Claims

1. A robotic system for compounding and preparation of medications comprising non-hazardous drugs, the system comprising: a laminar flow cabinet; and at least one robotic arm; characterized in that the robotic system further comprises at least one ventilated vial adapter (300), the ventilated vial adapter (300) and robotic system configured to allow liquid to be drawn out of a drug vial (16) and inserted into the drug vial (16), said at least one ventilated vial adapter (300) comprising:

a liquid conduit (308) extending at least partially through the at least one ventilated vial adapter (300);

a top part (304) comprising a hollow air chamber (318) at least partially surrounding the liquid conduit (308), said top part (304) further comprising a vent hole (320) configured to allow fluid communication between the hollow air chamber (318) and an exterior of the at least one ventilated vial adapter (300);

a bottom part (302) connected to the top part (304); and

a hydrophobic venting filter (316) positioned between the top part (304) and the bottom part (302).

2. The robotic system of claim 1, comprising: (i) at least two robotic arm assemblies configured to prepare syringes (450) and intravenous (IV) bags comprising a prescribed amount of liquid drug for administration to patients according to their individual prescriptions by moving drug vials to which ventilated vial adapters (300) have been connected and syringes (450) to which connector sections (452) have been connected, within the laminar flow cabinet, (ii) cameras, and (iii) a system processor comprising software comprising imaging process algorithms that are adapted to provide real-time feedback control of all stages of a compounding process.

3. The robotic system of claim 2, wherein the robotic arm assemblies are configured to move in three mutually orthogonal directions.

4. The robotic system of claim 3, characterized in that:

a) the connector sections (452) each comprise one of:

(i) a septum holder (500, 600) comprising two resilient elongated arms (562, 662) that project vertically downwards parallel to each other attached to a side of a body

part (560), each arm (562) having distinctively shaped protrusions (563, 602) on an inner side of distal ends of the arm (562); or

(ii) a securing actuator section (1401) comprising at least one rung formed on an inside wall of the connector section and at least one rotatable gear (1402) comprising sprockets (1404) peripherally arranged around the gear (1402), a void portion (1405) configured to house an anchoring ledge (1223), and a gap (1406) formed in the gear (1402) such that the void portion (1405) is provided with an opening (1203) the orientation of which changes with the rotation of the gear (1402);

b) the ventilated vial adapters (300) each comprise one of:

(i) an upwardly projecting portion (306) comprising a membrane at a proximal end and sockets (604) on an outside proximal end, the sockets (604) having a shape and dimensions configured to match those of the distinctively shaped protrusions (602) on the inner side of the arms (662) of the septum holder (600); or

(ii) an upwardly projecting portion (306) comprising a membrane at a proximal end and anchoring ledges (1223) on an outside proximal end, the anchoring ledges (1223) having a shape and dimensions configured to pass through the gap and fit into the void portion (1405) in the gear (1402) of the securing actuator section (1401) of the connector;

thereby allowing the connector sections to be connected only to drug vials connected to ventilated vial adapters comprising compatible sockets or anchoring ledges on an outside surface.

5. The robotic system of claim 4, wherein the distinctively shaped protrusions (602) are on an outside of the upwardly projecting structure (306) of the vial adapter and the matching sockets (604) are on the inner side of the arms (562, 662) of the septum holder (500, 600) in the connector section (452).

6. The robotic system of claim 4, comprising a spike adapter (700) configured for connection to an intravenous (IV) bag, the spike adapter comprising:

a) a body (762) terminating in a spike element (764) at a proximal end of the body (762), the spike element (764) comprising separate liquid and air channels (774, 776);

b) a standard port (766) for connecting an infusion set at a distal end of the body (762), the standard port (766) in fluid communication with the air channel (776) in the spike element (764); and

c) a longitudinal extension (768) connected substantially at right angles to the body (762), a proximal end of the longitudinal extension (768) comprising a membrane (772) and configured to be coupled with the connector section (452), and the longitudinal extension (768) comprising a liquid channel in fluid communication with the liquid channel (774) in the spike element (764);

the spike adapter (700) characterized in that the longitudinal extension (768) comprises one of: (i) a socket (604) having a shape and dimensions configured to match those of the distinctively shaped protrusions (563, 602) on the arms (562, 662) of the septum holder; or (ii) anchoring ledges (1223) having a shape and dimensions configured to pass through the gap and fit into the void portion (1405) in the gear (1402) of the securing actuator section (1401) of the connector section; thereby allowing the spike adapter (700) to be connected only to the connector section (452) of claim 4.

7. The robotic system of claim 4, wherein the cameras and software are configured to recognize the sockets (604), the protrusions (563, 602), the gaps (1406), the void portions (1405) and the anchoring ledges (1223) and to warn a user if wrong components are introduced into the cabinet; and, the robotic arm assemblies comprise mechanical features to insure that only components compatible with an open transfer system are being used.

8. The robotic system of claim 3, wherein the robotic arm assemblies configured to pick up, move, and release syringes comprise special mechanisms to grip the connector and the syringe in varying orientations and the system comprises software configured to deal with various syringes and various orientations, identifying them and reading the right dosage; thereby allowing the system to use conventional syringes from various manufacturers and various shapes and dimensions.