CLAIM:

1. A device including:

an outer sheath; and

a stent-engaging element disposed within the outer sheath;

wherein a stent is distally driveable out of the outer sheath through at least two periods of engagement of the stent by the stent-engaging element, each said period of engagement configured to drive the stent distally without a mechanized concomitant withdrawal of the outer sheath and each said period of engagement separated by a period of non-engagement of the stent by the stent-engaging element that is configured to not drive the stent distally.

2. The device of claim 1, further including a stent within the outer sheath.

3. The device of claim 2, wherein the stent has a distal end, a proximal end, and a lumen extending between the distal end and the proximal end, and wherein the stent-engaging element is positioned at least partially within the lumen of the stent.

4. The device of claim 2 or 3, wherein the stent exhibits varying axial density after being driven out of the outer sheath by the stent-engaging element.

5. The device of any one of claims 2-4, wherein the stent has a proximal end, and wherein the device further includes a stent-retention element engaging the proximal end of the stent.

6. The device of any one of claims 2-5, wherein the stent includes a plurality of woven wires.

7. The device of claim 6, wherein the stent-engaging element is configured to engage wire intersections during each said period of engagement, and wherein the stent-engaging element is configured to fold inwardly and slide proximally during each said period of non-engagement.

8. The device of claim 1, further including a handle coupled to the outer sheath, the outer sheath stationary relative to the handle.

9. The device of claim 8, wherein the handle has a proximal end and wherein a proximal-most point of contact of a user with the device that causes each said period of engagement is located at or distal of the proximal end of the handle.

10. The device of claim 8 or 9, further including a user-actuatable element coupled to the handle and coupled to the stent-engaging element by an element including a passageway.

11. The device of claim 10, further including an inner element having a portion within the element including the passageway, the inner element configured to accept a guidewire.

12. The device of claim 10 or 11, wherein the user-actuatable element is movable within a slot of the handle.

13. The device of any one of claims 10-12, further including a stopper having a first position that restricts distal advancement of the user-actuatable element.

14. The device of claim 13, wherein the stopper has a second position that does not restrict distal advancement of the user-actuatable element, and wherein the stopper is biased in the first position.

15. The device of any one of claims 1-14, wherein the stent-engaging element is shaped like a scoop or a shovel.

16. The device of any one of claims 1-15, wherein the stent-engaging element has portions that flex.

17. The device of any one of claims 1-16, wherein the stent-engaging element includes a flex slot.

18. The device of any one of claims 8-14, further including a stent-retention element configured to be coupled to the proximal end of a stent.

19. The device of-claim 18, further including:

a Y-adapter coupled to the handle;

wherein the stent-retention element includes a distal portion and a stent-retention line extending from outside the branch of the Y-adapter and through the branch, the handle, and a portion of the outer sheath to the distal portion of the stent-retention element.

20. A sterile kit including the device of any one of claims 1-19.

WE CLAIM:

1. A device comprising:

an outer sheath;

a stent disposed within the outer sheath, the stent having a distal end and a proximal end;

a stent-engaging element positioned at least partially within the lumen of the stent; and

a stent-retention element coupled to the proximal end of the stent;

where the device is configured such that:

the stent-engaging element can be operated in a reciprocating manner to engage and advance the stent distally at least partially out of the outer sheath; and

the stent-retention element will stay in contact with the stent during proximal movement of the stent-engaging element provided that the proximal end of the stent is disposed within the outer sheath.

2. The device of claim 1, further comprising:

a handle coupled to the outer sheath such that the outer sheath cannot move relative to the handle; and

a user-actuatable element coupled to the handle, the user-actuatable element also being coupled to the stent-engaging element by an element having a passageway.

3. The device of claim 2, further comprising:

a stopper biased to a first position that restricts distal advancement of the user-actuatable element.

4. The device of claim 2, further comprising:

an inner element having a portion positioned within the element having a passageway, the inner element being configured to accept a guidewire.

5. The device of claim 2, where the user-actuatable element is a movable within a slot of the handle.

6. The device of claim 1, where the stent has a deployment length, the outer sheath has a distal end, and the device further comprises:

a marker coupled to the outer sheath and spaced apart from the outer sheath's distal end by a distance corresponding substantially to the deployment length of the stent.

7. The device of claim 2, further comprising:

a side port coupled to the handle.

8. The device of claim 1, further comprising

an element that can be coupled to the outside of the outer sheath, the element being configured to interface with a hemostasis valve of an introducer.

9. The device of claim 1, further comprising:

a handle coupled to the outer sheath such that the outer sheath cannot move relative to the handle; and

a Y-adapter coupled to the handle;

where the stent-retention element includes a distal portion and a stent-retention line extending from outside a branch of the Y-adapter and through the

branch, the handle, and a portion of the outer sheath to the distal portion of the stent-retention element.

10. The device of claim 1, where the stent is woven, and the stent-engaging element is configured so as to (a) engage wire intersections on opposing sides of the stent when driving the stent distally, and (b) fold inwardly and slide proximally within the stent's lumen.

11. A device comprising:

an outer sheath;

a handle coupled to the outer sheath such that the outer sheath cannot move relative to the handle, the handle having a proximal end;

a stent disposed within the outer sheath, the stent having a distal end and a proximal end; and

a stent-engaging element configured to engage the stent between the distal and proximal ends of the stent;

where the device is configured such that:

a user can advance the stent distally out of the outer sheath through multiple engagements of the stent by the stent-engaging element, where each engagement:

occurs between the proximal and distal ends of the stent,

drives the stent distally without a mechanized concomitant withdrawal of the outer sheath, and

is separated from any subsequent engagement by a period of not driving the stent distally; and

the user's proximal-most point of contact with the device that causes each engagement is located at or distal of the proximal end of the handle.

12. The device of claim 11, further comprising:

a user-actuatable element coupled to the handle, the user-actuatable element also being coupled to the stent-engaging element by an element having a passageway.

13. The device of claim 12, further comprising:

a stopper biased to a first position that restricts distal advancement of the user-actuatable element.

14. The device of claim 12, further comprising:

an inner element having a portion positioned within the element having a passageway, the inner element being configured to accept a guidewire.

15. The device of claim 12, where the user-actuatable element is a movable within a slot of the handle.

16. The device of claim 11, where the stent has a deployment length, the outer sheath has a distal end, and the device further comprises:

a marker coupled to the outer sheath and spaced apart from the outer sheath's distal end by a distance corresponding substantially to the deployment length of the stent.

17. The device of claim 12, further comprising:

a side port coupled to the handle.

18. The device of claim 11, further comprising

an element that can be coupled to the outside of the outer sheath, the element being configured to interface with a hemostasis valve of an introducer.

19. The device of claim 11, further comprising:

a Y-adapter coupled to the handle; and

a stent-retention element coupled to the proximal end of the stent;

where the stent-retention element includes a distal portion and a stent-retention line extending from outside a branch of the Y-adapter and through the branch, the handle, and a portion of the outer sheath to the distal portion of the stent-retention element.

20. The device of claim 11, further comprising:

a stent-retention element coupled to the proximal end of the stent.

21. The device of claim 11, where the stent is woven, and the stent-engaging element is configured so as to (a) engage wire intersections on opposing sides of the stent when driving the stent distally, and (b) fold inwardly and slide proximally within the stent's lumen.

22. A device comprising:

an outer sheath;

a handle coupled to the outer sheath such that the outer sheath cannot move relative to the handle, the handle having a proximal end;

a stent disposed within the outer sheath, the stent having a lumen, a distal end and a proximal end; and

a stent-engaging element positioned at least partially within the lumen of the stent;

where the device is configured such that:

a user can advance the stent distally out of the outer sheath through at least two periods of engagement of the stent by the stent-engaging element that drive the stent distally and that are separated by a period of non-engagement that does not drive the stent distally; and

the user's proximal-most point of contact with the device that causes each period of engagement is located at or distal of the proximal end of the handle.

23. The device of claim 22, further comprising:

a user-actuatable element coupled to the handle, the user-actuatable element also being coupled to the stent-engaging element by an element having a passageway.

24. The device of claim 23, further comprising:

a stopper biased to a first position that restricts distal advancement of the user-actuatable element.

25. The device of claim 23, further comprising:

an inner element having a portion positioned within the element having a passageway, the inner element being configured to accept a guidewire.

26. The device of claim 23, where the user-actuatable element is a movable within a slot of the handle.

27. The device of claim 22, where the stent has a deployment length, the outer sheath has a distal end, and the device further comprises:

a marker coupled to the outer sheath and spaced apart from the outer sheath's distal end by a distance corresponding substantially to the deployment length of the stent.

28. The device of claim 23, further comprising:

a side port coupled to the handle.

29. The device of claim 22, further comprising

an element that can be coupled to the outside of the outer sheath, the element being configured to interface with a hemostasis valve of an introducer.

30. The device of claim 22, further comprising:

a Y-adapter coupled to the handle; and

a stent-retention element coupled to the proximal end of the stent;

where the stent-retention element includes a distal portion and a stent-retention line extending from outside a branch of the Y-adapter and through the branch, the handle, and a portion of the outer sheath to the distal portion of the stent-retention element.

31. The device of claim 22, further comprising:

a stent-retention element coupled to the proximal end of the stent.

32. The device of claim 22, where the stent is woven, and the stent-engaging element is configured so as to (a) engage wire intersections on opposing sides of the stent when driving the stent distally, and (b) fold inwardly and slide proximally within the stent's lumen.

33. A device comprising:

an outer sheath;

a stent disposed within the outer sheath, the stent having a lumen, a distal end and a proximal end;

an inner element positioned at least partially within the lumen of the stent, the inner element being configured to accept a guidewire; and

a stent-engaging element positioned at least partially within the lumen of the stent and being capable of moving distally and proximally while the inner element is stationary;

where the device is configured to distally drive the stent at least partially out of the outer sheath through at least two periods of engagement of the stent by the stent-engaging element that are separated by a period of non-engagement that does not drive the stent distally.

34. The device of claim 33, further comprising:

a handle coupled to the outer sheath such that the outer sheath cannot move relative to the handle; and

a user-actuatable element coupled to the handle, the user-actuatable element also being coupled to the stent-engaging element by an element having a passageway.

35. The device of claim 34, further comprising:

a stopper biased to a first position that restricts distal advancement of the user-actuatable element.

36. The device of claim 34, where the user-actuatable element is a movable within a slot of the handle.

37. The device of claim 33, where the stent has a deployment length, the outer sheath has a distal end, and the device further comprises:

a marker coupled to the outer sheath and spaced apart from the outer sheath's distal end by a distance corresponding substantially to the deployment length of the stent.

38. The device of claim 34, further comprising:

a side port coupled to the handle.

39. The device of claim 33, further comprising

an element that can be coupled to the outside of the outer sheath, the element being configured to interface with a hemostasis valve of an introducer.

40. The device of claim 33, further comprising:

a handle coupled to the outer sheath such that the outer sheath cannot move relative to the handle;

a Y-adapter coupled to the handle; and

a stent-retention element coupled to the proximal end of the stent;

where the stent-retention element includes a distal portion and a stent-retention line extending from outside a branch of the Y-adapter and through the branch, the handle, and a portion of the outer sheath to the distal portion of the stent-retention element.

41. The device of claim 33, further comprising:

a stent-retention element coupled to the proximal end of the stent.

42. The device of claim 33, where the stent-engaging element is also configured to fold inwardly and slide proximally within the stent's lumen.

43. A device comprising:

an outer sheath;

a handle coupled to the outer sheath such that the outer sheath cannot move relative to the handle;

a stent disposed within the outer sheath, the stent having a distal end and a proximal end; and

a stent-engaging element configured to engage the stent between the distal and proximal ends of the stent;

where the device is configured such that the stent can be distally driven at least partially out of the outer sheath through at least two periods of engagement of the stent by the stent-engaging element that are separated by a period of non-engagement that does not drive the stent distally, and the device and stent are configured such that a user can vary the axial density of the stent as the stent is delivered into a tubular structure by varying the axial position of the outer sheath relative to the tubular structure.

44. The device of claim 43, further comprising:

a user-actuatable element coupled to the handle, the user-actuatable element also being coupled to the stent-engaging element by an element having a passageway.

45. The device of claim 44, further comprising:

a stopper biased to a first position that restricts distal advancement of the user-actuatable element.

46. The device of claim 44, further comprising:

an inner element having a portion positioned within the element having a passageway, the inner element being configured to accept a guidewire.

47. The device of claim 44, where the user-actuatable element is a movable within a slot of the handle.

48. The device of claim 43, where the stent has a deployment length, the outer sheath has a distal end, and the device further comprises:

a marker coupled to the outer sheath and spaced apart from the outer sheath's distal end by a distance corresponding substantially to the deployment length of the stent.

49. The device of claim 44, further comprising:

a side port coupled to the handle.

50. The device of claim 43, further comprising

an element that can be coupled to the outside of the outer sheath, the element being configured to interface with a hemostasis valve of an introducer.

51. The device of claim 43, further comprising:

a Y-adapter coupled to the handle; and

a stent-retention element coupled to the proximal end of the stent;

where the stent-retention element includes a distal portion and a stent-retention line extending from outside a branch of the Y-adapter and through the branch, the handle, and a portion of the outer sheath to the distal portion of the stent-retention element.

52. The device of claim 43, further comprising:

a stent-retention element coupled to the proximal end of the stent.

53. The device of claim 43, where the stent is woven, and the stent-engaging element is configured so as to (a) engage wire intersections on opposing sides of the stent when driving the stent distally, and (b) fold inwardly and slide proximally within the stent's lumen.

54. A stent advancement method comprising:

distally driving a stent out of a sheath and into a tubular structure by repeatedly engaging the stent between its distal and proximal ends with a stent-engaging element, where at least two of the engagements are separated by a period of non-engagement; and

as the stent is distally driven out of the sheath, varying the axial density of the stent within the tubular structure by varying the axial position of the sheath relative to the tubular structure.

55. The stent advancement method of claim 54, where the tubular structure is animal tissue.

56. The stent advancement method of claim 55, further comprising:

engaging the stent at its proximal end with a stent-retention element that is positioned within the sheath.

57. The stent advancement method of claim 56, where the stent-retention element includes a stent-retention line, and the method further comprises:

after the stent is partially-driven out of the sheath, withdrawing the stent back into the sheath by moving the stent-retention line.

58. The stent advancement method of claim 57, where an operator accomplishes the driving of the stent by moving a user-actuatable element with the operator's thumb.

59. The stent advancement method of claim 58, where the stent is woven, a stent-engaging element engages multiple wire intersections of the stent and moves distally during the engagements that drive the stent, and the stent-engaging element slides proximally within the stent's lumen during the period of non-engagement.

60. The stent advancement method of claim 54, where the tubular structure is not part of an animal.

61. The stent advancement method of claim 60, further comprising:

engaging the stent at its proximal end with a stent-retention element that is positioned within the sheath.

62. The stent advancement method of claim 61, where the stent-retention element includes a stent-retention line, and the method further comprises:

after the stent is partially-driven out of the sheath, withdrawing the stent back into the sheath by moving the stent-retention line.

63. The stent advancement method of claim 62, where an operator accomplishes the driving of the stent by moving a user-actuatable element with the operator's thumb.

64. The stent advancement method of claim 63, where the stent is woven, a stent-engaging element engages multiple wire intersections of the stent and moves distally during the engagements that drive the stent, and the stent-engaging element slides proximally within the stent's lumen during the period of non-engagement.

65. A stent advancement method comprising:

distally driving a stent out of a sheath and into a tubular structure by repeatedly engaging the stent between its distal and proximal ends with a stent-engaging element, where at least two of the engagements are separated by a period of non-engagement; and

engaging the stent at its proximal end with a stent-retention element that is positioned within the sheath.

66. The stent advancement method of claim 65, where the tubular structure is animal tissue.

67. The stent advancement method of claim 66, where the stent-retention element includes a stent-retention line, and the method further comprises:

after the stent is partially-driven out of the sheath, withdrawing the stent back into the sheath by moving the stent-retention line.

68. The stent advancement method of claim 67, where an operator accomplishes the driving of the stent by moving a user-actuatable element with the operator's thumb.

69. The stent advancement method of claim 68, where the stent is woven, a stent-engaging element engages multiple wire intersections of the stent and moves distally during the engagements that drive the stent, and the stent-engaging element slides proximally within the stent's lumen during the period of non-engagement.

70. The stent advancement method of claim 65, where the tubular structure is not part of an animal.

71. The stent advancement method of claim 70, where the stent-retention element includes a stent-retention line, and the method further comprises:

after the stent is partially-driven out of the sheath, withdrawing the stent back into the sheath by moving the stent-retention line.

72. The stent advancement method of claim 71 where an operator accomplishes the driving of the stent by moving a user-actuatable element with the operator's thumb.

73. The stent advancement method of claim 72, where the stent is woven, a stent-engaging element engages multiple wire intersections of the stent and moves distally during the engagements that drive the stent, and the stent-engaging element slides proximally within the stent's lumen during the period of non-engagement.

74. A stent advancement instruction method comprising:

instructing a person on how to use a stent delivery device that includes a sheath and a stent disposed in the sheath, the instructing including demonstrating the following steps to the person:

distally driving the stent out of the sheath and into a tubular structure by repeatedly engaging the stent between its distal and proximal ends with a stent-engaging element, where at least two of the engagements are separated by a period of non-engagement; and

as the stent is distally driven out of the sheath, varying the axial density of the stent within the tubular structure by varying the axial position of the sheath relative to the tubular structure.

75. The stent advancement instruction method of claim 74, where, in the demonstration, the tubular structure is animal tissue.

76. The stent advancement instruction method of claim 75, where the instructing further includes demonstrating to the person:

engaging the stent at its proximal end with a stent-retention element that is positioned within the sheath.

77. The stent advancement instruction method of claim 76, where the stent-retention element includes a stent-retention line and the instructing further includes demonstrating to the person:

after the stent is partially-driven out of the sheath, withdrawing the stent back into the sheath by moving the stent-retention line.

78. The stent advancement instruction method of claim 77, where, in the demonstration, the driving of the stent is accomplished by an operator moving a user-actuatable element with the operator's thumb.

79. The stent advancement instruction method of claim 78, where, in the demonstration, the engagements that drive the stent are accomplished by a stent-engaging element engaging multiple wire intersections of the stent and moving distally, and during the period of non-engagement the stent-engaging element slides proximally within the stent's lumen.

80. The stent advancement instruction method of claim 74, where, in the demonstration, the tubular structure is not part of an animal.

81. The stent advancement instruction method of claim 80, where the instructing further includes demonstrating to the person:

engaging the stent at its proximal end with a stent-retention element that is positioned within the sheath.

82. The stent advancement instruction method of claim 81, where the stent-retention element includes a stent-retention line and the instructing further includes demonstrating to the person:

after the stent is partially-driven out of the sheath, withdrawing the stent back into the sheath by moving the stent-retention line.

83. The stent advancement instruction method of claim 82, where, in the demonstration, the driving of the stent is accomplished by an operator moving a user-actuatable element with the operator's thumb.

84. The stent advancement instruction method of claim 83, where, in the demonstration, the engagements that drive the stent are accomplished by a stent-engaging element engaging multiple wire intersections of the stent and moving distally, and during the period of non-engagement the stent-engaging element slides proximally within the stent's lumen.

85. A stent advancement instruction method comprising:

instructing a person on how to use a stent delivery device that includes a sheath and a stent disposed in the sheath, the instructing including demonstrating the following steps to the person:

distally driving a stent out of a sheath and into a tubular structure by repeatedly engaging the stent between its distal and proximal ends with a stent-engaging element, where at least two of the engagements are separated by a period of non-engagement; and

engaging the stent at its proximal end with a stent-retention element that is positioned within the sheath.

86. The stent advancement instruction method of claim 85, where, in the demonstration, the tubular structure is animal tissue.

87. The stent advancement instruction method of claim 86, where the stent-retention element includes a stent-retention line and the instructing further includes demonstrating to the person:

after the stent is partially-driven out of the sheath, withdrawing the stent back into the sheath by moving the stent-retention line.

88. The stent advancement instruction method of claim 87, where, in the demonstration, the driving of the stent is accomplished by an operator moving a user-actuatable element with the operator's thumb.

89. The stent advancement instruction method of claim 88, where, in the demonstration, the engagements that drive the stent are accomplished by a stent-engaging element engaging multiple wire intersections of the stent and moving distally, and during the period of non-engagement the stent-engaging element slides proximally within the stent's lumen.

90. The stent advancement instruction method of claim 85, where, in the demonstration, the tubular structure is not part of an animal.

91. The stent advancement instruction method of claim 90, where the stent-retention element includes a stent-retention line and the instructing further includes demonstrating to the person:

after the stent is partially-driven out of the sheath, withdrawing the stent back into the sheath by moving the stent-retention line.

92. The stent advancement instruction method of claim 91, where, in the demonstration, the driving of the stent is accomplished by an operator moving a user-actuatable element with the operator's thumb.

93. The stent advancement instruction method of claim 92, where, in the demonstration, the engagements that drive the stent are accomplished by a stent-engaging element engaging multiple wire intersections of the stent and moving distally, and during the period of non-engagement the stent-engaging element slides proximally within the stent's lumen.