CLAIMS

1. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including an elongate body portion, a recess along said elongate body portion, a stopper connected to said elongate body portion, and a plurality of first teeth formed within said recess on said elongate body portion, said first teeth defining a plurality of distally facing shoulders, said plurality of distally facing shoulders being equally spaced along a majority of said elongate body portion; and

a locking element slidably positioned within said chamber along said majority of said elongate body portion, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe barrel and engageable with said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel.

2. The syringe assembly of claim 1, wherein said elongate body portion further comprises a second tooth defining an intermediate distally facing shoulder provided between a first and second distally facing shoulder, said first and second distally facing shoulders being positioned most distally on said elongate body portion among said plurality of distally facing shoulders.

3. The syringe assembly of claims 1 or 2, wherein said elongate body portion of said plunger rod assembly further includes a portion of reduced cross-sectional area configured to break upon the application of excessive axial or torsional force to said plunger rod assembly.

4. The syringe assembly of claim 3, wherein said locking element includes a body portion having a proximal end, said proximal end of said locking element engaging said plunger rod assembly and said inner surface of said syringe barrel at a surface more proximal than the reduced cross-sectional area of said plunger rod assembly

5. The syringe assembly of claim 4, wherein said reduced cross-sectional area of said plunger rod is provided near a distal end of said elongate body portion of said plunger rod

assembly, said distal end comprising a portion extending proximally from said stopper to said first distally facing shoulder defined by a distal-most first tooth of said plurality of first teeth formed on said elongate body portion.

6. The syringe assembly of claim 3, wherein said portion of reduced cross-sectional area is provided at a plurality of positions along said majority of elongate body portion of said plunger rod assembly.

7. The syringe assembly of claim 6, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said reduced cross-sectional area is defined by a notch extending radially inward from an external edge provided at a corresponding position on each of said longitudinal vanes.

8. The syringe assembly of claim 6, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said portion of reduced cross-sectional area is defined by a hole provided at a corresponding position on each of said longitudinal vanes.

9. The syringe assembly of claim 1, wherein a first distally facing shoulder defined by a distal-most first tooth of said plurality of first teeth formed on said elongate body portion is positioned a distance from said stopper that is slightly longer than a longitudinal length of said locking element, to enable a user of said syringe assembly to perform an "air shot" and a "vein check" procedure.

10. The syringe assembly of claim 1, wherein a distal-most first tooth of said plurality of first teeth formed on said elongate body portion comprises an angled surface extending proximally from a top of said distally facing shoulder to a base of an adjacent distally facing shoulder, said angled surface further comprising at least one raised step provided on the surface thereof.

11. The syringe assembly of claim 1, wherein a distal-most first tooth of said plurality of first teeth formed on said elongate body portion comprises an angled surface extending proximally from a top of said distally facing shoulder to a base of an adjacent distally facing

shoulder, said angled surface further comprising at least one indentation provided on the surface thereof.

12. The syringe assembly of claim 1, wherein the locking element further includes:

a generally V-shaped body portion including first and second radially extending walls joined along a longitudinal axis;

a first and second leg extending in a proximal direction from said first and second walls, respectively, each of said legs including a proximal end portion engageable with at least one of said distally facing shoulders, each of said proximal end portions including an outer edge angled radially inward in a proximal direction; and

a distal end portion integral with said generally V-shaped body portion, said distal end portion including a straight distal edge perpendicular to said longitudinal axis, said distal edge being of a length less than a distance provided between an outer edge of said first leg and an outer edge of said second leg.

13. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including an elongate body portion, a recess along said elongate body portion and a stopper connected to said elongate body portion, said elongate body portion further including a portion of reduced cross-sectional area configured to break upon the application of excessive axial or torsional force to said plunger rod assembly; and

a locking element slidably positioned within said chamber, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe barrel and engageable with said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel, said locking element including a body portion having a proximal end, said proximal end of said locking element engaging said plunger rod assembly and said inner surface of said syringe barrel at a surface more proximal than the reduced cross-sectional area of said plunger rod assembly.

14. The syringe assembly of claim 13, wherein said plunger rod assembly further comprises a plurality of first teeth formed on said elongate body portion, said first teeth

defining a plurality of distally facing shoulders, said plurality of distally facing shoulders being equally spaced along a majority of said elongate body portion.

15. The syringe assembly of claim 14, wherein said plunger rod assembly further comprises a second tooth formed on said elongate body portion defining an intermediate distally facing shoulder provided between a first and second distally facing shoulder.

16. The syringe assembly of claim 15, wherein said first and second distally facing shoulders are positioned most distally on said elongate body portion among the plurality of distally facing shoulders.

17. The syringe assembly of claim 16, wherein said reduced cross-sectional area of said plunger rod is provided near a distal end of said elongate body portion of said plunger rod assembly.

18. The syringe assembly of claim 17, wherein said distal end of said elongate body portion comprises a portion extending proximally from said stopper to said first distally facing shoulder.

19. The syringe assembly of claim 18, wherein, after injection of a set dose, said locking element engages said plunger rod assembly and said inner surface of said syringe barrel along said distal end of said elongate body portion.

20. The syringe assembly of claim 13, wherein said portion of reduced cross-sectional area is provided at a plurality of positions along said majority of elongate body portion of said plunger rod assembly.

21. The syringe assembly of claim 20, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said portion of reduced cross-sectional area is defined by a hole provided at a corresponding position on each of said longitudinal vanes.

22. The syringe assembly of claim 20, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess,

wherein said reduced cross-sectional area is defined by a notch extending radially inward from an external edge provided at a corresponding position on each of said longitudinal vanes.

23. The syringe assembly of claim 13, wherein the locking element further includes:

a generally V-shaped body portion including first and second radially extending walls joined along a longitudinal axis;

a first and second leg extending in a proximal direction from said first and second walls, respectively, each of said legs including a proximal end portion engageable with at least one of said distally facing shoulders, each of said proximal end portions including an outer edge angled radially inward in a proximal direction; and

a distal end portion integral with said generally V-shaped body portion, said distal end portion including a straight distal edge perpendicular to said longitudinal axis, said distal edge being of a length less than a distance provided between an outer edge of said first leg and an outer edge of said second leg.

24. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including an elongate body portion, a recess along said elongate body portion and a stopper connected to said elongate body portion, said elongate body portion further including a portion of reduced cross-sectional area configured to break upon the application of excessive axial or torsional force to said plunger rod assembly, said reduced cross-sectional area of said plunger rod being provided near a distal end of said elongate body portion of said plunger rod assembly, said distal end comprising a portion extending proximally from said stopper to a first distally facing shoulder defined by a first tooth of a plurality of first teeth formed on said elongate body portion; and

a locking element slidably positioned within said chamber, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe barrel and engageable with said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel, said locking element including a body portion having a proximal end, said proximal end of said locking

element engaging said plunger rod assembly and said inner surface of said syringe barrel at a surface more proximal than the reduced cross-sectional area of said plunger rod assembly.

25. The syringe assembly of claim 24, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, said reduced cross-sectional area comprising a notch formed on the plurality of longitudinal vanes, said notch being defined by the boundaries of a pair of substantially parallel wall portions extending inward perpendicularly from an external edge of said longitudinal vanes, said parallel wall portions adjoining a pair of slanted wall portions extending radially inward toward each other from the respective parallel wall portions.

26. The syringe assembly of claim 25, wherein said pair of slanted wall portions are joined at a radially inward end of said notch by a wall parallel to said longitudinal vane.

27. The syringe assembly of claim 25, wherein said pair of slanted wall portions meet at a radially inward end of said notch.

28. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including an elongate body portion, a recess along said elongate body portion, a stopper connected to said elongate body portion, and a plurality of first teeth formed on said elongate body portion, said first teeth defining a plurality of distally facing shoulders, said plurality of distally facing shoulders being equally spaced along a majority of said elongate body portion, said elongate body portion further comprising a second tooth defining an intermediate distally facing shoulder provided between a first and second distally facing shoulder; and

a locking element slidably positioned within said chamber, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe barrel and engageable with said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel.

29. The syringe assembly of claim 28, wherein said first and second distally facing shoulders are positioned most distally on said elongate body portion among the plurality of distally facing shoulders.

30. The syringe assembly of claim 29, wherein said elongate body portion of said plunger rod assembly further includes a portion of reduced cross-sectional area configured to break upon the application of excessive axial or torsional force to said plunger rod assembly.

31. The syringe assembly of claim 30, wherein said reduced cross-sectional area of said plunger rod is provided near a distal end of said elongate body portion of said plunger rod assembly, said distal end comprising a portion extending proximally from said stopper to said first distally facing shoulder defined by a distal-most first tooth of said plurality of first teeth formed on said elongate body portion.

32. The syringe assembly of claim 31, said locking element including a body portion having a proximal end, said proximal end of said locking element engaging said plunger rod assembly and said inner surface of said syringe barrel at a surface more proximal than the reduced cross-sectional area of said plunger rod assembly.

33. The syringe assembly of claim 30, wherein said portion of reduced cross sectional area is provided on a plurality of positions along said elongate body portion of said plunger rod assembly.

34. The syringe assembly of claim 33, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said portion of reduced cross-sectional area is defined by a hole provided at a corresponding position on each of said longitudinal vanes.

35. The syringe assembly of claim 33, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said reduced cross-sectional area is defined by a notch extending radially inward from an external edge provided at a corresponding position on each of said longitudinal vanes.

36. The syringe assembly of claim 28, wherein said second tooth comprises a flat surface portion parallel to a longitudinal axis of said elongate body portion, said flat surface portion extending proximally from said intermediate distally facing shoulder a distance less than a length of said second tooth.

37. The syringe assembly of claim 28, wherein said second tooth comprises an angled surface portion provided along a radial outer edge of said second tooth and adjoining said intermediate distally facing shoulder.

38. The syringe assembly of claim 28, wherein the locking element further includes:

a generally V-shaped body portion including first and second radially extending walls joined along a longitudinal axis;

a first and second leg extending in a proximal direction from said first and second walls, respectively, each of said legs including a proximal end portion engageable with at least one of said distally facing shoulders, each of said proximal end portions including an outer edge angled radially inward in a proximal direction; and

a distal end portion integral with said generally V-shaped body portion, said distal end portion including a straight distal edge perpendicular to said longitudinal axis, said distal edge being of a length less than a distance provided between an outer edge of said first leg and an outer edge of said second leg.

39. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including an elongate body portion, a recess along said elongate body portion and a stopper connected to said elongate body portion, said elongate body portion further including a portion of reduced cross-sectional area configured to break upon the application of excessive axial or torsional force to said plunger rod assembly, said portion of reduced cross-sectional area being provided at a plurality of positions along said majority of elongate body portion of said plunger rod assembly; and

a locking element slidably positioned within said chamber, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe barrel and

engageable with said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel.

40. The syringe assembly of claim 39, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said portion of reduced cross-sectional area is defined by a hole provided at a corresponding position on each of said longitudinal vanes.

41. The syringe assembly of claim 39, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said reduced cross-sectional area is defined by a notch extending radially inward from an external edge provided at a corresponding position on each of said longitudinal vanes.

42. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including an elongate body portion, a recess along said elongate body portion, a stopper connected to said elongate body portion, and a plurality of first teeth formed within said recess on said elongate body portion, said first teeth defining a plurality of distally facing shoulders; and

a locking element slidably positioned within said chamber along said elongate body portion, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe barrel and engageable with said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel, said locking element including:

a generally V-shaped body portion including first and second radially extending walls joined along a longitudinal axis;

a first and second leg extending in a proximal direction from said first and second walls, respectively, each of said legs including a proximal end portion engageable with at least one of said distally facing shoulders, each of said proximal end portions including an outer edge angled radially inward in a proximal direction; and

a distal end portion integral with said generally V-shaped body portion, said distal end portion including a straight distal edge perpendicular to said longitudinal axis, said distal edge being of a length less than a distance provided between an outer edge of said first leg and an outer edge of said second leg.

What is claimed is:

1. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including a stopper, a user interface flange, an elongate body portion extending from said stopper to said flange, a recess along said elongate body portion, and a plurality of first teeth formed within said recess on said elongate body portion, said first teeth defining a plurality of distally facing shoulders, said plurality of distally facing shoulders being equally spaced along a majority of said elongate body portion; and

a locking element slidably positioned within said chamber along said majority of said elongate body portion, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe band and engageable with said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel.

2. The syringe assembly of claim 1, wherein said elongate body portion further comprises a second tooth defining an intermediate distally facing shoulder provided between a first and second distally facing shoulder, said first and second distally facing shoulders being positioned most distally on said elongate body portion among said plurality of distally facing shoulders.

3. The syringe assembly of claim 1 or 2, wherein said elongate body portion of said plunger rod assembly further includes a portion of reduced cross-sectional area configured to break upon the application of excessive axial or torsional force to said plunger rod assembly.

4. The syringe assembly of claim 3, wherein said locking element includes a body portion having a proximal end, said proximal end of said locking element engaging said plunger rodassembly and said inner surface of said syringe barrel at a surface more proximal than the reduced cross-sectional area of said plunger rod assembly.

5. The syringe assembly of claim 4, wherein said reduced cross-sectional area of said plunger rod is provided near a distal end of said elongate body portion of said plunger rod assembly, said distal end comprising a portion extending proximally from said stopper to said first distally facing shoulder defined by a distal-most first tooth of said plurality of first teeth formed on said elongate body portion.

6. The syringe assembly of claim 3, wherein said portion of reduced cross-sectional area is provided at a plurality of positions along said majority of elongate body portion of said plunger rod assembly.

7. The syringe assembly of claim 6, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said reduced cross-sectional area is defined by a notch extending radially inward from an external edge provided at a corresponding position on each of said longitudinal vanes.

8. The syringe assembly of claim 6, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said portion of reduced cross-sectional area is defined by a hole provided at a corresponding position on each of said longitudinal vanes.

9. The syringe assembly of claim 1, wherein a first distally facing shoulder defined by a distal-most first tooth of said plurality of first teeth formed on said elongate body portion is positioned a distance from said stopper that is slightly longer than a longitudinal length of said locking element, to enable a user of said syringe assembly to perform an "air shot" and a "vein check" procedure.

10. The syringe assembly of claim 1, wherein a distal-most first tooth of said plurality of first teeth formed on said elongate body portion comprises an angled surface extending proximally from a top of said distally facing shoulder to a base of an adjacent distally facing shoulder, said angled surface further comprising at least one raised step provided on the surface thereof.

11. The syringe assembly of claim 1, wherein a distal-most first tooth of said plurality of first teeth formed on said elongate body portion comprises an angled surface extending proximally from a top of said distally facing shoulder to a base of an adjacent distally facing shoulder, said angled surface further comprising at least one indentation provided on the surface thereof.

12. The syringe assembly of claim 1, wherein the locking element further includes:

a generally V-shaped body portion including first and second radially extending walls joined along a longitudinal axis;

a first and second leg extending in a proximal direction from said first and second walls, respectively. each of said legs including a proximal end portion engageable with at least one of said distally facing shoulders, each of said proximal end portions including an outer edge angled radially inward in a proximal direction; and

a distal end portion integral with said generally V-shaped body portion, said distal end portion including a straight distal edge portion perpendicular to said longitudinal axis, said distal edge portion being of a length less than a distance between an outer edge of said first leg and an outer edge of said second leg.

13. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including an elongate body portion, a recess along said elongate body portion and a stopper connected to said elongate body portion, said elongate body portion further including a portion of reduced cross-sectional area configured to break upon the application of excessive axial or torsional force to said plunger rod assembly; and

a locking element slidably positioned within said chamber, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe barrel and engageable with said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel, said locking element including a body portion having a proximal end, said proximal end of said locking element engaging said plunger rod assembly and said inner surface of said syringe barrel at a surface more proximal than the reduced cross-sectional area of said plunger rod assembly;

wherein said plunger rod assembly further comprises a plurality of first teeth formed within said recess, said first teeth defining a plurality of distally facing shoulders, said plurality of distally facing shoulders being equally spaced along a majority of said elongate body portion.

14. The syringe assembly of claim 13, wherein said plunger rod assembly further comprises a second tooth formed on said elongate body portion defining an intermediate distally facing shoulder provided between a first and second distally facing shoulder.

15. The syringe assembly of claim 14, wherein said first and second distally facing shoulders are positioned most distally on said elongate body portion among the plurality of distally facing shoulders.

16. The syringe assembly of claim 15, wherein said reduced cross-sectional area of said plunger rod is provided near a distal end of said elongate body portion of said plunger rod assembly.

17. The syringe assembly of claim 16, wherein said distal end of said elongate body portion comprises a portion extending proximally from said stopper to said first distally facing shoulder.

18. The syringe assembly of claim 17, wherein, after injection of a set dose, said locking element engages said plunger rod assembly and said inner surface of said syringe barrel along said distal end of said elongate body portion.

19. The syringe assembly of claim 13, wherein said portion of reduced cross-sectional area is provided at a plurality of positions along said majority of elongate body portion of said plunger rod assembly.

20. The syringe assembly of claim 19, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said portion of reduced cross-sectional area is defined by a hole provided at a corresponding position on each of said longitudinal vanes.

21. The syringe assembly of claim 19, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said reduced cross-sectional area is defined by a notch extending radially inward from an external edge provided at a corresponding position on each of said longitudinal vanes.

22. The syringe assembly of claim 13, wherein the locking element further includes:

a generally V-shaped body portion including first and second radially extending walls joined along a longitudinal axis;

a first and second leg extending in a proximal direction from said first and second walls, respectively, each of said legs including a proximal end portion engageable with at least one of said distally facing shoulders, each of said proximal end portions including an outer edge angled radially inward in a proximal direction; and

a distal end portion integral with said generally V-shaped body portion, said distal end portion including a straight distal edge portion perpendicular to said longitudinal axis, said distal edge portion being of a length less than a distance between an outer edge of said first leg and an outer edge of said second leg.

23. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including an elongate body portion, a recess along said elongate body portion, a stopper connected to said elongate body portion, and a plurality of teeth disposed within said recess, said elongate body portion further including a portion of reduced cross-sectional area configured to break upon the application of excessive axial or torsional force to said plunger rod assembly, said reduced cross-sectional area of said plunger rod being provided near a distal end of said elongate body portion of said plunger rod assembly, said distal end comprising a portion extending proximally from said stopper to a first distally facing shoulder defined by a first tooth of a plurality of first teeth formed on said elongate body portion; and

a locking element slidably positioned within said chamber, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe barrel and engageable with said teeth of said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel, said locking element including a body portion having a proximal end, said proximal end of said locking element engaging said plunger rod assembly and said inner surface of said syringe barrel at a surface more proximal than the reduced cross-sectional area of said plunger rod assembly.

24. The syringe assembly of claim 23, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, said reduced cross-sectional area comprising a notch formed on the plurality of longitudinal vanes, said notch being defined by the boundaries of a pair of substantially parallel wall portions extending inward perpendicularly from an external edge of said longitudinal vanes, said parallel wall portions adjoining a pair of slanted wall portions extending radially inward toward each other from the respective parallel wall portions.

25. The syringe assembly of claim 24, wherein said pair of slanted wall portions are joined at a radially inward end of said notch by a wall parallel to said longitudinal vane.

26. The syringe assembly of claim 24, wherein said pair of slanted wall portions meet at a radially inward end of said notch.

27. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including a stopper, a user interface flange. an elongate body portion extending from said stopper to said flange, a recess along said elongate body portion, and a plurality of first teeth formed within said recess, said first teeth defining a plurality of distally facing shoulders, said plurality of distally facing shoulders being equally spaced along a majority of said elongate body portion, said elongate body portion further comprising a second tooth defining an intermediate distally facing shoulder provided between a first and second distally facing shoulder; and

a locking element slidably positioned within said chamber, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe barrel and engageable with said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel.

28. The syringe assembly of claim 27, wherein said first and second distally facing shoulders are positioned most distally on said elongate body portion among the plurality of distally facing shoulders.

29. The syringe assembly of claim 28, wherein said elongate body portion of said plunger rod assembly further includes a portion of reduced cross-sectional area configured to break upon the application of excessive axial or torsional force to said plunger rod assembly.

30. The syringe assembly of claim 29, wherein said reduced cross-sectional area of said plunger rod is provided near a distal end of said elongate body portion of said plunger rod assembly, said distal end comprising a portion extending proximally from said stopper to said first distally facing shoulder defined by a distal-most first tooth of said plurality of first teeth formed on said elongate body portion.

31. The syringe assembly of claim 30, said locking element including a body portion having a proximal end, said proximal end of said locking element engaging said plunger rod assembly and said inner surface of said syringe barrel at a surface more proximal than the reduced cross-sectional area of said plunger rod assembly.

32. The syringe assembly of claim 29, wherein said portion of reduced cross sectional area is provided on a plurality of positions along said elongate body portion of said plunger rod assembly.

33. The syringe assembly of claim 32, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said portion of reduced cross-sectional area is defined by a hole provided at a corresponding position on each of said longitudinal vanes.

34. The syringe assembly of claim 32, wherein said elongate body portion of said plunger rod assembly comprises a plurality of longitudinal vanes arranged to define said recess, wherein said reduced cross-sectional area is defined by a notch extending radially inward from an external edge provided at a corresponding position on each of said longitudinal vanes.

35. The syringe assembly of claim 27, wherein said second tooth comprises a flat surface portion parallel to a longitudinal axis of said elongate body portion, said flat surface portion extending proximally from said intermediate distally facing shoulder a distance less than a length of said second tooth.

36. The syringe assembly of claim 27, wherein said second tooth comprises an angled surface portion provided along a radial outer edge of said second tooth and adjoining said intermediate distally facing shoulder.

37. The syringe assembly of claim 27, wherein the locking element further includes:

a generally V-shaped body portion including first and second radially extending walls joined along a longitudinal axis;

a first and second leg extending in a proximal direction from said first and second walls, respectively, each of said legs including a proximal end portion engageable with at least one of said distally facing shoulders, each of said proximal end portions including an outer edge angled radially inward in a proximal direction; and

a distal end portion integral with said generally V-shaped body portion, said distal end portion including a straight

distal edge portion perpendicular to said longitudinal axis, said distal edge portion being of a length less than a distance between an outer edge of said first leg and an outer edge of said second leg.

38. A syringe assembly comprising:

a syringe barrel having an inside surface defining a chamber, an open end, and a distal end;

a plunger rod assembly including an elongate body portion, a recess along said elongate body portion, a stopper connected to said elongate body portion, and a plurality of first teeth formed within said recess on said elongate body portion, said first teeth defining a plurality of distally facing shoulders; and

a locking element slidably positioned within said chamber along said elongate body portion, said locking element engaging said inner surface of said syringe barrel such that said locking element is substantially immovable in the direction of the open end of said syringe barrel and engageable with said plunger rod assembly such that said plunger rod assembly and locking element are movable distally together toward the distal end of the syringe barrel, said locking element including:

a generally V-shaped body portion including first and second radially extending walls joined along a longitudinal axis;

a first and second leg extending in a proximal direction from said first and second walls, respectively, each of said legs including a proximal end portion engageable with at least one of said distally facing shoulders, each of said proximal end portions including an outer edge angled radially inward in a proximal direction; and

a distal end portion integral with said generally V-shaped body portion, said distal end portion including a straight distal edge portion perpendicular to said longitudinal axis, said distal edge portion being of a length less than a distance between an outer edge of said first leg and an outer edge of said second leg.