

CLAIMS

What is claimed is:

1. A fluid injection device, comprising:
 - a housing comprising an inner surface and an outer surface which extend from a trigger end to a dispensing end along an injection axis, the trigger end comprising an external actuation surface disposed transverse to the injection axis;
 - a syringe adapter at the dispensing end of the housing, the syringe adapter configured to retain a needle-free syringe such that a plunger of the needle-free syringe is movable within the housing along the injection axis;
 - a piston retained within the housing by the syringe adapter and movable along the injection axis between a loaded position proximal the trigger end and an unloaded position proximal the dispensing end, the piston comprising a piston head proximal the dispensing end and a trigger catch proximal the trigger end of the housing, the piston head being movably positioned to bias the plunger of the needle-free syringe along the injection axis;
 - a compression spring associated with the piston, the piston and compression spring sized relative to the housing such that the compression spring is compressible along the injection axis within the housing; and
 - a trigger mounted within the housing proximal the trigger end and movable between a non-actuated position and an actuated position by depression of a push-button disposed at the external actuation surface of the housing, the trigger comprising a trigger latch configured to engage the trigger catch when the trigger is in the non-actuated position and the piston is in the loaded position and to release the trigger catch when the trigger is in the actuated position, wherein the trigger catch is

configured to urge the trigger latch in a direction transverse to the injection axis when the piston moves from the unloaded position to the loaded position.

2. The fluid injection device of claim 1, wherein:
the trigger catch comprises an annular engagement surface extending radially outward from the injection axis and facing towards the dispensing end of the housing; and
the trigger latch comprises an engagement surface extending inwardly towards the injection axis and facing towards the trigger end of the housing, and which engages the annular engagement surface of the trigger catch when the trigger is in the non-actuated position and clears the trigger catch when the trigger is in the actuated position.
3. The fluid injection device of claim 1, wherein:
the trigger catch further comprises an annular beveled surface which faces away from the injection axis towards the trigger end of the housing; and
the trigger latch further comprises a beveled surface which faces towards the injection axis and towards the dispensing end of the housing.
4. The fluid injection device of claim 1, wherein the trigger further comprises a lever biased towards the pushbutton by a return spring disposed within the housing.
5. The fluid injection device of claim 4, wherein the return spring is a clip spring biased against the lever of the trigger.
6. The fluid injection device of claim 1, further comprising a movable safety cap for blocking depression of the push-button.

7. The fluid injection device of claim 6, wherein the safety cap is pivotally mounted to the external actuation surface of the housing.
8. The fluid injection device of claim 1, wherein the interior surface of the housing comprises a portion extending towards the injection axis and which blocks the compression spring from contacting the trigger.
9. The fluid injection device of claim 1, wherein the syringe adapter comprises an outer surface that extends away from the injection axis beyond the outer surface of the housing.
10. The fluid injection device of claim 1, wherein the syringe adapter is removable, and the housing is configured to removably accept alternatively configured syringe adaptors.
11. The fluid injection device of claim 10, wherein:
 - the syringe adapter is removable;
 - the syringe adapter is connected to the injector via turning clockwise;
 - the piston and the compression spring are removable from the housing when the syringe adapter is removed from the housing; and
 - the housing is configured to removably accept at least one of the alternatively sized pistons and springs.
12. The fluid injection device of claim 1, wherein the syringe adapter is removably affixed to the dispensing end of the housing.
13. The fluid injection device of claim 1, wherein the syringe adapter is irremovably affixed to the dispensing end of the housing.

14. The fluid injection device of claim 1, wherein the compression spring is retained around the piston by the piston head.
15. A kit comprising:
- a fluid injection device including a syringe adapter that comprises an outer surface that extends away from an injection axis of the fluid injection device beyond an outer surface of a housing of the fluid injection device; and
 - a loader configured to receive the fluid injection device on an interior retaining surface comprising a lip adapted to engage the outer surface of the syringe adapter of the fluid injection device,
- wherein the loader is movable about a hinge between an open state and a closed state to extend a plunger into an open end of the syringe adapter to contact a piston head within the housing so as to push the piston from a unloaded position into a loaded position.
16. The kit of claim 15, wherein the syringe adapter of the fluid injection device is removable and the kit further comprises one or more compression springs, each of which is distinctly configured to provide a different spring force.
17. The kit of claim 15, wherein the syringe adapter of the fluid injection device is removable and the kit further comprises one or more additional syringe adapters, each of which is configured to retain a different needle-free syringe.
18. The kit of claim 15, wherein the syringe is labeled for 0.1-0.5 ml intervals for fluid delivery.

19. The kit of claim 16, wherein a spring force is in the range of 5-250 N with graduation of 5 N.
20. A fluid injection device, comprising:
a housing comprising a generally continuous inner surface and a generally continuous outer surface which extend from a trigger end opening to a dispensing end opening;
a syringe adapter at the dispensing end opening of the housing, the syringe adapter configured to retain a needle-free syringe and thereby create a seal of the dispensing end opening;
a piston retained within the housing and movable between a loaded position and an unloaded position to bias the plunger of the needle-free syringe; and
a trigger mounted proximal the trigger end and movable between a non-actuated position and an actuated position to initiate movement of the piston from the loaded position to the unloaded position upon actuation of the trigger;
wherein a sound created within the housing is prevented from exiting the housing through the generally continuous inner and outer surfaces or through the sealed dispensing end opening.
21. The fluid injection device of claim 20, wherein a thickness between the inner surface and the outer surface prevents sound from passing through the housing surfaces.
22. The fluid injection device of claim 21, wherein said housing is a metal material.
23. The fluid injection device of claim 22, wherein said material is stainless steel.

24. The fluid injection device of claim 20, wherein the sound created within the housing only exits the housing through the trigger end opening.
25. A fluid injection device, comprising:
- a housing comprising an inner surface and an outer surface which extend from a trigger end to a dispensing end along an injection axis;
 - a syringe adapter at the dispensing end opening of the housing, the syringe adapter configured to retain a needle-free syringe and thereby create a seal of the dispensing end opening;
 - a piston retained within the housing and movable between a loaded position and an unloaded position to bias the plunger of the needle-free syringe; and
 - a trigger mounted proximal the trigger end on the injection axis and movable between a non-actuated position and an actuated position to initiate movement of the piston from the loaded position to the unloaded position upon actuation of the trigger.
26. The fluid injection device of claim 25, wherein the trigger is actuated by depression of a push-button disposed at an external actuation surface of the housing.
27. The fluid injection device of claim 26, wherein the trigger comprises a trigger latch configured to engage a trigger catch when the trigger is in the non-actuated position and the piston is in the loaded position and to release the trigger catch when the trigger is in the actuated position, wherein the trigger catch is configured to urge the trigger latch in a direction transverse to the injection axis when the piston moves from the unloaded position to the loaded position.