WHAT IS CLAIMED IS:

1. A transfer set for transferring liquid into or out of a vial sealed by a stopper, the transfer set comprising:

an inner sleeve comprising a passage extending through the inner sleeve along a longitudinal axis;

an outer sleeve configured for connecting the inner sleeve to the vial such that the passage is disposed above the stopper of the vial;

a spike comprising a follower, wherein the spike is disposed within the passage of the inner sleeve and is configured for longitudinal translation along the passage to puncture the stopper; and

a cap configured for insertion into the outer sleeve such that the cap is connected to the outer sleeve and is detachable from the outer sleeve via rotation of the cap relative to the outer sleeve, the cap comprising:

a closed top wall;

an annular side wall extending from the closed top wall to define an open bottom and an interior space of the cap; and

a cam disposed within the interior space,

wherein the inner sleeve and the spike extend into the interior space when the cap is connected to the outer sleeve, and

wherein, as the cap is rotated relative to the outer sleeve for detachment of the cap from the outer sleeve, the cam interacts with the follower to translate the spike toward the stopper for puncturing the stopper.

2. The transfer set of claim 1 wherein the outer sleeve comprises a rim for retaining the cap rotatably connected to the outer sleeve.

3. The transfer set of claim 2 wherein the cap further comprises a plurality of tabs configured for disposition beneath the rim for retaining the cap rotatably connected to the outer sleeve.

4. The transfer set of claim 1 wherein the cap further comprises a plurality of circumferentially arranged teeth and wherein the outer sleeve comprises a pawl for engaging the teeth to provide ratcheting of the cap during rotation of the cap.

5. The transfer set of claim 4 wherein the pawl is a flexible finger that flexes to traverse each of the teeth.

6. A transfer set for transferring liquid into or out of a vial sealed by a stopper, the transfer set comprising:

a first conjoint unit comprising an inner sleeve and a spike disposed within the inner sleeve, wherein the inner sleeve is configured for seating on the stopper of the sealed vial and wherein the spike is configured for translation within the inner sleeve to puncture the stopper; and

a second conjoint unit comprising an outer sleeve and a cap connected to the outer sleeve such that the cap is detachable from the outer sleeve by rotating the cap relative to the outer sleeve, wherein the outer sleeve is configured for connection to the inner sleeve in a first connected state, in which the first conjoint unit is removably connected to the sealed vial, and a second connected state, in which the first conjoint unit is irremovably connected the sealed vial, the first conjoint unit and the second conjoint

unit being aligned along a longitudinal axis when the second conjoint unit is connected to the first conjoint unit,

wherein, by applying a longitudinal force to the second conjoint unit when the second conjoint unit is connected to the first conjoint unit, the second conjoint unit is configured for longitudinal displacement relative to the first conjoint unit to convert the connection of the second conjoint unit and the first conjoint unit from the first connected state to the second connected state, and

wherein, by rotating the cap relative to the outer sleeve to detach the cap from the outer sleeve in the second connected state, the cap translates the spike to puncture the stopper.

7. The transfer set of claim 6 wherein the outer sleeve comprises a rim, the cap being connected to the outer sleeve such that, when the longitudinal force is applied to the cap, the cap transmits the longitudinal force to the outer sleeve by being seated on the rim of the outer sleeve.

8. The transfer set of claim 6 wherein the inner sleeve comprises a flange, the outer sleeve configured for connection to the flange in the first connected state.

9. The transfer set of claim 6 wherein the inner sleeve comprises a plurality of teeth, the outer sleeve and the teeth being configured to collectively maintain the first conjoint unit irremovable from the sealed vial in the second connected state.

10. The transfer set of claim 6 wherein the inner sleeve comprise a plurality of grooves and wherein the outer sleeve comprises a plurality of tongues, the tongues being insertable into the grooves to align the inner sleeve with

the outer sleeve when the outer sleeve is connected to the inner sleeve.

11. A transfer set for transferring liquid into or out of a vial sealed by a stopper, the transfer set comprising:

a sleeve comprising a passage extending through the sleeve along a longitudinal axis, wherein the sleeve is configured for connection to the vial such that the passage is disposed above the stopper;

a spike disposed within the passage and configured for longitudinal translation along the passage to puncture the stopper when the sleeve is connected to the vial, the spike comprising a follower surface; and

a cap comprising a cam surface, the cap being rotatably connected to the sleeve such that the cam surface contacts the follower surface,

wherein rotating the cap causes the cam surface of the cap to interact with the follower surface of the spike to translate the spike toward the stopper for puncturing the stopper, and

wherein the follower surface has a slope that varies along the follower surface.

12. The transfer set of claim 11 wherein the follower surface is generally helically sloped.

13. The transfer set of claim 11 wherein the spike comprises a pair of follower surfaces.

14. The transfer set of claim 13 wherein the follower surfaces are sloped in a generally double-helical manner.

15. The transfer set of claim 11 wherein the cap has an interior space and wherein the cam surface is disposed within the interior space, the cap being configured to receive the inner sleeve and the spike within the interior space such that the cam surface contacts the follower surface within the interior space of the cap.

CLAIMS

1. A transfer set for transferring liquid into or out of a vial sealed by a stopper, the transfer set comprising:

a first conjoint unit comprising an inner sleeve and a spike disposed within the inner sleeve, wherein the inner sleeve is configured for seating on the stopper of the sealed vial and wherein the spike is configured for translation within the inner sleeve to puncture the stopper; and

a second conjoint unit comprising an outer sleeve and a cap connected to the outer sleeve such that the cap is detachable from the outer sleeve by rotating the cap relative to the outer sleeve, wherein the outer sleeve is configured for connection to the inner sleeve in a first connected state, in which the first conjoint unit is removably connected to the sealed vial, and a second connected state, in which the first conjoint unit is irremovably connected the sealed vial, the first conjoint unit and the second conjoint unit being aligned along a longitudinal axis when the second conjoint unit is connected to the first conjoint unit,

wherein, by applying a longitudinal force to the second conjoint unit when the second conjoint unit is connected to the first conjoint unit, the second conjoint unit is configured for longitudinal displacement relative to the first conjoint unit to convert the connection of the second conjoint unit and the first conjoint unit from the first connected state to the second connected state, and

wherein, by rotating the cap relative to the outer sleeve to detach the cap from the outer sleeve in the second connected state, the cap translates the spike to puncture the stopper.

2. The transfer set of claim 1 wherein the outer sleeve comprises a rim, the cap being connected to the outer sleeve

such that, when the longitudinal force is applied to the cap, the cap transmits the longitudinal force to the outer sleeve by being seated on the rim of the outer sleeve.

3. The transfer set of claim 1 wherein the inner sleeve comprises a flange, the outer sleeve configured for connection to the flange in the first connected state.

4. The transfer set of claim 1 wherein the inner sleeve comprises a plurality of teeth, the outer sleeve and the teeth being configured to collectively maintain the first conjoint unit irremovable from the sealed vial in the second connected state.

5. The transfer set of claim 1 wherein the inner sleeve comprise a plurality of grooves and wherein the outer sleeve comprises a plurality of tongues, the tongues being insertable into the grooves to align the inner sleeve with the outer sleeve when the outer sleeve is connected to the inner sleeve.

6. A transfer set for transferring liquid into or out of a vial sealed by a stopper, the transfer set comprising:

a sleeve comprising a passage extending through the sleeve along a longitudinal axis, wherein the sleeve is configured for connection to the vial such that the passage is disposed above the stopper;

a spike disposed within the passage and configured for longitudinal translation along the passage to puncture the stopper when the sleeve is connected to the vial, the spike comprising a follower surface; and

a cap comprising a cam surface, the cap being rotatably connected to the sleeve such that the cam surface contacts the follower surface,

wherein rotating the cap causes the cam surface of the cap to interact with the follower surface of the spike to translate the spike toward the stopper for puncturing the stopper, and

wherein the follower surface has a slope that varies along the follower surface,

wherein the spike comprises a pair of follower surfaces.

7. The transfer set of claim 6 wherein the follower surface is generally helically sloped.

8. The transfer set of claim 6 wherein the follower surfaces are sloped in a generally double-helical manner.

9. The transfer set of claim 6 wherein the cap has an interior space and wherein the cam surface is disposed within the interior space, the cap being configured to receive the inner sleeve and the spike within the interior space such that the cam surface contacts the follower surface within the interior space of the cap.