

SUMMARY

[0007] The present disclosure provides a compact and easily transported medical delivery device.

[0008] The present disclosure comprises, in one form thereof, a medical delivery device for use with a medicament container. The medicament container has a container body holding the medicament, defines an outlet, and further includes a piston disposed within the container body wherein advancement of the piston in the container body expels medicament through the outlet. The delivery device includes a support structure adapted to support the medicament container and a drive assembly supported on the support structure and adapted to advance the piston within the container body. The drive assembly includes a drive ribbon having a distal edge section and a proximal edge section. The drive ribbon has a retracted configuration and an extended configuration wherein a retracted portion of the drive ribbon in the retracted configuration defines a spiral and an extended portion of the drive ribbon in the extended configuration defines a helix. The drive ribbon is incrementally moveable between the retracted and extended configurations and movement of the drive ribbon from the retracted configuration to the extended configuration defines a drive axis. A mechanical drive is operably coupled with the drive ribbon and selectively rotates the drive ribbon about the drive axis wherein rotation of the drive ribbon in a first direction extends the drive ribbon and rotation of the drive ribbon in an opposite second direction retracts the drive ribbon. A thrust member is operably disposed between the support structure and the drive ribbon and is engaged with at least a portion of the proximal edge section when the drive ribbon is at least partially extended. A bearing member is supported on the drive ribbon proximate a distal end of the drive ribbon. The bearing member is adapted to exert an axial force on the piston when the drive ribbon is being extended. The axial force exerted by the bearing member on the piston is at least partially transmitted to the support structure through the medicament container. When an axial compressive load is exerted on the drive ribbon, the axial compressive load is at least partially transmitted to the support structure through the thrust member.

[0008a] In one aspect of the present disclosure, there is provided a medical delivery device for use with a medicament container having a container body holding the medicament and defining an outlet, the medicament container further including a piston disposed within the container body, advancement of the piston in the container body expelling medicament through the outlet; the delivery device comprising:

- a support structure adapted to support the medicament container; and

- a drive assembly supported on the support structure and adapted to advance the piston within the container body wherein the drive assembly comprises:

- a drive ribbon having a distal edge section and a proximal edge section, the drive ribbon having a retracted configuration and an extended configuration wherein a retracted portion of the drive ribbon in the retracted configuration defines a spiral and an extended portion of the drive ribbon in the extended configuration defines a helix, the drive ribbon being incrementally moveable between the retracted and extended configurations, movement of the drive ribbon from the retracted configuration to the extended configuration defining a drive axis;

- a mechanical drive operably coupled with the drive ribbon and selectively rotating the drive ribbon about the drive axis wherein rotation of the drive ribbon in a first direction extends the drive ribbon and rotation of the drive ribbon in an opposite second direction retracts the drive ribbon;

- a thrust member operably disposed between the support structure and the drive ribbon, the thrust member being engaged with at least a portion of the proximal edge section when the drive ribbon is at least partially extended;

- a bearing member supported on the drive ribbon proximate a distal end of the drive ribbon; the bearing member being adapted to exert an axial force on the piston when the drive ribbon is being extended; and

- wherein the axial force exerted by the bearing member on the piston is at least partially transmitted to the support structure through the medicament container and, when an axial compressive load is exerted on the drive ribbon, the axial compressive load is at least partially transmitted to the support structure through the thrust member.

[0008b] In another aspect of the present disclosure, there is provided a medical delivery device for use with a medicament container having a container body holding the medicament and defining an outlet, the medicament container further including a piston disposed within the container body, advancement of the piston in the container body expelling medicament through the outlet; the delivery device comprising:

- a support structure adapted to support the medicament container; and

- a drive assembly supported on the support structure and adapted to advance the piston within the container body, the drive assembly comprising a drive ribbon having a distal edge section and a proximal edge section, the drive ribbon having a retracted configuration and an extended configuration, wherein a retracted portion of the drive ribbon in the retracted configuration defines a spiral and an extended portion of the drive ribbon in the extended configuration defines a helix, the drive ribbon being incrementally moveable between the retracted and extended configurations about a drive axis; and

- a mechanical drive operably coupled with the drive ribbon to move the drive ribbon between the retracted and extended configurations.

[0008c] In a further aspect of the present disclosure, there is provided a medical delivery device for use with a medicament container having a container body holding the medicament and defining an outlet, the medicament container further including a piston disposed within the container body, advancement of the piston in the container body expelling medicament through the outlet; the delivery device comprising:

- a support structure adapted to support the medicament container; and

- a drive assembly supported on the support structure and adapted to advance the piston within the container body wherein the drive assembly comprises:

- a drive ribbon having a distal edge section defining a distal edge surface and a proximal edge section defining a proximal edge surface, the drive ribbon having a retracted configuration and an extended configuration wherein a retracted portion of the drive ribbon in the retracted configuration defines a spiral and an extended portion of the drive ribbon in the extended configuration defines a helix, the drive ribbon being

incrementally moveable between the retracted and extended configurations, movement of the drive ribbon from the retracted configuration to the extended configuration defining a drive axis and wherein the proximal edge surface defines a first axially facing lengthwise portion and a second axially facing lengthwise portion and the distal edge surface defines a third axially facing lengthwise portion and a fourth axially facing lengthwise portion, and, in the extended portion of the drive ribbon defining a helix, the proximal edge section of the ribbon is engaged with an adjacent portion of the distal edge section with the second lengthwise portion of the proximal edge surface engaged with the third lengthwise portion of the distal edge surface and wherein the first lengthwise portion of the proximal edge surface and the fourth lengthwise portion of the distal edge surface extend radially outwardly in opposite directions;

a mechanical drive operably coupled with the drive ribbon and selectively rotating the drive ribbon about the drive axis wherein rotation of the drive ribbon in a first direction extends the drive ribbon and rotation of the drive ribbon in an opposite second direction retracts the drive ribbon;

a thrust member operably disposed between the support structure and the drive ribbon, the thrust member being engaged with the first lengthwise portion of the proximal edge surface; and

[0009] a bearing member supported on the drive ribbon proximate a distal end of the drive ribbon; the bearing member being adapted to transfer an axial force to the drive ribbon when the drive ribbon is extended. In some embodiments, the support structure defines a housing adapted to be held in a human hand. In such embodiments, the medicament container may have a storage volume of at

[0014] The delivery device may have a drive ribbon which is a unitary one-piece ribbon wherein all of the axial forces transferred between the bearing member and the thrust member when the drive ribbon is at least partially extended are transferred by the unitary one-piece ribbon.

[0015] In some embodiments, the delivery device also includes a cylindrical bobbin wherein the retracted portion of the drive ribbon is stored in the bobbin. In such embodiments, the bobbin may be rotatably disposed on the thrust member. In embodiments including a bobbin, for the retracted portion of the drive ribbon disposed within the bobbin, the drive ribbon may be configured such that a distal edge surface of the drive ribbon lies in a first plane oriented perpendicular to the drive axis and a proximal edge surface of the drive ribbon lies in a second plane oriented perpendicular to the drive axis.

[0016] In some embodiments of the delivery device, the mechanical drive includes a battery powered motor.

[0017] In some embodiments of the delivery device, the proximal edge section defines a proximal edge surface and the distal edge section defines a distal edge surface with the proximal edge surface defining a first axially facing lengthwise portion and a second axial facing lengthwise portion and the distal edge surface defining a third axially facing lengthwise portion and a fourth axially facing lengthwise portion. In the extended portion of the drive ribbon defining a helix, the proximal edge section of the ribbon is engaged with an adjacent portion of the distal edge section with the second lengthwise portion of the proximal edge surface engaged with the third lengthwise portion of the distal edge surface and wherein the first lengthwise portion of the proximal edge surface and the fourth lengthwise portion of the distal edge surface extend radially outwardly in opposite directions. And, in such embodiments, the thrust member is engaged with the first lengthwise portion of the proximal edge surface. The thrust member may engage the first lengthwise portion of the proximal edge surface in a transition portion of the drive ribbon disposed between the retracted portion and extended portion of the drive ribbon.

[0018] The present disclosure comprises, in another form thereof, a medical delivery device for use with a medicament container having a container body holding the medicament and defining an outlet. The medicament container further includes a piston disposed within the container body wherein advancement of the piston in the container body expels medicament through the outlet.

21. The delivery device of claim 1 wherein the proximal edge section defines a proximal edge surface and the distal edge section defines a distal edge surface, the proximal edge surface defining a first axially facing lengthwise portion and a second axially facing lengthwise portion and the distal edge surface defining a third axially facing lengthwise portion and a fourth axially facing lengthwise portion, and, in the extended portion of the drive ribbon defining a helix, the proximal edge section of the ribbon is engaged with an adjacent portion of the distal edge section with the second lengthwise portion of the proximal edge surface engaged with the third lengthwise portion of the distal edge surface and wherein the first lengthwise portion of the proximal edge surface and the fourth lengthwise portion of the distal edge surface extend radially outwardly in opposite directions; and

the thrust member being engaged with the first lengthwise portion of the proximal edge surface.

22. A medical delivery device for use with a medicament container having a container body holding the medicament and defining an outlet, the medicament container further including a piston disposed within the container body, advancement of the piston in the container body expelling medicament through the outlet; the delivery device comprising:

a support structure adapted to support the medicament container; and

a drive assembly supported on the support structure and adapted to advance the piston within the container body, the drive assembly comprising a drive ribbon having a distal edge section and a proximal edge section, the drive ribbon having a retracted configuration and an extended configuration, wherein a retracted portion of the drive ribbon in the retracted configuration defines a spiral and an extended portion of the drive ribbon in the extended configuration defines a helix, the drive ribbon being incrementally moveable between the retracted and extended configurations about a drive axis; and

a mechanical drive operably coupled with the drive ribbon to move the drive ribbon between the retracted and extended configurations.

23. The delivery device of claim 22, wherein, in the extended portion of the drive ribbon, the proximal edge section of the drive ribbon is directly bearingly engaged with an adjacent portion of the distal edge section.

24. The delivery device of claim 23, further comprising a thrust member operably coupled with the drive ribbon, the thrust member being engaged with at least a portion of the proximal edge section when the drive ribbon is at least partially extended, wherein relative rotation between the drive ribbon and the thrust member in a first direction further extends the drive ribbon, and relative rotation between the drive ribbon and the thrust member in an opposite second direction further retracts the drive ribbon.

25. The delivery device of claim 23 further comprising a thrust member operably disposed between the support structure and the drive ribbon, the thrust member being engaged with at least a portion of the proximal edge section when the drive ribbon is at least partially extended.

26. The delivery device of claim 25, wherein, when an axial compressive load is exerted on the drive ribbon, the axial compressive load is at least partially transmitted to the support structure through the thrust member.

27. The delivery device of claim 23 further comprising a bearing member supported on the drive ribbon proximate a distal end of the drive ribbon, the bearing member being adapted to exert an axial force on the piston when the drive ribbon is being extended.

28. The delivery device of claim 27, wherein the axial force exerted by the bearing member on the piston is at least partially transmitted to the support structure through the medicament container.

29. The delivery device of claim 22, wherein the drive ribbon defines a plurality of gear teeth, wherein the mechanical drive is operable to transmit a rotational force, directly or indirectly, to the plurality of gear teeth to move the drive ribbon.

30. A medical delivery device for use with a medicament container having a container body holding the medicament and defining an outlet, the medicament container further including a piston disposed within the container body, advancement of the piston in the container body expelling medicament through the outlet; the delivery device comprising:

a support structure adapted to support the medicament container; and

a drive assembly supported on the support structure and adapted to advance the piston within the container body wherein the drive assembly comprises:

a drive ribbon having a distal edge section defining a distal edge surface and a proximal edge section defining a proximal edge surface, the drive ribbon having a retracted configuration and an extended configuration wherein a retracted portion of the drive ribbon in the retracted configuration defines a spiral and an extended portion of the drive ribbon in the extended configuration defines a helix, the drive ribbon being incrementally moveable between the retracted and extended configurations, movement of the drive ribbon from the retracted configuration to the extended configuration defining a drive axis and wherein the proximal edge surface defines a first axially facing lengthwise portion and a second axially facing lengthwise portion and the distal edge surface defines a third axially facing lengthwise portion and a fourth axially facing lengthwise portion, and, in the extended portion of the drive ribbon defining a helix, the proximal edge

section of the ribbon is engaged with an adjacent portion of the distal edge section with the second lengthwise portion of the proximal edge surface engaged with the third lengthwise portion of the distal edge surface and wherein the first lengthwise portion of the proximal edge surface and the fourth lengthwise portion of the distal edge surface extend radially outwardly in opposite directions;

a mechanical drive operably coupled with the drive ribbon and selectively rotating the drive ribbon about the drive axis wherein rotation of the drive ribbon in a first direction extends the drive ribbon and rotation of the drive ribbon in an opposite second direction retracts the drive ribbon;

a thrust member operably disposed between the support structure and the drive ribbon, the thrust member being engaged with the first lengthwise portion of the proximal edge surface; and

a bearing member supported on the drive ribbon proximate a distal end of the drive ribbon; the bearing member being adapted to transfer an axial force to the drive ribbon when the drive ribbon is extended.

31. The delivery device of claim 30 wherein the fourth lengthwise portion of the distal edge surface projects radially outwardly and the first lengthwise portion of the proximal edge surface projects radially inwardly.

32. The delivery device of claim 30 wherein the thrust member includes a helical thread engageable with the first lengthwise portion of the proximal surface.

33. The delivery device of claim 32 wherein the helical thread extends for greater than 360 degrees about the drive axis.

34. The delivery device of claim 32 wherein the fourth lengthwise portion of the distal edge surface projects radially outwardly and the first lengthwise portion of the proximal edge surface projects radially inwardly and the delivery device further comprises a ribbon bearing member circumscribing the drive ribbon and wherein the ribbon bearing member defines a second helical thread engageable with the fourth lengthwise portion of the distal edge surface.

35. The delivery device of claim 34 wherein the helical thread extends for greater than 360 degrees about the drive axis.

36. The delivery device of claim 35 wherein the second helical thread extends for greater than 360 degrees about the drive axis and circumscribes the drive ribbon proximate the thrust member.

37. The delivery device of claim 30 wherein, when the drive ribbon is unrolled and positioned in a plane, the drive ribbon defines an arc.

38. The delivery device of claim 37 wherein, when the drive ribbon is unrolled and positioned in a plane, the proximal edge section is positioned radially inward of the distal edge section and, when the drive ribbon defines a helix, the fourth lengthwise portion of the distal edge surface projects radially outwardly and the first lengthwise portion of the proximal edge surface projects radially inwardly.

39. The delivery device of claim 30 wherein one of the proximal and distal edge sections define a plurality of pegs and the other one of the proximal and distal edge sections define a plurality of holes, wherein, in the extended part of the drive ribbon defining a helix, engagement of the proximal edge section of the ribbon with the adjacent portion of the distal edge section includes engagement of the pegs with the holes.

40. The delivery device of 39 wherein the drive ribbon defines a plurality of gear teeth engageable with the mechanical drive whereby the mechanical drive can engage and rotate the drive ribbon by transmitting a rotational force through the plurality of gear teeth.

41. The delivery device of claim 40 wherein the drive ribbon defines first and second major surfaces on opposing sides of the drive ribbon, and wherein the plurality of pegs, the plurality of holes and the gear teeth are all expressed on the first major surface of the drive ribbon whereby the plurality of pegs, the plurality of holes and the gear teeth are adapted to be machined from the side of the first major surface and wherein the second major surface defines a planar surface.

42. The delivery device of claim 41 wherein the drive ribbon is a unitary one-piece ribbon and axial forces transferred between the bearing member and the thrust member when the drive ribbon is at least partially extended are transferred by the unitary one-piece ribbon and wherein the outermost portions of the first and second major surfaces define planes

which are parallel with each other and wherein the distance between the planes defined by the first and second major surfaces defines the greatest thickness of the drive ribbon.

43. The delivery device of claim 30 further comprising a bobbin rotatable relative to the thrust member, the retracted portion of the drive ribbon being stored in the bobbin.