CLAIMS

1. An auto-injector, comprising:

a container capable of comprising a medicament;

a shuttle coupled to the container and horizontally movable with the container on a horizontal path between a first position and a second position;

an energy source configured to release energy to translate the container and to translate the shuttle along the horizontal path from the first position to the second position, the energy source is pressurized fluid from a can;

an impediment preventing horizontal movement of the shuttle before activation of the auto-injector; and

a needle having

a first end configured to extend out of the auto-injector, and

a second end configured to extend into the container, wherein the second end of the needle and the container are not in fluid communication with one another before activation of the auto-injector;

wherein the energy is released from the energy source after:

a. the auto-injector is activated; and

b. the shuttle moves along its path, whereby

i. the container and the second end of the needle are put into fluid communication with one another, and

ii. the first end of the needle extends out of the auto-injector.

2. The auto-injector of claim 1, wherein activation of the auto-injector allows for movement of an actuator from its first location to its second location, whereby

the actuator contacts a portion of the can, to release the pressurized fluid.

3. The auto-injector of claim 2, wherein the actuator is interlocked with the impediment before the auto-injector is activated.

4. The auto-injector of claim 3, wherein movement of the actuator from its first location to its second location is horizontal and, the release of energy from the energy source causes the shuttle to move horizontally along the horizontal path from its first position to its second position.

5. The auto-injector of claim 4, further including:

a driver that can traverse the auto-injector vertically, is coupled to the needle, and has a first position, a second position, and a third position; and

a gear movable by the shuttle,

wherein horizontal movement of the shuttle from its first position toward its second position causes the gear to rotate and the driver to move vertically from the first position of the driver to the second position of the driver, and the vertical movements and horizontal movements are substantially perpendicular to one another.

6. The auto-injector of claim 5, further including a housing enclosing the container, the shuttle, the energy source, and at least a portion of the needle, wherein the first end of the needle is positioned:

within the housing when the driver is in the first position;

outside of the housing when the driver is in the second position; and

within the housing when the driver is in the third position.

7. The auto-injector of claim 5, wherein the actuator at its first location comprises

a resilient member that is movable from a first energy-storing state to a first energy-released state and is capable of translating the actuator from its first location to its second location, respectively.

8. The auto-injector of claim 7, wherein upon release of the energy from the energy source, the resilient member is moved from its first energy-released state toward a second energy-storing state by the shuttle and by the actuator, causing vertical translation of the first end of the needle to outside of the housing.

9. The auto-injector of claim 8, wherein after a threshold amount of energy is released, the resilient member is moved from the second energy-storing state toward a second energy-released state, causing vertical translation of the first end of the needle into the housing.

10. The auto-injector of claim 9, wherein after the threshold amount of energy is released, movement of the resilient member from the second energy-storing state toward the second energy-released state, urges the shuttle to move in the horizontal path from its second position toward its first position, causing rotation of the gear in a second rotational direction that is opposite of the first rotational direction, thereby causing the driver to move vertically from the second position of the driver, to the third position of the driver.

11. The auto-injector of claim 8, wherein the first energy-storing state and the second energy-storing state are the same location within the housing.

12. The auto-injector of claim 8, wherein the first energy-storing state and the second energy-storing state are different locations within the housing.

13. The auto-injector of claim 9, wherein the first energy-released state and the second energy-released state are the same location within the housing.

14. The auto-injector of claim 9, wherein the first energy-released state and the second energy-released state are different locations within the housing.

15. The auto-injector of claim 7, wherein the resilient member is a spring.

16. The auto-injector of claim 15, wherein the spring is the only spring contained within the auto-injector.

17. The auto-injector of claim 15, wherein the energy-storing state is a compressed position of the spring, and the energy-release state is an expanded position of the spring.

18. The auto-injector of claim 2, further including a resilient member, movable from an energy-storing state to an energy-released state, wherein the resilient member moves the actuator from the first location to the second location by moving from the energy-storing state to the energy-released state.

19. The auto-injector of claim 18, wherein the resilient member is moved from the energy-released state toward another energy-storing state by the shuttle and by the actuator upon release of the pressurized fluid from the energy source.

20. The auto-injector of claim 19, wherein after a threshold amount of the pressurized fluid is released from the energy source, the resilient member is moved from the second energy-storing state toward its second energy-released state, causing translation of the first end of the needle into an interior of the auto-injector.

21. The auto-injector of claim 1, wherein energy released from the energy source acts against the container and moves the container into fluid communication with the needle.

22. The auto-injector of claim 1, wherein before the auto-injector is activated, a first stop prevents the shuttle from moving and prevents the container from moving into fluid communication with the needle.

23. The auto-injector of claim 22, wherein the first stop abuts a surface of the shuttle before the auto-injector is activated.

24. The auto-injector of claim 1, wherein the auto-injector is activated by a button configured to be depressed by a user.

25. An auto-injector, comprising:

a container capable of comprising a medicament;

an energy source that is configured to translate the container and a shuttle within the auto-injector, wherein the energy source is a pressurized fluid;

a needle having a first end configured to extend out of the auto-injector, and a second end configured to extend into the container, wherein, before activation of the auto-injector, the second end of the needle and the container are not in fluid communication with one another;

an actuator configured to move from an extended position to a depressed position; and

a resilient member disposed inside a carrier that is engaged with the actuator when in the extended position, and movable between an energy-storing state and an energy-released state, the resilient member is maintained in the energy-storing state when the carrier is engaged with the actuator, and moved to the energy-released state when the actuator disengages the carrier upon moving to the depressed position;

wherein 1) a first movement of the resilient member from the energy-storing state to the energy-released state can cause a release of pressurized fluid from the energy source, that results in 2) a second movement of the resilient member from its energy-released state toward a second energy-storing state, followed by 3) a third movement of the resilient member toward a second energy-released state that causes the first end of the needle to retract into the auto-injector from outside of the auto-injector.

26. The auto-injector of claim 25, wherein the resilient member is a spring.

27. The auto-injector of claim 26, wherein the spring is the only spring contained within the auto-injector.

28. The auto-injector of claim 5, wherein the gear moveable by the shuttle includes:

a first gear portion and a second gear portion that rotate about a same axis, wherein the first gear portion and the second gear portion have different diameters.

29. The auto-injector of claim 28, wherein the first gear portion has a larger diameter than the second gear portion.

30. The auto-injector for claim 28, wherein the second gear portion has a larger diameter than the first gear portion.

31. The auto-injector of claim 28, wherein the driver further comprises a driver rack gear configured to engage with the first gear portion.

32. The auto-injector of claim 31, wherein the shuttle further comprises a shuttle rack gear configured to engage with the second gear portion.

33. The auto-injector of claim 22, wherein before the auto-injector is activated, a second stop prevents a button of the auto-injector from being depressed by a user.

34. The auto-injector of claim 33, further including a tab coupled to an outer surface of the auto-injector before the auto-injector is activated, wherein the tab includes the second stop.

35. The auto-injector of claim 34, wherein the tab must be removed from the auto-injector to enable the button to be depressed by the user.

36. The auto-injector of claim 1, further including a first indicator, wherein the first indicator is visible from outside of the housing before the auto-injector is activated.

37. The auto-injector of claim 36, wherein the first indicator is positioned on the shuttle.

38. The auto-injector of claim 37, further including a second indicator, wherein the second indicator is visible from outside of the housing only after the auto-injector is activated.

39. The auto-injector of claim 38, wherein the second indicator is positioned on the shuttle, and is visible from outside of the housing only after the

release of energy from the energy source moves the shuttle from the first position to the second position.

40. The auto-injector of claim 38, further including a third indicator, wherein the third indicator is visible from outside the housing only after an injection performed by the auto-injector is complete.

41. The auto-injector of claim 40, further including an indicator slide that is 1) uncoupled from the shuttle before activation of the auto-injector, and 2) becomes coupled to the shuttle when the shuttle moves from the first position to the second position, and wherein the third indicator is positioned on the indicator slide.

42. The auto-injector of claim 41, wherein movement of the shuttle from the second position back toward the first position also moves the indicator slide in a same direction so that the third indicator is visible from outside of the auto-injector.

43. The auto-injector of claim 8, wherein movement of the shuttle from its first position to its second position:

causes the shuttle to contact and push the actuator in the same direction;

transition the resilient member from its first energy-released state toward its second energy-storing state; and

causes movement of the driver and extension of the first end of the needle outside of the housing.

44. The auto-injector of claim 10, wherein movement of the resilient member from the second energy-storing state toward the second energy-released state urges the actuator into direct contact with the shuttle during horizontal movement of the shuttle from its second position toward its first position to cause rotation of the gear and retraction of the first end of the needle into the auto-injector.

45. The auto-injector of claim 22, wherein the auto-injector is activated by a button configured to be depressed by a user, and the button includes the first stop.

46. The auto-injector of claim 33, wherein:

the housing includes a third stop;

the auto-injector further includes an indicator slide configured to facilitate visibility of an indicator from outside of the auto-injector; and

the third stop maintains a position of the indicator slide so that horizontal movement of the shuttle locks the shuttle to the indicator slide.

47. The auto-injector of claim 1, further including a valve assembly coupled to the container, the valve assembly including a diaphragm having a unitary central body with an outer rim extending outwardly from the central body and about a periphery of the central body.

48. The auto-injector of claim 47, wherein the diaphragm includes a raised portion located at a radially center position of the central body, the raised portion having a thickness protruding outward from the central body at a distance that is greater than an extension of the outer rim relative to the central body.

49. An auto-injector, comprising:

a housing;

a container disposed in the housing and storing a medicament;

a fluid source disposed in the housing and storing a pressurized medium;

a fluid conduit disposed in the housing and selectively coupled to the container to receive the medicament, wherein the fluid conduit is configured to extend out of the housing and deliver the medicament from the container in response to the fluid source releasing the pressurized medium to expel the medicament; and

a drive system including a high pressure line, a low pressure line, and a flow restrictor disposed between the high pressure line and the low pressure line, wherein the flow restrictor is configured to (i) generate a pressure differential between the high pressure line and the low pressure line when the pressurized medium is released from the pressurized medium and (ii) a drive force against a plunger disposed within the container to deliver the medicament from the container.

50. An auto-injector, comprising:

a housing;

a container disposed in the housing and storing a medicament;

a fluid source disposed in the housing and storing a pressurized medium; and

a fluid conduit disposed in the housing and selectively coupled to the container to receive the medicament, wherein the fluid conduit is configured to extend out of the housing and deliver the medicament from the container in response to the fluid source releasing the pressurized medium to expel the medicament; and

a valve assembly disposed in the housing and including a high pressure body portion, a low pressure body portion, a valve seat positioned within the low pressure body portion, a conduit formed within the valve seat, and a diaphragm positioned between the high pressure body portion and the low pressure body portion,

wherein the fluid source is coupled to the valve assembly via one or more pressure lines, and the diaphragm is configured to deflect away from the high pressure body portion and into the low pressure body portion to seal the valve seat in response to a pressure differential being generated within the valve assembly from release of the pressurized medium by the fluid source.

51. An auto-injector, comprising:

a housing;

a container disposed in the housing and storing a medicament;

a fluid source disposed in the housing and storing a pressurized medium;

a fluid conduit disposed in the housing and selectively coupled to the container to receive the medicament, wherein the fluid conduit is configured to extend out of the housing and deliver the medicament from the container in response to the fluid source releasing the pressurized medium to expel the medicament;

a valve assembly disposed in the housing and coupled to the fluid source via one or more pressure lines; and

a regulator disposed within the valve assembly and including a flange, a rod extending outwardly from the flange, a conduit extending through the rod and the flange, and a resilient member disposed about the rod and abutting against the flange.

52. An auto-injector, comprising:

a housing;

a container movably disposed in the housing and storing a medicament;

a fluid source disposed in the housing and storing a pressurized medium;

a fluid conduit disposed in the housing and selectively coupled to the container to receive the medicament in response to the container moving into contact with the fluid conduit, wherein the fluid conduit is configured to extend out of the housing and deliver the medicament from the container in response to the fluid source releasing the pressurized medium to expel the medicament; and

a shuttle actuator movably coupled to the container such that the shuttle actuator is configured to move with the container along a horizontal path from a first position towards a second position within the housing in response to the fluid source releasing the pressurized medium.

53. An auto-injector, comprising:

a housing;

a container disposed in the housing and storing a medicament;

a fluid source disposed in the housing and storing a pressurized medium;

a fluid conduit disposed in the housing and selectively coupled to the container to receive the medicament, wherein the fluid conduit is configured to extend out of the housing and deliver the medicament from the container in response to the fluid source releasing the pressurized medium to expel the medicament; and

a can actuator configured to move within the housing from a first position towards a second position to contact a valve stem of the fluid source, thereby transitioning the fluid source from a closed configuration towards an open configuration, and releasing the pressurized medium from the fluid source.

54. An auto-injector, comprising:

a housing;

a container disposed in the housing and storing a medicament;

a fluid source disposed in the housing and storing a pressurized medium;

a fluid conduit disposed in the housing and selectively coupled to the container to receive the medicament, wherein the fluid conduit is configured to

extend out of the housing and deliver the medicament from the container in response to the fluid source releasing the pressurized medium to expel the medicament; and

a carrier configured to receive at least a portion of the fluid conduit, such that a position of the fluid conduit is maintained within the housing by the carrier, wherein the carrier includes an impediment positioned in a movement path of a can actuator, and the impediment is configured to prevent horizontal movement of the can actuator towards the fluid source.

55. An auto-injector, comprising:

a housing;

a container disposed in the housing and storing a medicament;

a fluid source disposed in the housing and storing a pressurized medium;

a fluid conduit disposed in the housing and selectively coupled to the container to receive the medicament, wherein the fluid conduit is configured to extend out of the housing and deliver the medicament from the container in response to the fluid source releasing the pressurized medium to expel the medicament; and

a driver including a first rack that is configured to mesh with a gear, the driver configured to (i) extend the fluid conduit out of the housing in response to the gear rotating in a first direction, and (ii) retract the fluid conduit back into the housing in response to the gear rotating in a second direction opposite the first direction.

56. An auto-injector, comprising:

a housing;

a container disposed in the housing and storing a medicament;

a fluid source disposed in the housing and storing a pressurized medium;

a fluid conduit disposed in the housing and selectively coupled to the container to receive the medicament;

a resilient member disposed within the housing; and

a needle shroud mechanism coupled to the resilient member, the needle shroud mechanism is configured to move relative to the housing to selectively cover the fluid conduit; wherein the fluid conduit is configured to extend out of the housing and deliver the medicament from the container in response to the fluid source releasing the pressurized medium to expel the medicament, and the needle shroud

mechanism is biased outwardly from the housing by the resilient member to cover the fluid conduit after expelling the medicament;

wherein the housing includes at least one opening along a bottom cover of the housing, and the fluid conduit is configured to extend out of the housing via the at least one opening along the bottom cover when expelling the medicament and the needle shroud mechanism is configured to extend outwards from the bottom cover in a locked out state to cover the fluid conduit after the medicament is expelled.

57. An auto-injector, comprising:

a housing;

a container disposed in the housing and storing a medicament;

a fluid source disposed in the housing and storing a pressurized medium;

a fluid conduit disposed in the housing and coupled to the container to receive the medicament,

a needle shroud mechanism extending outwardly from the housing in an extended configuration to cover the fluid conduit, the needle shroud mechanism being configured to move into the housing towards a compressed configuration to uncover the fluid conduit, and to become locked in the extended configuration once deployed outwardly away from the housing from the compressed configuration;

wherein the fluid conduit is configured to extend out of the housing, and through the needle shroud mechanism, when the needle shroud mechanism is in the compressed configuration, and the fluid conduit is concealed inside the housing by the needle shroud mechanism after the needle shroud mechanism returns to the extended configuration; and

wherein the medicament is delivered from the container in response to the fluid source releasing the pressurized medium to expel the medicament.

58. An auto-injector, comprising:

a housing;

a container configured to store a medicament;

a fluid source configured to store a pressurized fluid; and

a valve assembly fluidly coupled to the fluid source and the container, the valve assembly configured to regulate the pressurized fluid directed from the fluid

source towards the container to expel the medicament from the housing, the valve assembly including a first cavity, a second cavity, and a diaphragm positioned between the first cavity and the second cavity, wherein the diaphragm includes a flexible body that is configured to flex away from the first cavity and into the second cavity in response to a pressurization of the pressurized fluid within the first cavity exceeding the second cavity;

wherein, in response to the fluid source releasing the pressurized fluid, a pressure differential is generated within the valve assembly such that the diaphragm is urged away from the first cavity and towards the second cavity to direct the pressurized fluid towards the container, and

wherein, in response to the fluid source ceasing release of the pressurized fluid, the pressure differential within the valve assembly equalizes such that the diaphragm is urged away from the second cavity and towards the first cavity to vent the pressurized fluid out of the valve assembly and into the housing through the second cavity.

59. An auto-injector, comprising:

a housing;

a container disposed within the housing and storing a medicament;

a fluid source disposed within the housing and storing a pressurized fluid; and

a valve assembly disposed within the housing and in fluid communication with each of the fluid source and the container, the valve assembly including a first body, a second body coupled to the first body, and a diaphragm coupled between the first body and the second body, wherein the diaphragm is deformably movable from a stretched state towards a tensioned state between the first body and the second body in response to the valve assembly receiving the pressurized fluid from the fluid source;

wherein the valve assembly is configured to form a pressure differential between the first body and the second body, the diaphragm is configured to move away from the first body and towards the second body in response to the fluid source releasing the pressurized fluid and the pressure differential forming in the valve assembly, and the first body is configured to direct the pressurized fluid towards the container for delivering the medicament out of the housing, and

wherein the valve assembly is configured to equalize the pressure differential between the first body and the second body, the diaphragm is configured to move away from the second body and towards the first body in response to the fluid source ceasing release of the pressurized fluid and the pressure differential equalizing within the valve assembly, and the second body is configured to direct the pressurized fluid out of the valve assembly and into the housing for venting.

60. An auto-injector, comprising:

a housing;

a container storing a medicament;

a fluid source storing a pressurized fluid; and

a valve assembly fluidly coupled to the fluid source and the container, the valve assembly including a diaphragm that is moveable between a high pressure cavity and a low pressure cavity, a valve seat positioned within the low pressure cavity, and a conduit fluidly coupled to the valve seat;

wherein the fluid source is configured to generate a pressure differential within the valve assembly to move the diaphragm away from the high pressure cavity and into the low pressure cavity for engagement with the valve seat, to fluidly decouple the conduit from the low pressure cavity, in response to releasing the pressurized fluid into the valve assembly, wherein a portion of the pressurized fluid is directed towards the container for delivering the medicament out of the housing, and

wherein the fluid source is configured to equalize the pressure differential within the valve assembly to move the diaphragm away from the low pressure cavity and towards the high pressure cavity for disengaging the valve seat, to fluidly couple the conduit to the low pressure cavity, in response to terminating further release of the pressurized fluid into the valve assembly, wherein the pressurized fluid released into the valve assembly is directed by the low pressure cavity into the housing for venting via the conduit.