CLAIMS:

1. A system for dispensing cryogenically stored materials, the system comprising:

a cryochamber that is electrically cooled at cryogenic temperatures to maintain the stored materials within a first temperature range, the cryochamber including a cryo-access port;

a unit holder located inside the cryochamber and being configured to hold a plurality of container units, each container unit containing at least a portion of the stored material;

a user interface that allows an authenticated user to request a chosen container unit;

a warming chamber that, in response to the request, heats the chosen container unit until a thawed condition of the chosen container unit is achieved; and

a user access area for selectively permitting access to the system, such that the authenticated user can retrieve the chosen container unit which is in the thawed condition, upon providing authentication information to the system,

wherein the system provides a notification to the user when the thawed condition is achieved, and

wherein the cryochamber includes a temperature sensor, and the system further comprises a system control that receives an output of the temperature sensor and controls a metric associated with the cryochamber to maintain a temperature of the cryochamber within the first temperature range.

2. The system of claim 1, wherein the cryochamber is electrically cooled at a temperature within the first temperature range, with no fluid coolant provided to the cryochamber that is not a working fluid for electrical cooling.

3. The system of claim 2, wherein the cryochamber is electrically cooled via a Stirling engine.

4. The system of claim 1, including an elongate heat exchanger which penetrates longitudinally through at least a portion of an interior of the cryochamber.

5. A system for dispensing cryogenically stored materials, the system comprising:

a cryochamber that is electrically cooled at cryogenic temperatures to maintain the stored materials within a first temperature range, the cryochamber including a cryo-access port;

a unit holder located inside the cryochamber and being configured to hold a plurality of container units, each container unit containing at least a portion of the stored material;

a user interface that allows an authenticated user to request a chosen container unit;

a warming chamber that, in response to the request, heats the chosen container unit until a thawed condition of the chosen container unit is achieved;

a user access area for selectively permitting access to the system, such that the authenticated user can retrieve the chosen container unit which is in the thawed condition, upon providing authentication information to the system; and

a motive grasper for transferring the chosen container unit among the cryochamber, the warming chamber, and the user access area,

wherein the system provides a notification to the user when the thawed condition is achieved.

6. The system of claim 5, wherein the motive grasper extends through the cryo-access port only during the active retrieval of the chosen container unit from the cryochamber.

7. The system of claim 5, wherein the motive grasper includes at least one grasping arm selectively manipulable laterally with respect to a central grasper axis.

8. The system of any one of the previous claims, wherein the plurality of container units are removably held within the cryochamber via at least one cartridge.

9. The system of claim 8, wherein at least one cartridge is replaceable within the cryochamber by a separately provided replacement cartridge during maintenance of the system.

10. The system of claim 9, wherein the unit holder is a carousel, and at least one cartridge is rotatably mounted within the cryochamber via the carousel, the carousel being configured to selectively position the at least one cartridge with the chosen container unit, carried by the at least one cartridge, in operative alignment with the cryo-access port.

11. The system of claim 10, wherein an actuator revolver is inserted into the cryo-access port to interface with a feature of the unit holder and thereby rotate the carousel, the actuator revolver being inserted into the cryo-access port only during the active retrieval of the chosen container unit from the cryochamber.

12. The system of claim 11, wherein the actuator revolver is integrated with a motive grasper for transferring the chosen container unit among the cryochamber, the warming chamber, and the user access area.

13. The system of claim 10, wherein an actuator revolver interfaces with an outer rim of the unit holder and thereby rotates the carousel.

14. The system of claim 1, wherein the first temperature range is below -125° C.

15. The system of claim 1, including a humidity sensor, and the system further comprises a system control that receives an output of the humidity sensor and controls a metric associated with the cryochamber to

maintain a humidity of the cryochamber within a predetermined humidity range.

16. The system of claim 1, wherein the warming chamber includes a temperature sensor, and the system further comprises a system control that receives an output of the temperature sensor and controls a heating element associated with the warming chamber to ensure that a temperature of the chosen container unit does not exceed a maximum value of a second temperature range.

17. The system of claim 1, wherein the warming chamber includes a temperature sensor, and the system further comprises a system control that receives an output of the temperature sensor and controls a heating element associated with the warming chamber to ensure that a temperature of the chosen container unit reaches at least a minimum value of a second temperature range.

18. The system of claim 1, wherein the warming chamber includes a warming grasper configured to provide at least one of heat and agitating motion to the chosen container unit.

19. The system of claim 1, wherein the system includes a radio frequency identification (RFID) scanner, and the authenticated user provides authentication information to the system by presenting an object to the RFID scanner.

20. The system of claim 1, wherein the system includes a biometric authentication device, and the authenticated user provides authentication information to the system via the biometric authentication device.

21. The system of claim 1, wherein the system includes one of a bar code scanner and a radio frequency identification (RFID) scanner to provide identifying information for the chosen container unit before the authenticated user is permitted access to the user access area.

22. The system of claim 22, the system further comprising a system control that provides the identifying information to an inventory database to update the inventory database after at least one of the chosen container unit is taken from the cryochamber and the authenticated user accesses the user access area.

23. The system of claim 1, wherein the system includes at least one of a bar code scanner and a radio frequency identification (RFID) scanner to provide identifying information for at least one container unit that is placed into the cryochamber, the system further comprising a system control that provides the identifying information to an inventory database to update the inventory database.

24. The system of claim 1, wherein the user access area allows access only to the chosen container unit, and wherein at least the

cryochamber is secured within a housing configured to prevent user access and permit selected technician access.

25. The system of claim 1, wherein the system further comprises a network interface that provides the notification to the user when the chosen container unit has reached the thawed condition as an electronic notification.

26. The system of claim 1, wherein the system further comprises a network interface that communicates at least one of real-time and historical information with an outside monitor regarding at least one of cryochamber temperature, apparatus humidity, cryochamber operating status, chosen container unit temperature, chosen container unit location, inventory status, access records, and user security data.

27. The system of claim 1, wherein frost accumulation within the cryochamber is at least partially removed by application of at least one of electrical, pneumatic, or mechanical energy thereto.

28. The system of claim 1, wherein the cryogenically stored materials include at least one of cell therapy based treatments, gene therapy based treatments, and gene modified cell therapy based treatments.

29. A method of cryostorage and manipulation of a plurality of container units, the method comprising:

providing an apparatus including a cryochamber having an access port, a unit holder located inside the cryochamber, a user access area, and a motive grasper;

electrically cooling the cryochamber at cryogenic temperatures;

holding a plurality of container units at the cryogenic temperatures with the unit holder;

responsive to an order by an authenticated user, selectively removing a chosen container unit from the cryochamber through the cryo-access port with the motive grasper;

selectively placing the chosen container unit into the user access area with the motive grasper;

selectively permitting access by the authenticated user to the chosen container unit when the chosen container unit is in the user access area,

selectively occluding the cryo-access port with a cover in a closed position;

selectively moving the cover to an open position to permit access to an interior of the cryochamber via the cryo-access port; and

with the cover in the open position, extending the motive grasper through the cryo-access port and into contact with the chosen container unit.

30. The method of claim 29, including:

removably holding the plurality of container units within the cryochamber via at least one cartridge;

rotatably mounting the at least one cartridge within the cryochamber via a carousel type unit holder; and

selectively positioning the at least one cartridge with the chosen container unit, carried by the at least one cartridge, in operative alignment with the motive grasper via motion of the carousel type unit holder.

31. The method of claim 30, including replacing the at least one cartridge within the cryochamber with a separately provided replacement cartridge during maintenance of the system.

32. The method of claim 30, including selectively permitting access to the cryochamber by an authorized technician for maintenance of the system.

33. The method of claim 29, including:

selectively occluding the cryo-access port with a cover in a closed position;

rotatably mounting the at least one cartridge within the cryochamber via a carousel type unit holder;

selectively moving the cover to an open position to permit access to an interior of the cryochamber via the cryo-access port; and

with the cover in the open position, extending an actuator revolver into the cryo-access port to interface with a feature of the unit holder and thereby rotate the carousel, such insertion of the actuator revolver only occurring during active retrieval of the chosen container unit from the cryochamber.

34. The method of claim 29, wherein electrically cooling the cryochamber at cryogenic temperatures includes maintaining an interior of the cryochamber at cryogenic temperatures during operation via exclusively electrically powered cooling techniques, with no fluid coolant provided to the cryochamber that is not a working fluid for electrical cooling.

35. The method of claim 29, including bringing the chosen container unit into a thawed condition before the authorized user is permitted to access the chosen container unit.

36. The method of claim 35, including selectively moving the chosen container unit from the cryochamber to a warming chamber with the motive grasper, for at least partial warming toward the thawed condition.

37. The method of claim 36, including at least one of selectively physically supporting, mechanically agitating, and electrically heating the chosen container unit with a warming grasper within the warming chamber.

38. The method of claim 29, wherein at least one of selectively removing a chosen container unit from the cryochamber through the cryo-access port with the motive grasper, and selectively placing the chosen container unit into the user access area with the motive grasper includes:

moving at least one grasping arm laterally outward from a central grasper axis to place the motive grasper in an open condition;

orienting the at least one grasping arm in lateral alignment with a predetermined portion of the chosen container unit;

with the at least one grasping arm laterally aligned with the chosen container unit, moving the at least one grasping arm laterally inward toward the central grasper axis into a closed condition to operatively engage the chosen container unit; and

with the motive grasper in the closed condition and operatively engaged with the chosen container unit, moving the motive grasper to relocate the chosen container unit.

39. A method of cryostorage and manipulation of a plurality of container units, the method comprising:

providing an apparatus including a cryochamber having an access port, a unit holder located inside the cryochamber, a user access area, and a motive grasper;

electrically cooling the cryochamber at cryogenic temperatures;

holding a plurality of container units at the cryogenic temperatures with the unit holder;

responsive to an order by an authenticated user, selectively removing a chosen container unit from the cryochamber through the cryo-access port with the motive grasper;

selectively placing the chosen container unit into the user access area with the motive grasper;

selectively permitting access by the authenticated user to the chosen container unit when the chosen container unit is in the user access area;

conveying information to, and receiving inputs from, a user via a user interface of the apparatus; and

actuating at least one of the cryochamber, the unit holder, the user access area, and the motive grasper responsive to the inputs from the user via a control system of the apparatus.

40. The method of any one of claims 29 and 39, wherein the authenticated user is a first authenticated user having a first level of access associated with the apparatus, the method further comprising allowing a second authenticated user, having a second level of access associated with the apparatus, to remotely access at least one of real-time and historical information regarding at least one of cryochamber temperature, apparatus humidity, cryochamber operating status, chosen container unit temperature, chosen container unit location, inventory status, access records, order status for a plurality of orders associated with container units dispensed by the apparatus, billing and prescription information for the plurality of orders, and user security data.

41. The method of any one of claims 29 and 39, including the authenticated user providing authentication information to the system via the user interface as at least one of a biometric identification device, an RFID scanner, and an identification and password.

42. The method of any one of claims 29 and 39, wherein selectively removing the chosen container unit from the cryochamber through the cryo-

access port with the motive grasper occurs only upon determining that the cryochamber contains sufficient inventory to fulfill the order by authenticated user.

43. The method of any one of claims 29 and 39, wherein selectively permitting access by the authenticated user to the chosen container unit when the chosen container unit is in the user access area comprises reauthenticating the authenticated user before permitting ambient access to the chosen container unit.

44. The method of any one of claims 29 and 39, the method further comprising generating, in response to access by the authenticated user to the user access area, at least one of an invoice for a cost of the chosen container unit and documentation certifying a change in ownership of the chosen container unit.

45. The method of any one of claims 29 and 39, the method further comprising generating, in response to removal of the chosen container unit from the cryochamber, at least one of an invoice for a cost of the chosen container unit and documentation certifying a change in ownership of the chosen container
unit.

46. The method of any one of claims 29 and 39, including placing at least one of cell therapy based treatments, gene therapy based treatments,

and gene modified cell therapy based treatments into a selected container unit for cryogenic storage.

47. The method of claim 30, further including the step of shielding the at least one cartridge and the cryo-access port from ambient humid air during the step of replacing the at least one cartridge.

48. The method of claim 29, further including:

conveying information to, and receiving inputs from, the authenticated user via a user interface of the apparatus;

actuating the cryochamber, the unit holder, the user access area, and the motive grasper responsive to the inputs from the authenticated user via a control system of the apparatus;

monitoring the time between notification of access readiness and dispensing access authentication;

preventing such access if said time exceeds a predetermined expiration time limit;

depositing any said access-prevented container units in a waste area within the apparatus; and

notifying the authenticated user of said prevention.

49. The method of claim 29, wherein the producer-supplier of the container units and materials within, retains ownership of the apparatus installed at a user facility and provides at least one of monitoring, maintenance, and stocking services for the apparatus.

50. The method of claim 29, further including the step of transferring ownership of a container unit from the manufacturer to the authenticated user upon removal of the container unit from the cryochamber of the apparatus.

51. The method of claim 29, the method further comprising generating, in response to removal of a chosen unit from the cryochamber, at least one of an invoice for a cost of the chosen container unit and documentation certifying a change in ownership of the chosen container unit.

52. The method of claim 29, wherein inventory below a predetermined level generates a notice to a remote monitor to initiate a refill service.

53. An apparatus for cryostorage and manipulation of a plurality of container units, the apparatus comprising:

a cryochamber including a cryo-access port, the cryochamber being electrically cooled at cryogenic temperatures;

a unit holder located inside the cryochamber and being configured to hold a plurality of container units;

a user access area for selectively permitting access to a chosen container unit by an authenticated user who has been authenticated by the apparatus;

a motive grasper for selectively removing the chosen container unit from the cryochamber through the cryo-access port, and selectively placing the chosen container unit into the user access area, and

wherein the user interface is configured to remotely and/or directly convey information to, and receive inputs from, at least one of an outside monitor and the authenticated user, and a control system configured to actuate at least one of the cryochamber, the unit holder, the user access area, and the motive grasper responsive to the inputs from the authenticated user.

54. The apparatus of claim 53, wherein the plurality of container units is removably held within the cryochamber via at least one cartridge, the unit holder is a carousel, and at least one cartridge is rotatably mounted within the cryochamber via the carousel, the carousel being configured to selectively position the at least one cartridge with the chosen container unit, carried by the at least one cartridge, in operative alignment with the motive grasper.

55. The apparatus of claim 54, wherein an actuator revolver is inserted into the cryo-access port to interface with a feature of the unit holder and thereby rotate the carousel only during the active retrieval of the chosen container unit from the cryochamber.

56. The apparatus of claim 53, wherein an interior of the cryochamber is maintained at cryogenic temperatures via exclusively electrically powered cooling techniques, with no fluid coolant provided to the cryochamber that is not a working fluid for electrical cooling.

57. The apparatus of claim 53, including a housing substantially enclosing the cryochamber, unit holder, user access area, and motive grasper, selectively preventing user access to at least a portion of an interior of the housing, and selectively permitting technician access to at least a portion of the interior of the housing other than the user access area.

58. The apparatus of claim 53, including a network interface communicating at least one of real-time and historical information with an outside monitor regarding at least one of cryochamber temperature, apparatus humidity, cryochamber operating status, chosen container unit temperature, chosen container unit location, inventory status, access records, and user security data.

59. The apparatus of claim 53, wherein a selected container unit contains at least one of cell therapy based treatments, gene therapy based treatments, and gene modified cell therapy based treatments.

60. A system for dispensing cryogenically stored materials, the system comprising:

the apparatus of claim 53;

a user interface that allows an authenticated user to request a chosen container unit; and

a warming chamber that, in response to the request, heats the chosen container unit until a thawed condition is achieved;

wherein the authenticated user can retrieve the chosen container unit which is in the thawed condition, upon providing authentication information to the system; and

wherein the system provides a notification to the user when the thawed condition is achieved.