constant can result in large changes in the net kinetic energy applied to the drug and primary container.

[0006] The patient may feel this excessive energy as a "slap" or similar physical "bump", as the spring driven plunger impacts the stopper of the primary container storing the drug. It is known that such mechanical bumps can also be distracting or disturbing to users of the injectors and can therefore prevent proper dose completion. It is therefore desirable to eliminate such disturbances.

[0007] It is further known that the "slap" and "bump" generated by the excessive energy can cause catastrophic effects, such as breakage of the primary container and drug product damage cause by shear load. Furthermore, high force springs can produce high shear rates on the drug product. In some cases, this high shear rate is undesireable.

[0008] Accordingly, an autoinjector is needed that can maintain the intended spring force load while reducing the velocity of the plunger before impact with the stopper of the primary container. Such an autoinjector may be potentially more comfortable and safer to use, and applicable to a greater range of drugs.

SUMMARY OF THE INVENTION

[0008a] In one aspect, the present invention provides an injection device for drug delivery, the injection device comprising: a container for storing a drug, the container comprising a stopper movably disposed in the container for expelling the drug; an injection drive mechanism comprising a plunger for acting on the stopper and an energy source for exerting a force on the plunger to cause the plunger to act on the stopper to expel the drug, the force causing the plunger to accelerate to a velocity prior to acting on the stopper; and a damping mechanism for reducing the velocity of

the plunger prior to acting on the stopper, the damping mechanism comprising a housing, a piston assembly movable in the housing and acted upon by the plunger, and a working fluid displaceable by the piston assembly for resisting movement of the plunger.

[0008b] In another aspect, the present invention provides a damper mechanism for an injection device having a drug storage container including a stopper movably disposed in the container, and a plunger for acting on the stopper, the damping mechanism for reducing a velocity of the plunger prior to acting on the stopper, the damper mechanism comprising: a housing; a piston assembly movable in the housing and acted upon by a plunger of the injection device; and a working fluid displaceable by the piston assembly for resisting movement of the plunger.

[0009] Disclosed herein are an injection device, and methods and systems for drug delivery. Within this disclosure, reference may be made to "autoinjectors"; however, such reference should also be understood to refer to on-body injectors where the description is applicable. In various ~~embodiments~~examples, the device may comprise a container or reservoir for storing a drug, the container comprising a stopper movably disposed in the container for expelling the drug, an injection drive mechanism comprising a plunger for acting on the stopper, and an energy source for exerting a

force on the plunger to cause the plunger to act on the stopper to expel the drug, the force causing the plunger to accelerate to a velocity prior to acting on the stopper, and a damping mechanism for reducing the velocity of the plunger prior to acting on the stopper, the damping mechanism comprising a housing, a piston assembly movable in the housing and acted upon by the plunger, and a working fluid displaceable by the piston assembly for resisting movement of the plunger. The container or reservoir may contain a drug or medicament and can be a cartridge or prefilled syringe.

[0010] In various other ~~embodiments~~examples, the device may comprise a container for storing a drug, the container comprising a stopper movably disposed in the container for expelling the drug, an injection drive mechanism comprising a plunger for acting on the stopper and an energy source for exerting a force on the plunger to cause the plunger to act on the stopper to expel the drug, the force causing the plunger to accelerate to a velocity prior to acting on the stopper, and a damping mechanism for reducing the velocity of the plunger prior to acting on the stopper, the damping mechanism comprising energy absorbing material disposed on the plunger.

[0011] In still further ~~embodiments~~examples, the injection device may comprise a container for storing a drug, the container comprising a stopper movably disposed in the container for expelling the drug, an injection drive mechanism comprising a plunger for acting on the stopper and an energy source for exerting a force on the plunger to cause the plunger to act on the stopper to expel the drug, the force causing the plunger to accelerate to a velocity prior to acting on the stopper, an outer casing for encasing the container, the outer casing including at least one support member for holding container within the outer casing and a damping mechanism for reducing energy applied by the energy source to the container, the damping mechanism comprising

CLAIMS

What is claimed is:

1. An injection device for drug delivery, the injection device comprising:

a container for storing a drug, the container comprising a stopper movably disposed in the container for expelling the drug;

an injection drive mechanism comprising a plunger for acting on the stopper and an energy source for exerting a force on the plunger to cause the plunger to act on the stopper to expel the drug, the force causing the plunger to accelerate to a velocity prior to acting on the stopper; and

a damping mechanism for reducing the velocity of the plunger prior to acting on the stopper, the damping mechanism comprising a housing, a piston assembly movable in the housing and acted upon by the plunger, and a working fluid displaceable by the piston assembly for resisting movement of the plunger.

2. The injection device of claim 1, wherein the energy source comprises one or more springs.

3. The injection device of claim 1 or 2, wherein the energy source comprises a gas pressure or gas releasing arrangement.

4. The injection device of claim 1, wherein the damping mechanism is disposed between the stopper and the plunger.

5. The injection device of claim 1, wherein the damping mechanism is disposed at an end of the plunger which is opposite to the stopper.

6. The injection device of claim 1, wherein the damping mechanism is integral with the plunger.

7. The injection device of any of claims 1, 4, 5 and 6, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston.

8. The injection device of any of claims 1, 4, 5 and 6, wherein the piston assembly includes a disc-shaped piston.

9. The injection device of claim 8, wherein the piston is rigid.

10. The injection device of claim 9, wherein the piston includes at least one constriction.

11. The injection device of claim 10, wherein the at least one constriction is in a peripheral edge of the piston.

12. The injection device of claim 10, wherein the at least one constriction is in the piston.

13. The injection device of claim 9, further comprising a constriction between the peripheral edge of the piston and the housing.

14. The injection device of claim 8, wherein the piston is resilient.

15. The injection device of claim 8, wherein the piston is porous.

16. The injection device of any of claims 1, 4, 5 and 6, wherein the piston assembly includes a disc-shaped piston and a rod for pushing or pulling the piston.

17. The injection device of claim 16, wherein the piston is rigid.

18. The injection device of claim 17, wherein the piston includes at least one constriction.

19. The injection device of claim 18, wherein the at least one constriction is in a peripheral edge of the piston.

20. The injection device of claim 18, wherein the at least one constriction is in the piston.

21. The injection device of claim 17, further comprising a constriction between the peripheral edge of the piston and the housing.

22. The injection device of claim 16, wherein the piston is resilient.

23. The injection device of claim 16, wherein the piston is porous.

24. The injection device of any of claims 1, 4, 5 and 6, wherein the piston assembly includes a piston comprising two or more disc-shaped members.

25. The injection device of claim 24, wherein the members are rigid.

26. The injection device of claim 25, wherein each of the members includes at least one constriction.

27. The injection device of claim 26, wherein the at least one constriction is in a peripheral edge of at least one of the members.

28. The injection device of claim 26, wherein the at least one constriction is in at least one of the members.

29. The injection device of claim 25, further comprising a constriction between the peripheral edge of at least one of the members and the housing.

30. The injection device of claim 24, wherein the members are resilient.

31. The injection device of claim 24, wherein the members are porous.

32. The injection device of any of claims 1, 4, 5 and 6, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston, the piston comprising two or more disc-shaped members.

33. The injection device of claim 32, wherein the members are rigid.

34. The injection device of claim 33, wherein each of the members includes at least one constriction.

35. The injection device of claim 34, wherein the at least one constriction is in a peripheral edge of at least one of the members.

36. The injection device of claim 34, wherein the at least one constriction is in at least one of the members.

37. The injection device of claim 33, further comprising a constriction between the peripheral edge of at least one of the members and the housing.

38. The injection device of claim 32, wherein the members are resilient.

39. The injection device of claim 32, wherein the members are porous.

40. The injection device of any of claims 1, 4, 5 and 6, wherein the piston assembly includes a piston comprising a bellows structure.

41. The injection device of claim 40, wherein the bellows structure includes at least two lobes and a constriction for allowing the working fluid to flow between the two lobes.

42. The injection device of any of claims 1, 4, 5 and 6, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston, the piston comprising a bellows structure.

43. The injection device of claim 42, wherein the bellows structure includes at least two lobes and a constriction for allowing the working fluid to flow between the two lobes.

44. The injection device of claim 43, wherein the rod is hollow to allow the working fluid to be exhausted from the bellows structure.

45. The injection device of claim 42, wherein the rod is hollow to allow the working fluid to be exhausted from the bellows structure.

46. The injection device of claim 1, wherein the container further comprises a dose delivery member.

47. The injection device of claim 1, wherein the dose delivery member comprises an injection needle.

48. The injection device of claim 1, further comprising a triggering mechanism for activating the injection drive mechanism.

49. The injection device of claim 1, further comprising a guard mechanism for preventing contact with the dose delivery member.

50. The injection device of claim 1, further comprising an outer casing for encasing the container, the outer casing including at least one support member for holding container within the outer casing, and energy absorbing material disposed between the at least one support member and the container.

51. The injection device of claim 50, wherein the energy absorbing material comprises a layer of damping material.

52. The injection device of claim 50, wherein the energy absorbing material comprises a laminate formed by two or more layers of damping material.

53. The injection device of claim 52, wherein the layers of the laminate can have the same or different damping characteristics.

54. An injection device for drug delivery, the injection device comprising:

a container for storing a drug, the container comprising a stopper movably disposed in the container for expelling the drug;

an injection drive mechanism comprising a plunger for acting on the stopper and an energy source for exerting a force on the plunger to cause the plunger to act on the stopper to expel the drug, the force causing the plunger to accelerate to a velocity prior to acting on the stopper; and

a damping mechanism for reducing the velocity of the plunger prior to acting on the stopper, the damping mechanism comprising energy absorbing material disposed on the plunger.

55. The injection device of claim 54, wherein the energy absorbing material comprises a layer of damping material.

56. The injection device of claim 54, wherein the energy absorbing material comprises a laminate formed by two or more layers of damping material.

57. The injection device of claim 56, wherein the layers of the laminate can have the same or different damping characteristics.

58. An injection device for drug delivery, the injection device comprising:

a container for storing a drug, the container comprising a stopper movably disposed in the container for expelling the drug;

an injection drive mechanism comprising a plunger for acting on the stopper and an energy source for exerting a force on the plunger to cause the plunger to act on the stopper to expel the drug, the force causing the plunger to accelerate to a velocity prior to acting on the stopper;

an outer casing for encasing the container; and

a damping mechanism for reducing energy applied by the energy source to the container, the damping mechanism comprising absorbing material disposed between the outer casing and the container.

59. The injection device of claim 58, wherein the energy absorbing material comprises a layer of damping material.

60. The injection device of claim 58, wherein the energy absorbing material comprises a laminate formed by two or more layers of damping material bonded to one another.

61. The injection device of claim 60, wherein the layers of the laminate can have the same or different damping characteristics.

62. The injection device of claim 58, wherein the outer casing includes at least one support member for holding container within the outer casing, and wherein absorbing material of the damper mechanism is disposed between the at least one support member and the container.

63. The injection device of any one of claims 1, 54 or 58 further comprising a drug stored in the container.

64. The injection device of claim 63, wherein the drug is selected from the group consisting of TNF inhibitors, antibodies to the calcitonin gene-related peptide receptor, colony stimulating factors, erythropoiesis stimulating agents, apelin receptor agonists, anti-thymic stromal lymphopoietin antibodies,anti- thymic stromal lymphopoietinreceptor antibodies, antibodies that bind human Proprotein Convertase Subtilisin/Kexin Type 9and tissue inhibitors of metalloproteinases.

65. The injection device of claim 1, further comprising an outer casing for encasing the container, and energy absorbing material disposed between the outer casing and the container.

66. The injection device of claim 63, wherein the energy absorbing material comprises a layer of damping material.

67. The injection device of claim 63, wherein the energy absorbing material comprises a laminate formed by two or more layers of damping material.

68. The injection device of claim 65, wherein the layers of the laminate can have the same or different damping characteristics.

69. A damper mechanism for an injection device having a drug storage container including a stopper movably disposed in the container, and a plunger for acting on the stopper, the damping mechanism for reducing a velocity of the plunger prior to acting on the stopper, the damper mechanism comprising:

a housing;

a piston assembly movable in the housing and acted upon by a plunger of the injection device; and

a working fluid displaceable by the piston assembly for resisting movement of the plunger.

70. The damper mechanism of claim 69, wherein the damping mechanism is integral with the plunger.

71. The damper mechanism of claim 69 or 70, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston.

72. The damper mechanism of claim 69 or 70, wherein the piston assembly includes a disc-shaped piston.

73. The damper mechanism of claim 72, wherein the piston is rigid.

74. The damper mechanism of claim 73, wherein the piston includes at least one constriction.

75. The damper mechanism of claim 75, wherein the at least one constriction is in a peripheral edge of the piston.

76. The damper mechanism of claim 74, wherein the at least one constriction is in the piston.

77. The damper mechanism of claim 73, further comprising a constriction between the peripheral edge of the piston and the housing.

78. The damper mechanism of claim 72, wherein the piston is resilient.

79. The damper mechanism of claim 72, wherein the piston is porous.

80. The damper mechanism of claim 69 or 70, wherein the piston assembly includes a disc-shaped piston and a rod for pushing or pulling the piston.

81. The damper mechanism of claim 80, wherein the piston is rigid.

82. The damper mechanism of claim 81, wherein the piston includes at least one constriction.

83. The damper mechanism of claim 82, wherein the at least one constriction is in a peripheral edge of the piston.

84. The damper mechanism of claim 81, wherein the at least one constriction is in the piston.

85. The damper mechanism of claim 81, further comprising a constriction between the peripheral edge of the piston and the housing.

86. The damper mechanism of claim 80, wherein the piston is resilient.

87. The damper mechanism of claim 80, wherein the piston is porous.

88. The damper mechanism of claim 69 or 70, wherein the piston assembly includes a piston comprising two or more disc-shaped members.

89. The damper mechanism of claim 88, wherein the members are rigid.

90. The damper mechanism of claim 89, wherein each of the members includes at least one constriction.

91. The damper mechanism of claim 90, wherein the at least one constriction is in a peripheral edge of at least one of the members.

92. The damper mechanism of claim 90, wherein the at least one constriction is in at least one of the members.

93. The damper mechanism of claim 89, further comprising a constriction between the peripheral edge of at least one of the members and the housing.

94. The damper mechanism of claim 88, wherein the members are resilient.

95. The damper mechanism of claim 88, wherein the members are porous.

96. The damper mechanism of claim 69 or 70, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston, the piston comprising two or more disc-shaped members.

97. The damper mechanism of claim 96, wherein the members are rigid.

98. The damper mechanism of claim 97, wherein each of the members includes at least one constriction.

99. The damper mechanism of claim 98, wherein the at least one constriction is in a peripheral edge of at least one of the members.

100. The damper mechanism of claim 98, wherein the at least one constriction is in at least one of the members.

101. The damper mechanism of claim 97, further comprising a constriction between the peripheral edge of at least one of the members and the housing.

102. The damper mechanism of claim 96, wherein the members are resilient.

103. The damper mechanism of claim 96, wherein the members are porous.

104. The damper mechanism of claim 69 or 70, wherein the piston assembly includes a piston comprising a bellows structure.

105. The damper mechanism of claim 104, wherein the bellows structure includes at least two lobes and a constriction for allowing the working fluid to flow between the two lobes.

106. The damper mechanism of claim 69 or 70, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston, the piston comprising a bellows structure.

107. The damper mechanism of claim 106, wherein the bellows structure includes at least two lobes and a constriction for allowing the working fluid to flow between the two lobes.

108. The damper mechanism of claim 107, wherein the rod is hollow to allow the working fluid to be exhausted from the bellows structure.

109. The damper mechanism of claim 106, wherein the rod is hollow to allow the working fluid to be exhausted from the bellows structure.

110. A method for administering a drug comprising:

providing a container containing a drug and a stopper movably disposed in the container for expelling the drug;

acting on the stopper with a plunger driven by an energy source that exerts a force on the plunger, the force causing the plunger to accelerate to a velocity prior to acting on the stopper; and

reducing the velocity of the plunger with a damping mechanism prior to acting on the stopper, the damping mechanism comprising a piston assembly movable in a housing and acted upon by the plunger, and a working fluid displaceable by the piston assembly for resisting movement of the plunger.

111. The method of claim 110, wherein the drug is selected from the group consisting of TNF inhibitors, antibodies to the calcitonin gene-related peptide receptor, colony stimulating factors, erythropoiesis stimulating agents, apelin receptor agonists, anti-thymic stromal lymphopoietin antibodies,anti- thymic stromal lymphopoietinreceptor antibodies, antibodies that bind human Proprotein Convertase Subtilisin/Kexin Type 9and tissue inhibitors of metalloproteinases.

112. The method of claim 110, wherein the energy source comprises one or more springs.

113. The method of claim 110 or 112, wherein the energy source comprises a gas pressure or gas releasing arrangement.

114. The method of claim 110, wherein the damping mechanism is disposed between the stopper and the plunger.

115. The method of claim 110, wherein the damping mechanism is disposed at an end of the plunger which is opposite to the stopper.

116. The method of claim 110, wherein the damping mechanism is integral with the plunger.

117. The method of any of claims 110, 114, 115 and 116, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston.

118. The method of any of claims 110, 114, 115 and 116, wherein the piston assembly includes a disc-shaped piston.

119. The method of claim 118, wherein the piston is rigid.

120. The method of claim 119, wherein the piston includes at least one constriction.

121. The method of claim 120, wherein the at least one constriction is in a peripheral edge of the piston.

122. The method of claim 120, wherein the at least one constriction is in the piston.

123. The method of claim 119, further comprising a constriction between the peripheral edge of the piston and the housing.

124. The method of claim 118, wherein the piston is resilient.

125. The method of claim 118, wherein the piston is porous.

126. The method of any of claims 110, 114, 115 and 116, wherein the piston assembly includes a disc-shaped piston and a rod for pushing or pulling the piston.

127. The method of claim 126, wherein the piston is rigid.

128. The method of claim 127, wherein the piston includes at least one constriction.

129. The method of claim 128, wherein the at least one constriction is in a peripheral edge of the piston.

130. The method of claim 128, wherein the at least one constriction is in the piston.

131. The method of claim 127, further comprising a constriction between the peripheral edge of the piston and the housing.

132. The method of claim 126, wherein the piston is resilient.

133. The method of claim 126, wherein the piston is porous.

134. The method of any of claims 110, 114, 115 and 116, wherein the piston assembly includes a piston comprising two or more disc-shaped members.

135. The method of claim 134, wherein the members are rigid.

136. The method of claim 135, wherein each of the members includes at least one constriction.

137. The method of claim 136, wherein the at least one constriction is in a peripheral edge of at least one of the members.

138. The method of claim 136, wherein the at least one constriction is in at least one of the members.

139. The method of claim 135, further comprising a constriction between the peripheral edge of at least one of the members and the housing.

140. The method of claim 134, wherein the members are resilient.

141. The method of claim 134, wherein the members are porous.

142. The method of any of claims 110, 114, 115 and 116, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston, the piston comprising two or more disc-shaped members.

143. The method of claim 142, wherein the members are rigid.

144. The method of claim 143, wherein each of the members includes at least one constriction.

145. The method of claim 144, wherein the at least one constriction is in a peripheral edge of at least one of the members.

146. The method of claim 144, wherein the at least one constriction is in at least one of the members.

147. The method of claim 143, further comprising a constriction between the peripheral edge of at least one of the members and the housing.

148. The method of claim 142, wherein the members are resilient.

149. The method of claim 142, wherein the members are porous.

150. The method of any of claims 110, 114, 115 and 116, wherein the piston assembly includes a piston comprising a bellows structure.

151. The method of claim 150, wherein the bellows structure includes at least two lobes and a constriction for allowing the working fluid to flow between the two lobes.

152. The method of any of claims 110, 114, 115 and 116, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston, the piston comprising a bellows structure.

153. The method of claim 152, wherein the bellows structure includes at least two lobes and a constriction for allowing the working fluid to flow between the two lobes.

154. The method of claim 153, wherein the rod is hollow to allow the working fluid to be exhausted from the bellows structure.

155. The method of claim 152, wherein the rod is hollow to allow the working fluid to be exhausted from the bellows structure.

156. The method of claim 110, wherein the container further comprises a dose delivery member.

157. The method of claim 110, wherein the dose delivery member comprises an injection needle.

158. The method of claim 110, further comprising a triggering mechanism for activating the injection drive mechanism.

159. The method of claim 110, further comprising a guard mechanism for preventing contact with the dose delivery member.

160. The method of claim 110, further comprising an outer casing for encasing the container, the outer casing including at least one support member for holding container within the outer casing, and energy absorbing material disposed between the at least one support member and the container.

161. The method of claim 160, wherein the energy absorbing material comprises a layer of damping material.

162. The method of claim 160, wherein the energy absorbing material comprises a laminate formed by two or more layers of damping material.

163. The method of claim 162, wherein the layers of the laminate can have the same or different damping characteristics.

164. The method device of claim 110, wherein the container comprises a syringe.

165. The method of claim 110, wherein the velocity of the plunger is reduced by less than 1%.

166. The method of claim 110, wherein the velocity of the plunger is reduced by about 1-5%.

167. The method of claim 110, wherein the velocity of the plunger is reduced by about 5-10%.

168. The method of claim 110, wherein the velocity of the plunger is reduced by about 5-10%.

169. The method of claim 110, wherein the velocity of the plunger is reduced by about 10-15%.

170. The method of claim 110, wherein the velocity of the plunger is reduced by about 15-20%.

171. The method of claim 110, wherein the velocity of the plunger is reduced by about 20-30%.

172. The method of claim 110, wherein the velocity of the plunger is reduced by about 30-50%.

173. The method of claim 110, wherein the velocity of the plunger is reduced by about 51%-100%.

174. The injection device of any of claims 1, 54, and 58, wherein the container comprises a syringe.

175. The injection device of claim 1 or claim 54, wherein the velocity of the plunger is reduced by less than 1%.

176. The injection device of claim 1 or claim 54, wherein the velocity of the plunger is reduced by about 1-5%.

177. The injection device of claim 1 or claim 54, wherein the velocity of the plunger is reduced by about 5-10%.

178. The injection device of claim 1 or claim 54, wherein the velocity of the plunger is reduced by about 5-10%.

179. The injection device of claim 1 or claim 54, wherein the velocity of the plunger is reduced by about 10-15%.

180. The injection device of claim 1 or claim 54, wherein the velocity of the plunger is reduced by about 15-20%.

181. The injection device of claim 1 or claim 54, wherein the velocity of the plunger is reduced by about 20-30%.

182. The injection device of claim 1 or claim 54, wherein the velocity of the plunger is reduced by about 30-50%.

183. The injection device of claim 1 or claim 54, wherein the velocity of the plunger is reduced by about 51%-100%.

184. The injection device of claim 1 or claim 54, further comprising an outer casing, a sleeve disposed within the outer casing, the container mounted in the sleeve, and a first strip of energy absorbing or damping material disposed between the container and the sleeve at a location where the container and the sleeve contact one another.

185. The injection device of claim 184, wherein the sleeve includes a container support flange and the container includes a rim flange, the first strip of energy absorbing or damping material disposed between the container support flange and the rim flange.

185. The injection device of claim 184 or claim 185, further comprising a second strip of energy absorbing or damping material disposed between the sleeve and the outer casing at a location where the sleeve and the outer casing contact one another.

186. The injection device of claim 185, wherein the sleeve includes a casing engagement flange and the outer casing includes a support member, the second strip of energy absorbing or damping material disposed between the casing engagement flange and the support member.

CLAIMS

What is claimed is:

1. An injection device for drug delivery, the injection device comprising:

a container for storing a drug, the container comprising a stopper movably disposed in the container for expelling the drug;

an injection drive mechanism comprising a plunger for acting on the stopper and an energy source for exerting a force on the plunger to cause the plunger to act on the stopper to expel the drug, the force causing the plunger to accelerate to a velocity prior to acting on the stopper; and

a damping mechanism for reducing the velocity of the plunger prior to acting on the stopper, the damping mechanism comprising a housing, a piston assembly movable in the housing and acted upon by the plunger, and a working fluid displaceable by the piston assembly for resisting movement of the plunger.

2. The injection device of claim 1, wherein the damping mechanism is (a) disposed between the stopper and the plunger, (b) disposed at an end of the plunger which is opposite to the stopper, or (c) integral with the plunger.

3. The injection device of claim 1, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston.

4. The injection device of claim 3, wherein the piston assembly includes a disc-shaped piston.

5. The injection device of claim 4, wherein (a) the piston is rigid, (b) the piston is resilient, or (c) the piston is porous.

6. The injection device of claim 5, wherein the piston includes at least one constriction (a) in a peripheral edge of the piston or (b) in the piston.

7. The injection device of claim 3, wherein the piston assembly includes a piston comprising two or more disc-shaped members.

8. The injection device of claim 3, wherein the piston assembly includes a piston comprising a bellows structure.

9. The injection device of claim 1, further comprising an outer casing for encasing the container, the outer casing including at least one support member for holding container within the outer casing, and energy absorbing material disposed between the at least one support member and the container.

10. The injection device of claim 1 further comprising a drug stored in the container.

11. The injection device of claim 10, wherein the drug is selected from the group consisting of TNF inhibitors, antibodies to the calcitonin gene-related peptide receptor, colony stimulating factors, a granulocyte colony-stimulating factor, erythropoiesis stimulating agents, apelin receptor agonists, anti-thymic stromal lymphopoietin antibodies, anti- thymic stromal lymphopoietin receptor antibodies,

antibodies that bind human Proprotein Convertase Subtilisin/Kexin Type 9 and tissue inhibitors of metalloproteinases.

12. A damper mechanism for an injection device having a drug storage container including a stopper movably disposed in the container, and a plunger for acting on the stopper, the damping mechanism for reducing a velocity of the plunger prior to acting on the stopper, the damper mechanism comprising:

a housing;

a piston assembly movable in the housing and acted upon by a plunger of the injection device; and

a working fluid displaceable by the piston assembly for resisting movement of the plunger.

13. The damper mechanism of claim 69, wherein the damping mechanism is integral with the plunger.

14. The damper mechanism of claim 12, wherein the piston assembly includes a piston and a rod for pushing or pulling the piston.

15. The damper mechanism of claim 14, wherein the piston assembly includes a disc-shaped piston.

16. The damper mechanism of claim 15, wherein (a) the piston is rigid, (b) the piston is resilient, or (c) the piston is porous.

17. The damper mechanism of claim 16, wherein the piston includes at least one constriction (a) in a peripheral edge of the piston or (b) in the piston.

18. The damper mechanism of claim 14, wherein the piston assembly includes a piston comprising two or more disc-shaped members.

19. The damper mechanism of claim 14, wherein the piston assembly includes a piston comprising a bellows structure.

20. The damper mechanism of claim 19, wherein the bellows structure includes at least two lobes and a constriction for allowing the working fluid to flow between the two lobes.

21. The damper mechanism of claim 19, wherein the rod is hollow to allow the working fluid to be exhausted from the bellows structure.