

WHAT IS CLAIMED IS:

1. A fully automated suturing system comprising:
an automated suture fixture comprising a plurality of motorized actuator devices and a suture target holder, the automated suture fixture being configured to maneuver a target suture device secured by the suture target holder; and
a suturing arm comprising a plurality of motorized actuator devices and a needle holder, the suturing arm configured to maneuver a needle to pass the needle through a material of the target suture device; and
a second suturing arm comprising a plurality of motorized actuator devices and a needle holder, the second suturing arm configured to cooperate with the suturing arm to pass the needle back-and-forth through the material of the target suture device.
2. The system of claim 1, wherein the target suture device is a heart valve.
3. The system of any one of claims 1-2, further comprising a needle transfer fixture configured to secure the needle during a suturing procedure to allow the suturing arm to release the needle to adjust an orientation of the needle relative to the needle holder.
4. The system of any one of claims 1-3, further comprising a targeting system configured to acquire images of the target suture device to provide feedback to the automated suture fixture or the suturing arm.
5. The system of claim 4, wherein the feedback provided by the targeting system is configured to adjust the suturing arm to target the needle to specified points on the target suture device.
6. The system of any one of claims 1-5, further comprising a controller configured to direct the automated suture fixture or the suturing arm to perform a pre-programmed suturing procedure.

7. The system of any one of claims 1-6, wherein the target suture device holder is a gimbal holder assembly.

8. The system of claim 7, wherein the gimbal holder assembly comprises a three-axis gimbal.

9. The system of any one of claims 1-8, wherein the automated suture fixture comprises a plurality of servo motor devices daisy-chained together.

10. The system of any one of claims 1-9, wherein the suturing arm comprises a plurality of servo motor devices daisy-chained together.

11. The system of any one of claims 1-10, wherein the automated suture fixture comprises an encoder associated with an articulation arm, the encoder configured to provide position information for the articulation arm.

12. A suturing system comprising:

- an automated suture fixture comprising a plurality of motorized actuator devices and a suture target holder, the automated suture fixture being configured to position a target suture device secured by the suture target holder;

- a suturing arm comprising a plurality of motorized actuator devices and a needle holder, the suturing arm configured to maneuver a needle to pass the needle through a material of the target suture device;

- a second suturing arm comprising a plurality of motorized actuator devices and a needle holder, the second suturing arm configured to cooperate with the suturing arm to pass the needle back-and-forth through the material of the target suture device;

- a data store storing suturing procedure script data, the suturing procedure script data including a data set representing a plurality of positions of the automated suture fixture assembly and the suturing arm for a suturing procedure; and

- a controller configured to access the suturing procedure script data and to provide position control signals to the automated suture

fixture and to the suturing arm based at least in part on the suturing procedure script data to perform the suturing procedure.

13. The suturing system of claim 12, wherein the target suture device is a prosthetic human heart valve implant device.

14. The suturing system of any one of claims 12-13, wherein the controller is further configured to select the data set from among a plurality of data sets of the suturing procedure script data.

15. The suturing system of any one of claims 12-14, wherein the needle is a double-tipped needle.

16. The suturing system of claim 12, wherein the second suturing arm does not rotate the needle 180 degrees after the needle is passed completely through the material of the target suture.

17. The suturing system of claim 16, further comprising a needle transfer fixture configured to secure the needle to allow the suturing arm to re-orient itself relative to the needle after the second suturing arm passes the needle through the material of the target suture device.

18. A fully automated system comprising:

- a first automated fixture comprising a plurality of motorized actuator devices and a target holder, the automated fixture being configured to maneuver a target device secured by the target holder;
- a second automated fixture comprising a plurality of motorized actuator devices and a first processing-device holder, the second automated fixture configured to maneuver a processing device to perform an operation on the target device; and
- a third automated fixture comprising a plurality of motorized actuator devices and a second processing device holder, the third automated fixture configured to maneuver the processing device to perform a second operation on the target device; and

wherein the processing device is a needle for suturing the target device, the system further comprising a needle transfer fixture

configured to secure the needle during a suturing procedure to allow the second automated fixture to adjust an orientation of the needle relative to the first processing device holder.

19. The system of claim 20, wherein the target device is a heart valve.

20. The system of any one of claims 18-19, further comprising a targeting system configured to acquire images of the target device to provide feedback to at least one of the first automated fixture and the second automated fixture.

21. The system of claim 20, wherein the feedback provided by the targeting system is configured to adjust the second automated fixture to target the processing device to specified points on the target device.

22. The system of any one of claims 18-21, further comprising a controller configured to direct the first automated fixture or the second automated fixture to perform a pre-programmed procedure.

23. The system of any one of claims 18-22, wherein the target device holder is a gimbal holder assembly.

24. The system of claim 23, wherein the gimbal holder assembly comprises a three-axis gimbal.

25. The system of any one of claims 18-24, wherein the first automated suture fixture and the second automated fixture each comprise a plurality of servo motor devices daisy-chained together.

26. The system of any one of claims 18-25, wherein the first automated fixture comprises an encoder associated with an articulation arm, the encoder configured to provide position information for the articulation arm.