CASSETTE ASSEMBLY AND UNIT DOSE MEDICATION CART USING THE CASSETTE ASSEMBLY

Inventors: Robert R. Steele, Sweet Valley, PA (US); David R. McGovern, Lake Winola, PA (US); David A. Reppert, Kingston, PA (US)

Assignee: INTERMETRO INDUSTRIES CORPORATION, Wilkes-Barre, PA

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ABSTRACT
A medication cart also holding at least one drawer or tray and at least one bin supported on the tray containing an array of drawers and bins, and a multi-level cassette assembly. An internal locking mechanism secures the cassette assembly when it is positioned in the medication cart, and an external locking mechanism secures the cassette assembly outside of the medication cart. In addition, the cassette assembly includes a mechanism that selectable provides access to an entire tray and all bins carried in it at one time or that provides access to single bins carried on the tray one at a time. This mechanism, more particularly, (a) permits a tray to be nearly fully withdrawn from the cassette assembly thereby exposing a major portion of all carried bins to access all of their contents, and (b) permits the tray to be only partially withdrawn from the cassette assembly so that only a minor portion is exposed but such that each bin can independently be removed from the tray one at a time to access its contents.
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CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to, and the benefit of, U.S. Provisional Patent Application No. 60/650,529, filed Feb. 8, 2005, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The invention relates generally to a mobile cart for storing and transporting items, and more particularly to a medication cart featuring a cassette assembly ideally suited for storing and dispensing medication.

[0004] 2. Description of the Prior Art

[0005] Mobile medication carts for storing medicinal-related patient supplies have been used for many years. Medication carts are typically used in hospitals or other health care facilities, and are wheeled from room to room transporting, for example, medication to be dispensed to patients.

[0006] Two well-known medication carts are manufactured by Drutar® and Artromick Int'l®. Both medication carts use a cart frame supported on casters and are designed to receive an array of drawers, multi-level cassettes, shelves, etc. Each level of the cassette contains a plurality of pull-out bins, with the bins on different levels sometimes varying in size (i.e., width). Both medication carts also provide locking systems for securing the medication and other items in the cart.

[0007] In addition, Artromick Int'l® offers a patented drawer slide module, which is the subject of U.S. Pat. No. 5,211,461, for use with their medication cart.

[0008] InterMetro Industries Corporation, a company related to the assignee of the subject application, also manufactures and sells medication carts. In one type of mobile cart, known as the METOFLEX® cart, two interlocking side/bottom panels are joined together to form the lateral sides and bottom of the cart and a back panel is secured to the side/bottom panels. A top portion is added to complete a 3-sided enclosed cart. The interior sides of the cart are corrugated to support an array of differently sized drawers and bins, and shelves or other accessories can be provided on the outer sides of the cart. The METOFLEX® cart is the subject of U.S. Pat. No. 5,016,948, No. 5,673,983, and No. D 323,915.

[0009] In U.S. Pat. No. 5,673,983, also assigned to the assignee of the present inventors, a cassette assembly is described that includes a cassette tray designed to be partially withdrawn. In this regard, Prior Art FIG. 14 shows a cassette tray with a block 158 on the underside of a horizontal ledge 146. The block interfaces with a notch in a frame of the cassette assembly to indicate a normal stop position. At this stop position, the cassette tray is partially withdrawn, and individual bins 22 in the tray become accessible by lifting a bin over a vertical lip of the tray and sliding it out. U.S. Pat. No. 5,673,983 (the "’983 Patent") is incorporated herein in its entirety by reference.

[0010] However, further improvements in medication carts are desired. For example, it is desirable to provide a medication cart such as that disclosed in the ’983 Patent, having increased versatility. In particular, it is desirable to provide a cassette assembly for use with such a cart that permits selection between accessing a full cassette tray and all of the bins carried by it at one time or individual bins on a cassette tray one at a time.

SUMMARY OF THE INVENTION

[0011] It is a principal object of the present invention to provide an improved cassette assembly for use in a medication cart.

[0012] More particularly, it is a principal object of the present invention to provide a cassette assembly for a medication cart of the type disclosed in the ’983 Patent, that can selectively provide access to a full tray and all bins carried in it at one time or that can provide access to single bins carried in the tray one at a time. This object is achieved by providing a mechanism that selectively (a) permits a tray to be nearly fully withdrawn from the cassette assembly thereby exposing a major portion of all of the carried bins to access all of their contents or (b) permits the tray to be only partially withdrawn from the cassette assembly so that only a minor portion of each bin is exposed but such that each bin can independently be removed from the tray one at a time to access its contents.

[0013] Thus, in accordance with one aspect of the invention, a cassette assembly comprises a frame for supporting at least one cassette tray, at least one tray slidably supported in the frame, and at least one bin received in the cassette tray. Locking means can secure the cassette tray in the frame. A cassette tray limiting device limits sliding movement of the cassette tray out of the cassette assembly so that only a minimal portion of the bin is exposed. However, the bin and tray are configured so that any one bin can nevertheless be removed from the tray independently of other bins. An actuator actuates the cassette tray limiting device.

[0014] In accordance with another aspect of the invention, a cassette assembly comprises frame means for supporting at least one cassette tray, the frame means including side panels with corrugated interior surfaces and ribbed outer surfaces. At least one cassette tray is slidably supported in the frame means on the corrugated interior surfaces. At least one bin is received in the cassette tray, and locking means can secure the cassette tray in the frame. In addition, the cassette assembly includes means for limiting the sliding movement of the cassette tray, and actuating means for actuating the means for limiting the sliding movement of the cassette tray.

[0015] In accordance with yet another aspect of the invention, a cart comprises an enclosed structure including a plurality of support posts, at least two side walls supported between the support posts, each side wall having a corrugated interior surface, a bottom platform supporting the support post and the side walls and a top platform fitting over the support posts and the side walls. In addition, a cassette assembly is removably supported in the enclosed structure. The cassette assembly includes a frame for supporting at least one cassette tray, the frame including side
panels with a corrugated interior and ribbed outer surfaces, with the ribbed outer surfaces engaging with the corrugated interior surface of the side walls. At least one cassette tray is supported in the frame; at least one bin is received in the cassette tray; and locking means secures the cassette tray in the frame. In addition, a cassette tray limiting device limits the sliding movement of the cassette tray, and an actuator actuates the cassette tray limiting device.

These and other objects, aspects, features and advantages of the present invention will become apparent from the following detailed description of the preferred embodiment taken in conjunction with the accompanying drawings.

**BRIEF DESCRIPTION OF THE DRAWINGS**

**FIG. 1** is a perspective view of a medication cart in accordance with the '983 Patent that can incorporate an improved cassette assembly utilizing the present invention;

**FIG. 2** is a perspective view of a support post forming a part of that cart;

**FIG. 3** is a top plan view of the support post shown in **FIG. 2**;

**FIG. 4** is a fragmented partial view of **FIG. 3**, isolating a slot in the support post;

**FIG. 5** is a perspective view of a frame assembly forming a part of the cart shown in **FIG. 1**;

**FIG. 6** is a perspective view of a modified interior side panel for use in the frame assembly shown in **FIG. 5**;

**FIG. 7A** is a fragmented top plan view of a support post in use in a back corner of an enclosed structure for the cart of **FIG. 1**;

**FIG. 7B** is a three-axis coordinate system and a schematic view of a side panel used in the cart of **FIG. 1**;

**FIG. 8** is a fragmented top plan view of a support post in use in a front corner of the enclosed structure;

**FIG. 9** is a perspective view of a multi-level cassette assembly generally in accordance with the present invention;

**FIG. 10** is a perspective view of a top or bottom component of the cassette assembly;

**FIG. 11** is a perspective view of a right side panel of the cassette assembly;

**FIG. 12** is a perspective view of a left side panel of the cassette assembly;

**FIG. 13** is a perspective view of a cassette tray used in the cassette assembly;

**FIG. 14** is a partial perspective view of the underside of the right side of the cassette tray shown in **FIG. 13**, configured in accordance with the prior art as described in the '983 Patent and in accordance with the present invention;

**FIG. 15** is a perspective view of a cassette bin that may be carried in a cassette tray;

**FIG. 16(A)** is a partial perspective view of the right side panel and part of an external locking mechanism for the cassette assembly;

**FIG. 16(B)** is a partial front elevational view of a locking bar shown in **FIG. 16(A)**;

**FIG. 16(C)** is a cross-section of the locking bar shown in **FIG. 16(B)**;

**FIG. 17** is an exploded perspective view of an improved multi-level cassette assembly in accordance with the present invention, which provides the advantages noted above;

**FIG. 18** is a perspective view of a left side panel of the cassette assembly depicted in **FIG. 17**;

**FIG. 19** is a partial perspective view of the underside of the left side of the cassette tray shown in **FIG. 13** and in accordance with the present invention; and

**FIG. 20** is a partial perspective view of the right side of the underside of the tray shown in **FIG. 13**.

**DESCRIPTION OF THE PREFERRED EMBODIMENTS**

**FIG. 1** illustrates a medication cart **10** in accordance with the present invention that is constructed generally as described in U.S. Pat. No. 5,673,983 (the "'983 Patent"). While this structure is known from that patent, it is useful to describe it here as background. **FIG. 1** to **16** are essentially taken from the '983 Patent to provide such background.

Generally, the cart includes a frame assembly **12** supported on casters **14**. A plurality of drawers **16** of various sizes (i.e., depths) are slidably supported in the frame assembly, and hinged side pods **18** are supported on the sides of the cart to swing out toward the front as disclosed in the '983 Patent.

The medication cart features a cassette assembly **20** that includes a plurality of pull-out cassette trays provided on different levels, each of the trays being configured to carry a plurality of individual bins. In accordance with the subject invention, the medication cart includes a security system for preventing unauthorized access to the drawers and the cassette trays and bins, and the cassette assembly includes its own security system for securing the trays and bins even when the cassette assembly is not in the cart. Further, as will be described in detail below, the cassette assembly incorporates a mechanism that selectively permits all of the bins in one tray to be fully accessed at one time or each of the trays to be accessed individually one at a time while the remaining trays stay substantially concealed in the cassette assembly. (It is to be understood that the cassette assembly of the present invention is described as a part of a larger medication cart. However, the principles of this invention may be used with equal advantage in a stand-alone cassette assembly.)

Initially the basic cart structure will be described.

Details of the frame assembly **12** are shown in **FIGS. 2** through **8**. The frame assembly is based on a platform system using a plurality of flanged support posts and side panels.
A support post 30 in accordance with the subject invention is illustrated in FIGS. 2, 3 and 4. The support post 30 is generally comprised of an interior post 32 and a plurality of radially extending, equally spaced flanges 34. The post is designed to be vertically disposed in normal use and can be supported at its lower end by a base platform, a foot, a caster, etc. In a single-wide platform, which is preferred for the medication cart, four support posts are used together to provide corner supports for the frame assembly.

The interior post 32 is preferably tubular in shape, with a circular cross-section and interior 36 and exterior 38 concentric wall surfaces as best seen in FIGS. 2 and 3. The flanges 34 preferably extend along the entire longitudinal length of the interior post. In addition, the flanges and interior post are preferably formed by conventional extrusion techniques to form an integral structure made of, for example, aluminum. However, other comparable means, e.g., pultrusion, roll-formed steel, could be used to form the support post in accordance with the subject invention.

The flanges 34, or dovetails, are preferably spaced equi-distant from each other around the periphery of the interior post 32 to create a symmetrical support post. Thus, four flanges would be spaced at 90° intervals around the post. Although using four flanges is preferred because of the versatility such an arrangement provides, the number of flanges is arbitrary and can vary without departing from the scope of the invention. With reference to FIG. 3, each flange has a first portion 40, which extends radially from the interior post 32. At the terminal end of each first portion is a transversely-disposed second portion 42. The second portions are formed with arcuate outer surfaces 44, that together outline a circumference that is concentric with the interior 36 and exterior 38 wall surfaces of the interior post 32. Referring to FIG. 2, the outer surfaces 44 of each flange are formed with a series of equally spaced circumferential grooves 46. The vertically-spaced grooves are desirably provided along the entire longitudinal length of the flanges. In one embodiment, the outside diameter of the support post, as defined by the arcuate outer surfaces 44, is 1.625" and the inside diameter is 0.875".

A slot 48 is formed between each pair of adjacent flanges 34. Because of the arcuate shapes of the exterior wall surface 38 and the flanges, the slots can be described as substantially concave T-shaped, with respect to a longitudinal axis of the support post. With reference to FIG. 4, each slot is shaped to have concave-shaped opposite end surfaces 50 and 52. The exterior wall 38 forms a convex interior surface of the slot. The contour of the end surfaces and outer wall form a slot that is simple in design but provides maximum flexibility and support. In addition, the curved single-wall design of the flanges makes extrusion easier, is readily cleanable and allows the support posts to be aesthetically integrated into the finished structure as will be discussed in detail below.

The frame assembly 12 in FIG. 5 is built on a single-wide platform constructed of four support posts 30. In this embodiment, the support posts support two exterior side panels 54 and a back panel 56 (unseen in FIG. 6). In addition, interior side panels 58 are disposed side-by-side adjacent to the exterior side panels 54. Top and bottom platforms 60 and 62, respectively, complete the frame assembly. The top platform houses a mechanical locking mechanism 64 and an electronic controller 66, both used for operating a security system that will be described in detail below. The completed structure forms a 3-sided enclosed frame assembly, with the front side, or fourth side, open to receive an array of drawers, shelves, cassette assemblies or other accessories. The horizontal corrugations are uniformly spaced in the vertical direction. Small, semicircular openings 72 can be seen in the lateral front face of the interior side panel immediately below the end of each corrugation. The openings extend to the underside of each corrugation but cannot be seen in this view. The openings allow locking fingers, which will be positioned in each corrugations, to move in and out of the corrugations as part of the security system that will be discussed below. Openings can also be provided along the right-hand side of the interior panel 58 for the same purpose.

The top and bottom platforms 60 and 62 are preferably formed of a metal frame fitted with a plastic cover. As shown in FIG. 5, the top platform has a substantially rectangular shape for fitting over the four support posts 30. The bottom platform 62 is preferably designed, at least in a single-wide platform, to have a “C”-shape formed to have two extending legs 74 defining an open front portion 76. By cutting out the front portion of the bottom platform, the overall appearance of the cart is enhanced, especially when drawers or other accessories are not disposed in the lower part of the cart.

Both top and bottom platforms can be secured to the support posts by using threaded plugs (unshown) that are force-fitted, for example, in opposite ends of each support post and threaded fastening means fed through the top and bottom platforms and into the plugs. In assembling the enclosed frame assembly, each support post is positioned on the base platform fitted with its cover, and a threaded bolt or other fastener is inserted through a hole in the platform from the underside and into engagement with the threaded plug. The side panels are then top loaded into the support posts. Threaded fasteners are inserted through the metal frame of the top platform and into the plugs at the top ends of the support posts. Finally, the top cover is fitted over the top platform. Of course, other comparable means for securing the platforms to the support posts could be used.

In the single-wide platform design as discussed above, the enclosed frame assembly preferably has one support post 30 positioned at each of four corners. In this design, the support posts are spaced, for example, 19.841 from center to center. Of course, the spacing of the posts is arbitrary and can be varied to construct different size and shaped structures. A “double-wide” design platform includes, in addition to four corner posts, a rear center post and, in an enclosed frame assembly, a front center post.

A slightly modified interior side panel 58 is shown in FIG. 6. The modified side panel 58 differs from the side panel 58 only in that each corrugation 70 is formed in two halves to define a dividing slot 74 that runs the vertical length of the side panel. The modified panel can be used in a two-sided enclosed structure, i.e., a dual access cart, whereby the front and back are open to receive, for example,
a cassette assembly or drawers. In a dual access cart, a thin, flat panel (unshown) can be secured in the dividing slot 74 for dividing the interior of the frame assembly in half.

[0055] A recessed opening, or pocket, 76 in the lower part of the interior surface 68 and pockets 78 in the back of the interior side panel 58 (and 58) are provided to house various components of a security system. Offset lateral ends, or edges, 80 of the interior panel are received in slots 48 in the support posts as discussed below to secure the side panel.

[0056] All of the side panels can be made of a polymer material, e.g., polyethylene, and are preferably blow molded or formed by other comparable means to form a hollow, two-faced structure. The interior side panels 58 are also compression molded in part as discussed below.

[0057] FIGS. 7A and 8 are top views of the support posts 30 engaging side panels in accordance with the present invention. As discussed above, the side panels are top-loaded into the slots 48 of the support posts and rest on the bottom platform, or base, 62.

[0058] FIG. 7A is a partial top view of the support post 30 in use as a right rear support (with reference from the front side of the cart). Clockwise in this figure, the support post 30 secures an interior side panel 58, a back side panel 56, a blank extrusion 80 and an exterior side panel 54. The blank extrusion 80 is essentially a linear trim piece of molded plastic, preferably extending the length of the support post, that is inserted into an empty slot 48 for aesthetic purposes, i.e., to provide a finished look to the enclosed structure.

[0059] As FIG. 7A shows, each side panel is shaped to have a neck portion 82 and a head portion 84 forming each lateral end for engagement in the support post. The head portion is shaped to compliment the shape of the slots 48. In addition, each neck portion is offset from its respective panel. Using the exterior side panel 54 in FIG. 7A as an example, and using the coordinate system in FIG. 7B as a reference, the side panel has a longitudinal axis A running in the heightwise direction (in the Z-axis direction), a lateral axis B in the widthwise direction (Y-axis) and an orthogonal axis C representing its depth (X-axis). Axis C is orthogonal to both axes A and B. Likewise, the head portion 84 has its own longitudinal axis E, lateral axis F and orthogonal offset axis G. In accordance with the subject invention, the offset axis G of the head portion is transverse to the lateral axis B of the panel. In this manner, a contour fit is achieved between the panels and the support posts. As will also be appreciated, lateral axes M of the flanges 34 extend in directions either parallel with or perpendicular to the lateral axes (axis B) of the panels they secure. This arrangement allows the support posts to be visually integrated into the structure and provide a clean, aesthetically-pleasing appearance.

[0060] FIG. 8 illustrates a support post 30 in use as a right front support in an enclosed structure. In FIG. 8, the slots 48 in the support post 30 receive an exterior side panel 54, an interior side panel 58 and a blank extrusion 80 in the same manner as described above in FIG. 7A. In the remaining slot is secured a drawer-abutting extrusion 86 for abutting, e.g., a drawer 16 that is slidably received in the enclosed frame assembly. As discussed in detail below, the drawer is provided with a surface, e.g., one or more ribs, that is slidably supported on the corrugated surface 68 of the interior side panel 58. As shown in FIG. 8, the drawer-abutting extrusion 86, which is preferably a resilient plastic, includes an abutting face 88 for contacting the fully closed drawer and a locking face 90 for contacting a part of the drawer and preventing it from being accidentally pulled out.

[0061] A multi-level cassette assembly 20 in accordance with the invention of the ’983 Patent is shown generally in FIG. 9. This cassette assembly is provided with improved features as will be described in greater detail below. It includes a frame 102 formed by a top component 104, which includes a handle 106, a plurality of side panels 108, a bottom component 110 and a back panel (unshown). The bottom component has essentially the same configuration as the top component but does not include a handle. An isolated view of the top (or bottom) component 104 is provided by FIG. 10.

[0062] The multi-level cassette assembly supports a cassette tray 112 on each level, and each cassette tray contains a plurality of pull-out cassette bins 22. A lock 114, which is part of an external locking mechanism, is secured in a front face of the top assembly. While the cassette assembly in this figure provides three levels, the number of levels (which corresponds to the number of cassette trays) can of course vary without departing from the scope of the invention. The components comprising the cassette assembly are preferably made of a polymer plastic, e.g., ABS, and can be formed by conventional molding techniques.

[0063] The side panels 108 are shown in detail in FIGS. 11 and 12, with FIG. 11 illustrating a right side panel for use on the right-hand side of the cassette assembly and FIG. 12 showing a left side panel for use on the left-hand side of the cassette assembly. A single right and left side panel are used for each level of the cassette assembly. Each side panel is preferably an integrally formed piece of molded plastic.

[0064] With reference first to FIG. 11, the side panel includes a lateral face 116 formed with two elongated ribs 118. The ribs are shaped to complement the corrugated surface of the interior side panels 58 as discussed above so that the cassette assembly can be slid into the frame assembly to be supported thereby. At the front of each rib 118 is an open slot 119 for receiving a component of the security system which will be described below. The top and bottom edges of the side panel are provided with a plurality of male/female connectors 120/122 for snap-fitting the side panel to other side panels or top or bottom components when assembling the cassette assembly. The male connectors 120 are best seen in FIG. 12.

[0065] At the rear end of the side panel is formed a U-shaped panel interface 124 for receiving the flat back panel of the cassette assembly. A front edge 126 of the side panel is formed to have both an elongated slot 128 and a through-hole 130 running through it. The slot receives part of the external locking mechanism that will be described below. A hollow rod (unshown) made of, for example, aluminum is inserted through the hole and stabilizes the assembled cassette frame.

[0066] FIG. 12 best illustrates the corrugated interior surface of the side panel. Corrugations 132 form a slot 134 therebetween for receiving the cassette tray 112. Elongated recesses 136 formed in the corrugations interface with the cassette tray in a manner described below.
[0067] To assemble the frame, the side panels are snap-fitted together using the male and female connectors to provide as many levels as desired. The formed left and right sides can then be snap-fitted to the bottom component and a back panel can be fit into the panel interfaces in the side panels and into a portion of the bottom component. Hollow rods can then be loaded into the elongated holes 130 in both right and left side panels, and the external locking mechanism is positioned in the elongated slot in the right side panels. The top component can now be placed on the side walls. Screws or other fasteners are then inserted through holes 131 in the top and bottom components and into threaded ends of the hollow rods to complete the assembly.

[0068] The cassette tray 112 that is received in each level of the cassette assembly is shown in FIGS. 13 and 14. With reference to FIG. 13, as seen from the top and right, the cassette tray is formed to have a flat bottom surface 138 surrounded on three sides by a vertical edge 140. At the front of the tray is a front face 142 which provides a small lip 144 at the front edge of the bottom surface 138. The edges on the left and right sides of the tray extend into horizontal ledges 146 for resting on the corrugations 132 in the side panels 108 of the cassette assembly frame. A channel 148 with a notched portion 150 is formed at the front part of the ledges. The notched portion is part of an internal locking assembly and will be engaged by a locking finger to secure the tray in the cassette assembly frame.

[0069] FIG. 14 shows a portion of the underside of the cassette tray as seen from the bottom and right, and illustrates a flexible latch 152 that forms part of the external locking assembly. The latch is cantilevered from the front face and includes, at its free end, an abutting face 154 and a sloping, or angled, face 156. The sloping face allows the latch to flex upwardly when receiving a horizontal force. A small block 158 located beneath the notched portion 150 will interfere with the recess 136 in the corrugation 132 and indicate a normal stop position of the cassette tray as it is withdrawn from the frame.

[0070] The cassette tray 112 supports a plurality of bins 22 as shown in FIG. 9. The size (i.e., width) of the bins can be varied to best fit the end-user's needs. For example, FIG. 9 shows a cassette assembly with 6 bins supported on the top level, 4 bins supported on the middle level and 3 bins supported on the lower level. An individual bin 22 is illustrated in FIG. 15.

[0071] As can be seen there, each bin has a front end 160 that includes a front wall 163 and a hollow downwardly open finger pull 166 formed on the front wall 163. The bin can be supported on a cassette tray 112 again shown in FIG. 13 with its bottom 165 resting on the bottom surface 138 of the tray and the front wall 163 below the finger pull 166 loosely abutting the lip 144 on the tray. The bin has a length that is substantially equal to the distance between the lip 144 and the opposing back vertical edge 140 of the tray 112. Accordingly, engagement of the front wall 163 of the bin with the lip 144 of the tray prevents the bin from being withdrawn from the tray in a direction parallel to the tray bottom surface 138. Moreover, the bins and trays are dimensioned so that when a tray is fully inserted in the cassette assembly in a retracted position, a bin is obstructed by an upper adjacent tray or in the case of the top most tray by top of the cassette from being withdrawn from the supporting tray.

[0072] However, when a tray is withdrawn from the cassette assembly to a withdrawn position, a pin may be pivoted upwardly about its rear bottom edge on the bottom tray surface 138 to permit the bin front wall 163 to clear the tray lip 144 so that it can be removed from the tray.

[0073] FIGS. 16(A)-16(C) show additional components of the external locking assembly. This locking assembly is designed to lock the cassette trays 112 when the cassette assembly is removed from, i.e., external, to the medical cart, hence the name “external locking mechanism.” An internal locking mechanism in the frame assembly secures the cassette trays when the cassette assembly is inserted in the medication cart.

[0074] With reference to FIG. 16(A), a bolt lock 168, which is mounted in the top assembly 104 as shown in FIG. 9, actuates a saw-tooth locking bar 170 to operate the external locking assembly. The bolt lock, which is conventional per se, includes a locking barrel 172 and an extended T-bolt 174 that moves in and out of the barrel when a key is inserted into the lock barrel and turned 180°. Bolt locks manufactured by the HURD LOCK Co. (H75N and H75C series), in Greeneville, Tenn., have been successfully used in the external locking assembly. Comparable assemblies besides the bolt lock could be used to actuate the locking bar without departing from the scope of the invention. A pin 176 extends from the T-bolt and engages an angled slot 178 in the flag-shaped top portion 180 of the locking bar 170. A vertical slot 182 in the top portion interfaces with the top assembly 104 to vertically guide the locking bar.

[0075] A partial front view of the locking bar 17 is shown in FIG. 16(B). The locking bar is preferably formed from metal, e.g., steel, and is shaped to include an elongated bar 171 and at least one locking tooth 184. A relief 173 is shown at the lower end for metal forming purposes (i.e., to prevent the metal from cracking as it is bent). Another relief for the same purpose is provided toward the upper end of the elongated bar 171. The elongated bar 170 is formed, e.g., to have an I-shaped cross-section as evident in FIG. 16(C). A first leg 173 of the bar fits in elongated slot 128 in the side panels. Only one locking bar is normally provided in each cassette assembly and usually disposed in the side panels. A plurality of the teeth 184 is evenly spaced along the length of the locking bar. One tooth is preferably provided for each side panel and moves, with actuation of the locking bar, in and out of a locking position. In the locking position the tooth 184 is substantially even with the lower corrugation 132 (i.e., the bottom of the slot 134).

[0076] FIG. 16(A) shows the locking bar in the up, or locked, position, whereby the tooth 184 will engage the latch 152 on the underside of the cassette tray. In this position, engagement between the tooth and the abutting face 154 of the latch will prevent the cassette tray from being withdrawn from its retracted position in the cassette assembly to its withdrawn position.

[0077] If the cassette tray is already withdrawn when the external locking assembly is actuated, the shape and flexibility of the latch permit the tray to be inserted into the cassette assembly frame and subsequently locked. When inserting the tray, the flexible latch will flex upwardly when the sloping face 156 slides over the tooth, thus allowing the drawer to be inserted and locked.

[0078] To unlock the cassette assembly, the bolt is actuated to move the T-bolt and thus the pin 176 in the direction
of arrow x. This sliding movement forces the locking bar downward through a camming action between the pin and the angled slot 178. In the down position, the cassette tray is free to slide in and out of the cassette assembly frame with the tooth 184 located low enough to permit the latch 152 and its abutting face 154 to pass over it.

[0079] The external locking assembly has been disclosed in terms of locking the cassette trays. As will be appreciated, however, locking the cassette trays effectively locks the bins and prevents access to the contents therein. By virtue of the vertical lip 144 on the cassette tray 112 and the close fit between the structure immediately above the bins, i.e., either the front face of another cassette tray or the top assembly, the individual bins cannot be withdrawn unless the cassette tray is slid out a sufficient amount, e.g., one inch, such that the bin can be lifted over the vertical lip and then slidably withdrawn. Thus, by preventing the cassette tray from being withdrawn, the bins can be securely locked.

[0080] Details of a drawer assembly for use in the medication cart are provided in the '983 Patent.

[0081] An improved multi-level cassette assembly 350 in accordance with the present invention is shown in an exploded view in FIG. 17. As with the multi-level cassette assembly 20 shown generally in FIG. 9 of the improved cassette assembly is formed by a top component 104, which includes a handle 106, a plurality of corrugated side panels 108, a bottom component 110 and a back panel 352.

[0082] The multi-level cassette assembly 350 supports a cassette tray 112 on each level, and each cassette tray may contain a plurality of bins 22. A lock 114, which is part of an external locking mechanism, is secured in a front face of the top assembly in the same manner as discussed above. While the cassette assembly in this figure provides three levels, the number of levels (which correspond to the number of cassette trays) can of course vary without departing from the scope of the invention. The components comprising the cassette assembly are preferably made of a polymer plastic, e.g., ABS and can be formed by conventional molding techniques.

[0083] The multi-level cassette assembly 350 depicted in FIG. 17 features a selection mechanism 351 for controlling the sliding action of each cassette tray to permit it to selectively assume one of two positions when unlocked. These are a position with each cassette tray nearly fully withdrawn to a withdrawn position, from the retracted position, in the assembly to expose a major portion of the interiors of all bins at the same time, and a partially withdrawn or intermediate position with only a minor portion of each bin exposed, which nevertheless permits each bin to be removed from the tray one at a time. The exploded view of the multi-level cassette assembly 350 shows the components of this selection mechanism, which can be substantially the same mechanical arrangement as the lock and locking bar on the right-hand side of the cassette assembly. When the selection mechanism is in a first position, each cassette tray can be partially withdrawn to the intermediate position. In this position, each individual bin can be accessed by lifting it over the front lip of the tray and withdrawing the bin completely.

[0084] When the selection mechanism is in the withdrawn position, the cassette tray can be nearly fully withdrawn, and direct access to all of the bins in the tray is provided. [0085] The selection mechanism will be described below. First, however, the basic structure of the cassette assembly will be described. The multi-level cassette assembly depicted in FIG. 17 also has levers 368 and 370 mounted in the front face of the top assembly. Levers 368 and 370 each connected to a latch 372 and are each biased by springs (unshown) to urge the latches 372 outwardly. Each latch 372 engages with a slot (unshown) in side panel 58 of the frame assembly. When a latch 372 is engaged with the slot in opposing side panels, the cassette assembly is secured in the medication cart 10. Sliding the levers together against the bias of the springs loads the springs and retracts each latch 372 toward the interior of the cassette assembly. The latches 372 are then disengaged from the slots in the side panel 58, allowing the cassette assembly to be removed by being slid out from the medication cart 10. Similarly, when cassette assembly is to be placed in the medication cart, urging levers 368 and 370 together allows the cassette assembly to slide into place in the medication cart. Releasing the levers allows the latches 372 to engage the slots in side panels 58, securing the cassette assembly in place.

[0086] The side panels 108 of the cassette assembly are shown in detail in FIGS. 11 and 18, with FIG. 11 illustrating a right side panel for use on the right-hand side of the cassette assembly and FIG. 18 showing a left side panel for use on the left-hand side of the cassette assembly. A single right and left side panel are used for each level of the cassette assembly. Each side panel is preferably an integrally formed piece of molded plastic.

[0087] With reference to FIG. 11, the side panel includes a lateral face 116 formed with two elongated ribs 118. The ribs are shaped to complement the corrugated surface of the interior side panels 58 as discussed above. At the front of each rib 118 is an open slot 119 for receiving a component of the security system discussed above. The top and bottom edges of the side panel are provided with a plurality of male/female connectors 120/122 for snap-fitting the side panel to the other side panels or to the top or bottom components when assembling the cassette assembly. The male connectors 120 are best seen in FIG. 55.

[0088] At the rear end of the side panel is formed a U-shaped panel interface 124 for receiving the flat back panel of the cassette assembly. A front edge 126 of the side panel is formed to have both an elongated slot 128 and a through-hole 130 running through it. The slot receives part of the external locking mechanism that was described above. A hollow rod (unshown) made of, for example, aluminum is inserted through the hole and stabilizes the assembled cassette frame.

[0089] FIG. 18 best illustrates the left side panel of the multi-level cassette assembly 350. Ports corresponding to parts of the left side panel depicted in FIG. 12 are indicated with the same label numbers and a discussion of them is not provided herein. A front edge 126 of the side panel is formed to have both an elongated slot 374 and a through-hole 130 running through it. The slot receives the selection rod of the selection mechanism that was described above.

[0090] The selection mechanism comprises a saw-tooth selection bar 366 that has substantially the same features and characteristics as the saw-tooth locking bar 170 described above and depicted in FIGS. 16(B) and 16(C). The selection bar is actuated by rotation of a toggle 354 shown in FIG. 17,
the body of which is secured to the cassette assembly by a nut 356. A bolt 358 is attached to the toggle 354 by a screw 360. A pin 362 on the bolt 358 engages slot 364 of the selection bar. As the toggle 354 is rotated 90°, the pin rotates correspondingly, causing the selection bar 366 to move up or down in a vertical direction. As will be appreciated, the toggle 354 can be replaced by a key-operated lock like the lock 114, because the internal components are the same.

[0091] FIG. 19 depicts an underside of the cassette tray and illustrates a small block or stop 376, which depends upon the ledge 146 and forms part of the selection mechanism. When the selection mechanism is in the position which provides single bin access, namely when the selection bar is moved to its first upper position by the toggle, a saw-tooth of the selection bar will interfere with the block 376 allowing the cassette tray 112 only to be partially withdrawn but preventing the tray from being fully withdrawn. In other words, the position of the block 376 defines a short stop position of the cassette tray when the selection mechanism is in the up or single bin access position. The small block 376 is positioned such that it does not enter the slot 134, and thus, will not interfere with recess 136 in the corrugation 132.

[0092] In the first or single bin access position, the selection mechanism permits the tray only to be partially withdrawn from the cassette assembly so that only a minor portion of each bin is exposed. However, dimensions of the lip 144 of the tray and the front wall 163 of the bin, and the inter-tray spacing are determined so that each tray can independently be pivoted or tilted, as described with reference to FIGS. 13 and 15, clearing the wall 163 from the lip 144 and permitting the bin to be withdrawn to expose it completely. Therefore, in this selected intermediate or single bin access position each tray is accessible individually while the remaining trays remain largely inaccessible and in place on the tray.

[0093] When the selection mechanism is in the second position, the selection bar does not engage the block 376, and the tray can be fully withdrawn to the withdrawn position thereby exposing the interiors of all bins simultaneously. A lip 380 of the tray (shown in FIG. 17) will interfere with a small block (not shown) on the underside of corrugation 132 of the side panel and indicate a normal stop position of the cassette tray as it is withdrawn from the frame.

[0094] FIG. 20 depicts an underside of the cassette tray. As can be seen in this figure, the cassette tray in this embodiment does not include a block corresponding to block 158 on its right-hand side to regulate movement.

[0095] Thus, what has been described is a medication cart that includes an improved cassette assembly. The cassette assembly includes its own external locking assembly for securing its contents when disposed outside of the medication cart. The cassette assembly is also provided with a selection mechanism for selectively permitting positioning of a tray carried therein in either a single bin access position or in an all tray access position.

[0096] Although specific embodiments of the present invention have been described in detail, it will be understood that this description is merely for purposes of illustration. Various modifications of and equivalent structures corresponding to the disclosed aspects of the preferred embodiment in addition to those described above may be made by those skilled in the art without departing from the spirit of the present invention which is defined in the following claims, the scope of which is to be accorded the broadest interpretation so as to encompass such modifications and equivalent structures.

What is claimed is:
1. A cassette assembly comprising:
   a frame;
   at least one cassette tray;
   means for slidably supporting said cassette tray in said frame for movement between a retracted position and a withdrawn position;
   at least one bin received in said cassette tray; and
   a cassette tray limiting device for selectively limiting sliding movement of said cassette tray from the retracted position to an intermediate position between the retracted and withdrawn positions, wherein said cassette tray is moved to the intermediate position at most a minor portion of said bin is exposed.
2. The cassette assembly according to claim 1, wherein said tray comprises an upstanding lip at its forward end and said bin comprises a front wall adapted to abut said lip when said bin is received in said tray.
3. The cassette assembly according to claim 2, wherein said lip of said tray and said bin are configured to permit said bin to be pivoted on said tray with said front wall clearing said lip when said tray is moved to the limited intermediate position.
4. The cassette assembly according to claim 1, further comprising an actuator for actuating said cassette tray limiting device.
5. The cassette assembly according to claim 4, wherein said actuator is operative to place said cassette tray limiting device (a) in condition to limit sliding movement of the cassette tray to the intermediate position, and (b) in condition to permit movement of said cassette tray to the withdrawn position.
6. The cassette assembly according to claim 1, wherein said cassette tray limiting device includes a rod slidably mounted in said frame for movement between a first position and a second position.
7. The cassette assembly according to claim 6, wherein said cassette tray includes a stop configured to engage said rod when said rod is in the first position and when said cassette tray is moved from the retracted position toward the withdrawn position.
8. A cassette assembly according to claim 7, wherein said rod includes a tooth and said stop includes an abutting face for abutting said tooth when said rod is in the first position.
9. A cassette assembly comprising:
   frame means;
   at least one cassette tray;
   means for slidably supporting said cassette tray in said frame for movement between a retracted position and a withdrawn position;
   at least one bin received in said cassette tray;
locking means for releasably securing said cassette tray in said frame in the retracted position;

means for limiting sliding movement of said cassette tray, when said locking means is released, from the retracted position to an intermediate position between the retracted position and the withdrawn position, wherein when said cassette tray is moved to the intermediate position at most a minor portion of said bin is exposed; and

actuating means for selectably actuating said limiting means (a) for limiting sliding movement of said cassette tray to the intermediate position and (b) for permitting sliding movement of said cassette tray to the withdrawn position.

10. A cart comprising:

a support structure comprised of a plurality of support posts; and at least two side walls supported between said support posts, each said side wall having a corrugated interior surface; and

a cassette assembly removably supported in said support structure, said cassette assembly comprising:

a frame including side panels having ribbed outer surfaces, said ribbed outer surfaces being formed to engage said corrugated interior surfaces of said side walls of said support structure;

at least one cassette tray;

means for slidably supporting said cassette tray in said frame for movement between a retracted position and a withdrawn position;

at least one bin received in said cassette tray;

locking means for releasably securing said cassette tray in said frame in the retracted position;

means for limiting sliding movement of said cassette tray, when said locking means is released, from the retracted position to an intermediate position between the retracted position and the withdrawn position, wherein when said cassette tray is moved to the intermediate position at most a minor portion of said bin is exposed; and

actuating means for selectably actuating said limiting means (a) for limiting sliding movement of said cassette tray to the intermediate position and (b) for permitting sliding movement of said cassette tray to the withdrawn position.

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