

CLAIMS

WE CLAIM:

1. A medication delivery device comprising:

a housing including a container retainer;

a medication container held within the container retainer, the medication container including a barrel and a plunger, the barrel made of a light transmitting material and extending in an axial direction between a forward outlet end and a rearward end, the plunger having at least one peripheral surface region in fluid tight engagement with an interior surface of a wall of the barrel to seal medication in the barrel forward of the plunger;

an advancing mechanism within said housing operable to advance said plunger within said barrel to dispense medication from the medication container through said forward outlet end;

a light source mounted within said housing to emit light into the barrel wall so that the barrel wall serves as a waveguide to guide the light to travel therein in the axial direction;

a light detector mounted within the container retainer to detect reflected light that was emitted by the light source, traveled through the barrel wall serving as the waveguide, and then reflected off the at least one peripheral surface region; and

a controller mounted within the housing in communication with said light detector to determine an axial position of the at least one peripheral surface region within the medication container based on data from said light detector of said detected reflected light.

2. The medication delivery device of Claim 1 wherein said light source is configured to direct light into an axial end face of the barrel wall at the rearward end.

3. The medication delivery device of Claim 2 wherein said light source is a single light emitting diode.

4. The medication delivery device of Claim 1 further comprising an axially extending light filtering element positioned between said light detector and said barrel wall.

5. The medication delivery device of Claim 1 wherein said light source is configured to direct light into a protuberance integrally formed with the barrel wall and projecting therefrom in a radial direction.

6. The medication delivery device of Claim 1 further comprising a display in electronic communication with said controller for indicating information determined based on said axial position of said at least one peripheral surface region.

7. The medication delivery device of Claim 1 further comprising an actuator accessible externally of the housing and manually operable to control operation of said advancing mechanism.

8. The medication delivery device of Claim 1 further comprising a first light polarizing filter and a second light polarizing filter, said first and second light polarizing filters oriented transverse to each other, said first light polarizing filter disposed between said light detector and said container, said second light polarizing filter arranged on said container retainer over said container to restrict ambient light.

9. The medication delivery device of Claim 1 wherein said light source emits light into the barrel wall through a fiber optic, light pipe or wave guide disposed therebetween.

10. The medication delivery device of Claim 1 wherein said light detector is mounted within the container retainer to detect reflected light that was emitted by the light source, traveled through the barrel wall serving as the waveguide, and then reflected off a neck section of the barrel at the forward outlet end, said detected reflected light associated with said neck section being used by said controller with the determined axial position of the at least one peripheral surface region to calculate an amount of medication remaining in the medication container.

11. The medication delivery device of Claim 1, wherein said light source is configured to direct light into a protuberance integrally formed with the barrel wall, the protuberance projecting outwardly therefrom in a radial direction and extending continuously around a circumference of the barrel wall.

12. The medication delivery device of Claim 11, wherein said light source is configured to direct light into the protuberance that comprises a finger grippable flange of the barrel wall.

13. The medication delivery device of Claim 11, wherein the at least one peripheral surface region comprises first and second peripheral surface regions spaced in the axial direction, and wherein said controller determines a first axial position of the first peripheral surface region and a second axial position of the second peripheral surface region, said controller configured to determine a plunger compression based on the first and second axial positions.

14. The medication delivery device of Claim 11, wherein said light detector is configured to extend around the barrel wall.

15. The medication delivery device of Claim 14, wherein said light detector has a helical configuration.