

[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 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

WHAT IS CLAIMED IS:

1. 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 transmitted to the support structure through the thrust member.

2. The delivery device of claim 1 wherein the support structure defines a housing adapted to be held in a human hand.
3. The delivery device of claim 2 wherein the medicament container has a storage volume of at least 3 mL and the support structure defines an axial length of no more than 110 mm.
4. The delivery device of claim 3 wherein the support structure defines an axial length of no more than 100 mm.
5. The delivery device of claim 1 wherein the thrust member is rotationally fixed relative to the support structure and defines a helical ramp engageable with the proximal edge section of the drive ribbon wherein, when the drive ribbon is rotated in the first direction, a transition portion of the drive ribbon engaging the helical ramp transitions from the retracted configuration to the extended configuration and, when the drive ribbon is rotated in the second direction, the transition portion of the drive ribbon engaging the helical ramp transitions from the extended configuration to the retracted configuration.
6. The delivery device of claim 5 further comprising a ribbon bearing member circumscribing the thrust member exerting a radially inward bearing force on the drive ribbon proximate the helical ramp.
7. The delivery device of claim 6 wherein the ribbon bearing member further comprises a plurality of rollers engageable with the drive ribbon, the plurality of rollers exerting the radially inward force and biasing the drive ribbon onto the helical ramp of the thrust member as the drive ribbon is rotated.
8. The delivery device of any one of claim 5 through 7 wherein the retracted portion of the drive ribbon proximate the helical ramp defines a radius larger than the radius of the helical ramp.
9. The delivery device of any one of claims 5 through 7 wherein the bearing member includes a rotational bearing allowing relative rotational movement between the drive ribbon and the piston about the drive axis.
10. The delivery device of claim 9 wherein the rotational bearing is a jewel bearing.

11. The delivery device of any one claims 5 through 7 wherein the drive ribbon defines a plurality of gear teeth engageable with the mechanical drive whereby the mechanical drive can rotate the drive ribbon by transmitting a rotational force through the plurality of gear teeth.

12. The delivery device of claim 11 wherein the mechanical drive includes a worm gear engageable with the plurality of gear teeth.

13. The delivery device of any one of claims 5 through 7 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.

14. The delivery device of claim 13 wherein one of the proximal and distal edge sections defines a radially extending lip to directly bearingly engage the other one of the proximal and distal edge sections.

15. The delivery device of claim 13 wherein one of the proximal and distal edge sections defines a plurality of projections and the other one of the proximal and distal edge sections defines a plurality of cooperating recesses.

16. The delivery device of claim 1 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.

17. The delivery device of claim 1 further comprising a cylindrical bobbin, the retracted portion of the drive ribbon being stored in the bobbin.

18. The delivery device of claim 17 wherein the bobbin is rotatably disposed on the thrust member.

19. The delivery device of either one of claims 17 or 18 wherein, for the retracted portion of the drive ribbon disposed within the bobbin, 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.

20. The delivery device of claim 1 wherein the mechanical drive comprises a battery powered motor.

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 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.

23. The delivery device of claim 22 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.

24. The delivery device of claim 22 wherein the thrust member includes a helical thread engageable with the first lengthwise portion of the proximal surface.

25. The delivery device of claim 24 wherein the helical thread extends for greater than 360 degrees about the drive axis.

26. The delivery device of claim 24 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.

27. The delivery device of claim 26 wherein the helical thread extends for greater than 360 degrees about the drive axis.

28. The delivery device of claim 27 wherein the second helical thread extends for greater than 360 degrees about the drive axis and circumscribes the drive ribbon proximate the thrust member.

29. The delivery device of claim 22 wherein, when the drive ribbon is unrolled and positioned in a plane, the drive ribbon defines an arc.

30. 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.

31. The delivery device of claim 22 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.

32. The delivery device of 31 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.

33. The delivery device of claim 32 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.

34. The delivery device of claim 33 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.

35. The delivery device of claim 22 further comprising a bobbin rotatable relative to the thrust member, the retracted portion of the drive ribbon being stored in the bobbin.