicament.

Similarly, various configurations of bolus drive mechanisms of the fluid delivery device may provide the bolus delivery of the first and/or second medicament. For example, one bolus drive mechanism may provide the bolus delivery of only the first medicament, only the second medicament, or both the first and second medicaments. In instances where the bolus drive mechanism provides the bolus delivery of only one of the first and second medicaments, a second bolus drive mechanism of the fluid delivery device may provide the bolus delivery of the other medicament.

According to another ~~aspect~~embodiment of the present disclosure, the fluid delivery device may include one or more needles in fluid communication with the first and second reservoirs containing the first and second medicaments. For example, a first needle may be in fluid communication with the reservoir containing the first medicament while a second needle may be in fluid communication with reservoir containing the second medicament. Such needles may be spaced-apart from each other or positioned on opposite ends of the fluid delivery device to substantially prevent any mixing of the first and second medicaments during delivery. Further, one needle may include a delivery arm (for subcutaneous insertion into the patient's skin) which is longer than a delivery arm of the other needle. In such a case, one of the first and second

medicaments will be delivered to a subcutaneous depth greater than the other one of the first and second medicaments. Delivering the medicaments to a different depth may also substantially prevent any mixing of the first and second medicaments.

According to still another ~~aspect~~embodiment of the present disclosure, a single needle may be provided which is in fluid communication with each reservoir of the first and second medicaments. Such a needle may be "Y-shaped" and include a first uptake arm for fluid communication with the reservoir containing first medicament and a second uptake arm for fluid communication with the reservoir containing the second medicament. Each of the first and second uptake arms of the needle may be in fluid communication with a delivery arm of the needle such that the first and second medicaments may mix with each other within the delivery arm of the needle prior to being delivered into the patient.

Illustratively, a fluid delivery device of the present disclosure may include an exterior housing, a first reservoir within the housing configured to contain the first medicament, and a second reservoir within the housing configured to contain the second medicament. The fluid delivery device may further include a needle having a first end configured for fluid communication with the first reservoir and a second end configured to extend exteriorly from the housing. Alternatively, the needle may include a third end configured for fluid communication with the second reservoir containing the second medicament. The fluid delivery device may further include a second needle having a first end configured for fluid communication with the second reservoir and a second end configured to extend exteriorly from the housing. The first needle may be positioned at a first end of the housing while the second needle may be positioned at a second end of the housing. Further, a delivery arm of the first needle may be longer than a delivery arm of the second needle.

Further illustratively, the fluid delivery device may include a basal drive mechanism for providing a basal delivery of the first medicament. The same basal drive mechanism may also provide a basal delivery of the second medicament. Alternatively, a second basal drive mechanism may provide the basal delivery of the second medicament. In either case, the basal drive mechanism may include a coil spring, a basal drive piston, and a hydraulic fluid reservoir. Further, the fluid delivery device may include a first pump chamber associated with the first medicament in fluid communication with the hydraulic fluid reservoir of the first basal drive mechanism via a first flow restrictor. Similarly, a second pump chamber associated with the second medicament may be in fluid communication with the hydraulic fluid reservoir of the second basal drive mechanism via a second flow restrictor.

Further illustratively, a first delivery piston of the fluid delivery device may be positioned within the first fluid reservoir to exert a force on the first medicament within the first fluid reservoir. Similarly, a second delivery piston may be positioned within the second fluid reservoir to exert a force on the second medicament within the second fluid reservoir.

The fluid delivery device may further include a bolus drive mechanism for providing a bolus delivery of the first medicament. The same bolus drive mechanism may also provide a bolus delivery of the second medicament. Alternatively, a second bolus drive mechanism may provide the bolus delivery of the second medicament. In either case, the bolus drive mechanism may include a ratchet and a bolus piston coupled to the ratchet. A pump chamber of the fluid delivery device is associated with the first fluid reservoir and the bolus piston is positioned within a bolus fluid reservoir in fluid communication with the pump chamber.

According to another ~~aspect~~embodiment of the present disclosure, a method of administering first and second medicaments from an fluid delivery device includes delivering a first basal delivery of the first medicament, and delivering a second basal delivery of the second medicament. The first basal delivery may be approximately equal to the second basal delivery. Alternatively, the first basal delivery may be greater than the second basal delivery.

Illustratively, delivering the first medicament may include actuating a first basal drive mechanism and delivering the second medicament may similarly include actuating the first basal drive mechanism. Alternatively, delivering the second medicament may include actuating a second basal drive mechanism different from the first basal drive mechanism.

The method may further include delivering a first bolus delivery of the first medicament and delivering a second bolus delivery of the second medicament. The first bolus delivery may be the same as the second bolus delivery. Alternatively, the first bolus delivery may be greater than the second bolus delivery.

Illustratively, delivering the first bolus delivery may include actuating a first bolus drive mechanism and delivering the second bolus delivery may include actuating the first bolus drive mechanism. Alternatively, delivering the second bolus delivery may include actuating a second bolus drive mechanism different from the first bolus drive mechanism.

According to still another ~~aspect~~embodiment of the present disclosure, another method of administering first and second medicaments from a fluid delivery device includes (i) forcing hydraulic fluid from a hydraulic fluid reservoir into a first pump chamber to exert a force on a first movable barrier, (ii) forcing hydraulic fluid from the hydraulic fluid reservoir into a second pump chamber to exert a force on a second movable barrier, (iii) exerting a force on a first

piston to expel at least a portion of the first medicament through an aperture of the first fluid reservoir, and (iv) exerting a force on a second piston to expel at least a portion of the second medicament through an aperture of the second fluid reservoir.

Illustratively, forcing the hydraulic fluid from the hydraulic fluid reservoir may include applying a spring force to a piston within the hydraulic fluid reservoir. Forcing the hydraulic fluid from the hydraulic fluid reservoir may further include forcing hydraulic fluid from the hydraulic fluid reservoir through a flow restrictor and into the first and second pump chambers.

The fluid delivery devices described herein may be used to delivery a wide variety of drugs, pharmaceutical agents, and medicaments, and other components useful for treating diseases and disease states. In one embodiment, the delivery devices described herein include or are configured or adapted to include pre-selected medicaments in the corresponding reservoirs. In ~~one aspect~~another embodiment, the pre-selected medicaments are used to treat diabetes and/or diabetic conditions. In another ~~aspect~~embodiment, the pre-selected medicaments are used to treat bacterial infections and/or other diseases associated with pathogenic cell populations. In another ~~aspect~~embodiment, the pre-selected medicaments are used to treat diseases associated with neurotransmitter dysfunction, including but not limited to diseases that are treatable with dopamine and/or compounds that function as dopamine agonists and/or dopamine antagonists.

The above and other features of the present disclosure will become apparent from the following description and the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description particularly refers to the accompanying figures in which:

FIGS. 1-5b are schematics showing dual-cartridge drug delivery devices of the present disclosure which provide a basal delivery of both first and second medicaments and which provide a bolus delivery of both first and second medicaments;

FIGS. 6-7 are schematics showing additional drug delivery devices of the present disclosure which provide a basal delivery of the first medicament only and a bolus delivery of the first and second medicaments;

FIGS. 8-9 are schematics further showing additional drug delivery devices of the present disclosure which provide a basal delivery of the first and second medicaments while providing a bolus delivery of only the second medicament;